MASTER THESIS URBAN, PORT AND TRANSPORT ECONOMICS
ERASMUS UNIVERSITY, ROTTERDAM, THE NETHERLANDS

The Great Lakes: The world's most underutilized waterway

An economic analysis of the potential of container transportation on the Great Lakes

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Executive Summary

The goal of this thesis was to provide an overview of the economic opportunities of container shipping in the Great Lakes basin, with the objective to intensify trade between key markets in North West Europe and the U.S. Midwest, through the ports of Cleveland, Toledo and Rotterdam. In order to identify these economic opportunities of container shipping, an analysis has been made on door-to-door transportation rate and the transit time of the existing services on the transatlantic versus a direct service into the Great Lakes based on publicly available data from the ocean carriers and an economic model to calculate expected transportation rates and time for a 14 and 18 knots direct service, next to a feeder service briefly discussed as scenario.

From a door-to-door transportation rate perspective, the direct service from Rotterdam into the Great Lakes proves to be an economically feasible alternative for container shipping compared to the existing services in its current situation, although exceptions exist. Also under the different scenarios of lower Harbor Maintenance Tax and higher hinterland transportation rates for road and rail haulage, the direct service is able to offer competitive transportation rates. Although seasonality of the system impacts the supply chain of shippers and consignees, the economical benefits that they receive are sufficient to switch to an alternative routing during the closure of the Seaway.

Also on transit time, the direct service is able to compete with the existing services on a door-to-door basis. As a result of longer in-direct routings or longer container dwell time scenarios, the 14 knots and 18 knots service is able to give shippers and consignees a substitute for existing services. Although 4 additional shipping days does not seem a lot, it could have a severe impact on the time-sensitive production or distribution lines if switching from the 18 knots direct service to the existing service. Based on the analysis, it seems that slow steaming has a larger impact in terms of transit time than longer dwell times in the ports and strongly contributes to the competitive position of a 14 knots direct service, which is assumed comparable to existing services in the base situation.

Based on these two factors, a direct service from Rotterdam into the Great Lakes would be competitive enough versus the existing services, although smaller vessels are used than existing services as a result of the lock specification. Although the seasonality of the system is an issue, the economic benefits of using a direct services exceeds the additional switching costs during the period of the closure of the system, independently of the various scenarios that have been analyzed. Especially as this period is considered to be months with a low volume of shipping as a result of seasonal production volumes, this problem can be overcome. The feeder service on the other hand was not competitive versus the existing services. As a result of additional container handling charges and the North-American rail structure, the feeder service is not competitive on these two factors.

Chapter 1 – Introduction

1.1 Origin of research

This research project is a joint undertaking by the Erasmus School of Economics of the Erasmus University Rotterdam and the Ministry of Foreign Affairs of the Kingdom of The Netherlands, embodied by its Consulate-General based in Chicago. The Netherlands is consistently ranked among the top 10s of foreign countries investing in U.S. Midwestern States and aims to strengthen its position as the 'Gateway to Europe'. As such, the Dutch government strives to take a leading role in researching how trade between the U.S. Midwest and Northwest Europe can be facilitated in order to spur growth in local business sectors.

In order to conduct this research in a thoroughly covered scale this research is done by means of two complementary parts, one on the institutional aspects and one on the economic aspects, each serving as a Masters' thesis in the trajectory of the program 'Urban, Port and Transport Economics' at the Erasmus University Rotterdam. The first part aims to combine findings with respect to the system's key opportunities and barriers as identified by interviewees, the second part incorporates some of these barriers to have a close look at the economic aspects of shipping on the Great Lakes, under the assumptions of a direct service from/to Northwest Europe. The economic analysis is aided by a model, based on the tariffs and schedules of shipping lines, which gives insights for shippers and consignees through which route they could send or receive their cargo based on the transportation rate and time preferences. To allow for shippers to thoroughly review their options, the economic analysis not only looks at the competitiveness of ports in North America, a comparison with the ports in the Hamburg-Le Havre range is part of the model as well.

After combining the findings of both the analyses, recommendations are provided that aim to assist system optimization for the Northwest Europe – North America corridor. The goal of this research project is to create an insight for policymakers, port authorities and shipping lines on the question whether or not the ports of Cleveland and Toledo are able to compete with existing container services destined for the U.S. Midwest and to what extent changes in federal policies and economic factors could influence this competitive position.

The primary focus of this research centers around the view that major tariff and regulatory barriers in the GLSLS system are existent and the potential gains for shippers and consignees, if these barriers could be reduced to improve the position of the ports of Cleveland and Toledo on the American side and the ocean capable ports in The Netherlands. If proven significant, the findings of this research provides a starting point for ocean carriers, shippers, port authorities, federal, state and municipal authorities to further research the potential of trade intensification in the Northwest Europe - North America corridor. Of particular interest are industries in the U.S. Midwest given the high production and consumption levels observed in this region.

1.2 Background

With continuous globalization of production and the forthcoming trade between regions, transport routing and port of origin and destination decisions have become an important issue for shippers, consignees, and other stakeholders such as shipping lines and hinterland transport operators.

As a result of globalization of world trade; time, reliability and costs for moving cargo have become a crucial part in the competitiveness of companies. For shipping lines globalization of world trade have led to operational changes with respect to their network and vessel operation. For these businesses the growing demand for maritime transportation has led to an increased importance on economies of scale in their decision-making concerning which port to call with their vessels. Currently, the largest container line in the world, Maersk, is operating 20 13,000 TEU Maersk E-Class vessels on their Asia-Europe routes. In February 2011, in the midst of economic uncertainty, Maersk has ordered an amount of 8 even larger, 18,000 TEU vessels, indicating expectations of a world economy in which competitive advantages of regions are continually exploited maximally by scale-efficient transport services.

Despite the benefits these ever-expanding vessels provide in terms of per unit transport costs, one should not overlook the fact that the infrastructure and superstructure of many ports could be inadequate to accommodate the inbound and outbound flow of cargo between ports and their hinterlands resulting in the so-called diseconomies of scale. This view has been supported by a European survey on port decision by forwarders and shippers (De Langen, 2007). The outcomes show that although total transport rates are a very significant factor in the port selection process, the level of service plays an important role as well. With respect to the Europe – North America corridor it was found that this leads to the fact that some shipping lines prefer to use alternative ports – for instance those in Montreal, Boston or Baltimore – over the two largest ports on the North American East Coast – New York/New Jersey and Hampton Roads – as gateways into some North American markets.

On the European side of the corridor, for container transport, it holds that 4 ports dominate the market in the Hamburg-Le Havre range; Rotterdam, Hamburg, Antwerp and Bremen (Havenraad, 2010). For shippers the major advantage in this range is the flexibility to choose their port of entry/exit because of the ports' contestable hinterlands. Competition for European cargo is very fierce as is highlighted by the case of Austria. For several years in a row the port of Rotterdam has in terms of throughput been the leading port for Austria bound cargo, thereby outperforming Hamburg, Koper, Bremen and Antwerp (De Langen, 2007; Port of Rotterdam Authority, 2010). Interestingly, the port of Rotterdam is located farthest from Austria compared to all other ports in the range. The competition between the ports in the Hamburg-Le Havre range for the European market is further illustrated by Notteboom (see Figure 1.1); stretching from North-West Europe to France, Italy and Eastern Europe.

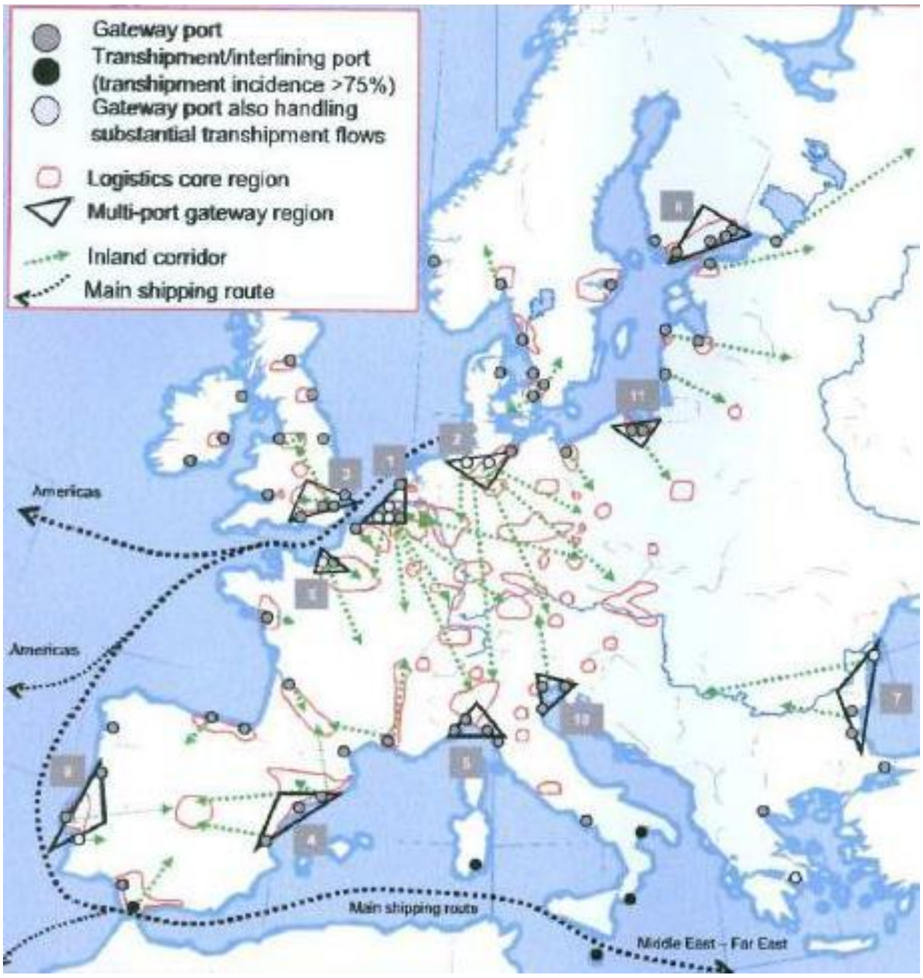

Figure 1.1: The European container port system and logistics core regions in the hinterlands – From: Seaports and the intermodal hinterland – OECD Round Table 143 – Port competition and hinterland connections – Notteboom 2009

Clearly, on both sides of the Atlantic shippers have multiple options to choose from when it comes to their route decision-making. As a result, shippers continuously search for routes and service providers that serve their needs optimally. It is then the interplay between the demand for services, services provided and regulation which determines the extent to which these needs are met. In this respect, we can state that seemingly because of increasing volumes and containerization one particular region in the North American maritime transportation network has gone out of the picture; the Great Lakes/St. Lawrence Seaway (GLSLS) system. The maritime industry in the area surrounding the Great Lakes between Canada and the United States used to thrive in the 60's and

70’s but has seen its throughput volumes decline since. The reasons that lay at the core of this trend are said to vary from the system’s incapability to serve larger ships, to inefficiencies stemming from the system not being able to provide services on a year-round basis and/or institutional barriers. Various authors have tried to shed more light on these issues which seem highly relevant given the large industrial and consumption markets in the system’s proximity, yet because today not a single container is shipped on the lakes, data sources are limited. This research aims to facilitate discussion and to explore the opportunities of waterborne transport in the Great Lakes area, a mode extensively used for inland transportation in the European shipping industry and of key interest to North American authorities in the background of increasing congestion, rising fuel prices, and concerns about the impact of transport on the environment.

This thesis will focus on whether the view that major barriers in the system are existent is valid and on the role of these barriers for intensifying maritime trade between Northwest-Europe and the U.S. Midwest/Great Lakes and provide recommendations for policymakers, port authorities and shipping lines. This thesis will also look at the economic aspects of shipping through the Great Lakes, either by a direct service or a Harbor Maintenance Tax-free feeder service from Montreal into the Great Lakes. This model, based on the tariffs and schedules of shipping lines, will give an insight for shippers and consignees through which route they could send or receive their cargo based on their transportation rates and time requirements and the potential (dis)advantages of creating a maritime connection to the Great Lakes for container transportation. Not only will this thesis look at the competitiveness of the ports in North America, but also a comparison to the ports within the Hamburg-Le Havre range will be implemented in the model.

The goal of this thesis is gain insight on the potential (dis)advantages of creating a maritime connection to the Great Lakes for container transportation. This thesis targets primarily shippers, consignees, policy makers, port authorities, shipping lines and other stakeholders that are currently involved in the transportation of freight from Northwest-Europe towards the U.S. Midwest and vice-versa.

This thesis focuses on the maritime transportation between Northwest-Europe, in particular the ports of Rotterdam and Amsterdam, and the U.S. Midwest, through the Great Lakes and St. Lawrence Seaway. The Great Lakes is the world’s largest reserve of fresh water and is considered as the North coast of the United States of America. The ports along the St. Lawrence Seaway and the Great Lakes contain a huge hinterland, the U.S. Midwest, containing nearly 60% of the entire U.S. population within a one-day drive and the American industrial production (HWY H2O, 2011). Not only are the Great Lakes geographically closest to Northwest Europe but also, surprisingly, over the last decades ports around the Great Lakes have not received regular scheduled container services to and from Europe or feeder services through Montreal or Halifax, likely due to the increasing focus of container shipping lines on achieving economies of scale and institutional barriers. When we look at the accessibility of ports in the U.S. Midwest area, it is observed that because of draught restrictions container shipping lines call at the port of Montreal to load or discharge their cargo mainly from/onto Canadian rail service providers Canadian Pacific (CP) and Canadian National (CN), two large Class I railroads in North-America. Other substantial volumes are transported to and from states in the Midwest to East Coast ports mainly by rail as well. The most prominent service providers on these routes are the American CSX and Norfolk Southern (NS)..

Figure 1.2: Overview of Great Lakes and St. Lawrence Seaway ports (Great Lakes Seaway Review, 2012)

This thesis will provide recommendations how to improve the transportation connection of containers between Northwest Europe and the Great Lakes. This creates insights for policymakers, port authorities and shipping lines how they can improve the competitiveness of the Great Lakes for shippers and consignees to transport their cargo. In the following chapter, the problem analysis will be presented.

1.3 Problem statement

With U.S. highways today being fairly congested with cargo traffic already, the U.S. Department of Transport has predicted that truck volumes will keep increasing in the upcoming years to the extent that roads into major urban consumption areas may get saturated, thereby putting a large burden on the timeliness, transportation rates, and environmental footprint of cargo delivery. As a result of this, businesses located in the U.S. Midwest that import goods from overseas through the U.S. East Coast seaports seem to face disadvantages in particular. As a result of the congested highways, trucks heading to the Midwestern states with an East Coast port as their origin will need to bypass many miles of congested highways, while these roads are also used by trucks with destinations relatively close to their place of origin. Other than congestion, U.S. Midwest businesses shipping products from and to the East Coast by truck will most likely be facing higher rates for road transportation resulting from increasing fuel prices. In this respect, when the three main modes of transportation for large volumes of cargo, i.e. road, rail, and waterborne transport, are compared, it can be concluded that road transport will increasingly be less competitive given that trucking is the least fuel efficient mode, while oil reserves in the global marketplace are dampening. Moreover, while the number of U.S. truck drivers in recent years has declined steadily due to stricter regulations with respect to working hours and quality, some experts predict a severe shortage of truck drivers in the near future as many drivers are reaching the age of retirement while relatively few new drivers join the trucking labor force. If such shortage will become reality trucking companies will have to respond by increasing truck driver wages, which will on their part drive up the price of road haulage or specific selection for the highest paying cargoes.

On the other hand, the rail infrastructure is also facing a severe pressure from increasing cargo flows on the U.S. East Coast – Chicago corridor. Although there is not as much of a difference as with moving cargo by truck, transportation by rail is significantly less fuel efficient than waterborne transport as well. In the U.S. the railroad companies that supply the hinterland from the East Coast ports have recently invested hundreds of millions of dollars to optimize their facilities for moving freight into the Midwestern markets. These investments have led to the opportunity to move higher volumes of cargo into the Midwest in shorter amounts of time. Businesses that are mainly dependent on fast delivery of the products they import or export are thus well accommodated with these undertakings, yet from a transportation rate efficient perspective it is likely that rising fuel prices will put the railroad companies at a disadvantage. Additionally, experts state that shippers moving freight inland from the East Coast ports often face multiple day delays when they try to get their products on a train. This is an important aspect to take note of as businesses often hold the reliability of transport, i.e. the extent to which freight is delivered at the expected time of arrival, in high regard so that their costs for holding inventory can be reduced.

Potentially with the opening of the widened Panama Canal scheduled for 2014 more terminal congestion problems await the East Coast ports. What transportation patterns will look like exactly after the opening remains to be awaited, but some experts foresee a significant diversion of cargo that originates in Asia which currently enters the U.S. on the West Coast to be delivered in East Coast ports. Competition for accommodating the larger sized vessels from Asia will be tough between the East Coast ports, which is why some of these ports have initiated large scale expansion projects. If these projects prove insufficient it may occur that East Coast port terminals that seem quite congested already may get busier than their capacity allows for, thereby impeding on the reliability of deliveries.

The alternative of using waterborne transport in the transportation network with the U.S. Midwest as a target market is available with the presence of the St. Lawrence Seaway and Great Lakes basin, yet using this route to move freight into the region does not seem to be considered by the majority of supply chain managers. Access to the U.S. Midwest from North West Europe and vice versa through the St. Lawrence Seaway is geographically the shortest route and as such the St. Lawrence Seaway and ports along the Great Lakes coasts used to thrive several decades ago because of their proximity to multiple large manufacturing areas. However, when newly built ships started to be too large to fit through the locks that characterize the system shippers could achieve economies of scale by diverting cargo to East Coast ports that were able to handle the larger sized vessels. Experts from the field however state that the route could still be a viable option for transatlantic container shipping from a transportation rate perspective, provided that an alternative for the seasonality barrier can be offered as currently proven by several bulk-focused shippers. Because of maintenance operations during the winter season that characterizes itself because of lower volumes that are being shipped, the locks of the St. Lawrence Seaway system are entirely closed. It seems however that supply chain managers, shipping agencies, and government representatives on both ends of the route lack both the awareness of the potential benefits of the system and the unity to initiate any step in the direction of operating such route in case they are aware of the opportunities.

If waterborne transportation can accommodate container traffic flows between North West Europe and the U.S. Midwest and if it proves to be a reliable and cost efficient in terms of a lower door-to-door transportation rate way of moving freight between both areas, many parties can reap the benefits on both continents. If transatlantic transportation can be offered at cheaper rates than is currently the case, companies could potentially expand their international markets by increased competitiveness in both regions. Economic activity and foreign trade is then stimulated leading to more employment and higher tax revenues. On the U.S. side, a well-functioning waterborne transportation network could to some extent ease the burden that is currently foreseen for road transport. As more cargo enters the U.S. Midwest by ship; less congestion, pollution, and road accidents can be expected on the roads that supply the region from the East Coast. The alternative scenario in case an all water route does not prove to be a viable option, is that it can be expected that ever increasing fuel prices will push more and more importing and exporting businesses out of the foreign markets as long as no cheaper alternative to road and rail transportation is offered. With less optimal access to foreign markets internationally orientated businesses will not be able to gain a strong competitive advantage versus their local competitors. And miss potential revenues gained from foreign trade, which could be a significant amount for niche players in the market.

The reasoning behind the decision to focus on container transport for this paper solely stems from the fact that current practices show that non-container shipping services between U.S. Great Lakes ports and Northwest European ports are already proven to be profitable. Tata Steel for example is a large steel rolls exporter from Ijmuiden, The Netherlands, delivering its cargo with direct shipments to multiple ports in the Great Lakes basin and often loading grain for its outbound shipments. To attract container shipments however, the system will have to provide a reliable and cost-efficient, in terms of transportation rate, alternative for traditional routes on a year-round basis, i.e. including the low volume winter months when the locks are closed due to maintenance and ice formation. Moreover, the U.S. charge a fee based on the value of each imported item coming into the country through any seaport; the Harbor Maintenance Tax. This fee poses a barrier, both from a transportation rate perspective as well as an image perspective, to shipping freight directly into U.S. ports, as long as there is the alternative of transloading freight from ships in Montreal, Canada, onto trucks or trains before it is moved into the U.S.. Given the bi-national character of the system, documentation requirements imposed by the governments of the U.S. and Canada may create an extra barrier given that shippers prefer not to have to go through extensive paperwork. Evaluating whether there is scope for synthesizing the requirements imposed by Canadian and U.S. authorities is thus one of the key interests of this study.

1.4 Research Objective

The problem statement described above leads us to the following objective for this study:

"Create an overview of the economic opportunities and institutional barriers of container shipping in the Great Lakes basin, with the aim to intensify trade between key markets in Northwest Europe and the U.S. Midwest and contributing to the discussion on the role of the Great Lakes/St. Lawrence Seaway maritime transportation system on the transatlantic container trade route."

Through the analysis of opportunities and barriers measured by an economic analysis, the potential of using the Great Lakes in the supply chain of shippers, consignees and shipping lines is assessed on a general level without taking into account company specific data on volumes and discounts on ocean transportation. By providing an overview, this paper will provide a pioneering role for authorities on both sides of the North American border to further investigate the feasibility of exploiting opportunities and reducing barriers such that the American and European consumer can benefit from a better competitive position for imported and exported goods in this corridor.

Chapter 2 – Research Setup

2.1 Introduction

This chapter will discuss the academic structure and relevance of this research by means of a detailed description of the research method. The first paragraph will focus on the main research question and the sub-questions which build the basis upon which to answer our main question. Subsequently, the research strategy and type of research will be discussed in detail such that an overview of the structure of the research is given. Following the research structure, the relevance of the research and its scope will be explained. Finally, the research framework is presented which gives an overview of all the steps taken that have led to this report and its conjunctively written counterpart dealing with the economic analysis.

2.2 Main and sub research questions

2.2.1 Main research question

As discussed in chapter 1.3 this paper researches the economic opportunities and institutional barriers of container shipping in the GLSLS maritime transportation system such that transport rates in the Northwest Europe – North America corridor are minimized and trade intensification is facilitated. The main research question of this paper is, in line with the objective, as follows:

"Does the Great Lakes/St. Lawrence Seaway maritime transportation system hold the potential to better accommodate the needs of stakeholders on both ends of the Northwest Europe – U.S. Midwest container transport corridor and if so, what measures can be suggested to enable the implementation of a regular scheduled container transport services between U.S. Midwest ports along the Great Lakes coasts and the port of Rotterdam?"

This main research question is focused particularly on container transportation, because this seems a potential market for intensifying trade between Northwest Europe and the U.S. Midwest through the Great Lakes. The reason for this specialization is the fact that bulk shipping has already proven to be an option for multiple companies. Also the mobility of cargo and contestable hinterland for containers plays an important role in our analysis of the potential usage of the Great Lakes ports.

2.2.2 Sub research questions

In order to answer the main research question, a solid framework from which the analysis can be conducted is necessary. Three sub-research questions have therefore been formulated, which are dealt with in part 1 and part 2 of this research conjunctively:

a. **“Which key opportunities can be identified to intensify trade between major manufacturing industries in U.S. Midwestern states and Northwest European countries from which consumers, shippers, and society as a whole can reap the benefits?”**
b. **“Which key barriers can be identified that limit the intensification of trade between major manufacturing industries in U.S. Midwestern states and Northwest European countries and to what extent is there scope to reduce these barriers?”**
c. **“To what extent could the implementation of a direct service between the port of Rotterdam and the Great Lakes or a HMT-free container feeder service to the ports of Cleveland and/or Toledo through Montreal, result in potential economic benefits for shippers and consignees in both North America and Europe, compared to the current routings between both regions?”**

2.3 Research strategy

2.3.1 Research approach and strategy

Given the character of this research project in terms of the relationship between theory and data, it can be stated that the research is of an inductive nature. In such setting, data is collected and interpreted leading to the development of a theoretical framework. This approach was chosen in order to provide the authors maximum flexibility as the research progresses, which should allow for laying out an analysis of factors that play a role in the research problem in such way that the needs of stakeholders can be served optimally.

This report encompasses a section in which quantitative data is developed into a model that aims to facilitate shippers to make decisions with respect to what route would be optimal for their cargoes transported in the considered corridor, given their set of preferences in terms of willingness to pay a certain transportation rate and time efficiency. Regularly, the gathering of quantitative data is related to research projects taking a deductive approach rather than inductive, however in this case we do not test hypotheses that confirm or reject a theory specified before gathering the data.

In order to get thorough insights on what factors may provide opportunities or impose barriers to the system’s development; interviews are conducted with field experts and researchers in the local shipping industry. These interviews serve as a framework upon which is determined what data sources are needed for the analysis of institutional frameworks, what data is required to develop a decision model for shippers, and what measures can be recommended to establish a task force if one or more route alternatives prove beneficial.

2.3.2 Data collection

To gain all necessary data for this research multiple methods are used; both through expert interviews and desk research valuable data is obtained. To determine the barriers to container transport on the Great Lakes, various semi-structured interviews are conducted with port authorities, academic experts, federal and state institutions, shippers, consignees and freight forwarders.

In order to develop a transport rate-model and time-model the research focuses on the 4 largest ports in Europe, namely Rotterdam, Hamburg, Antwerp and Bremen and their hinterland, containing 4 major industrial and population centers; *Rhine-Ruhr Region, Rhine-Neckar Region, Baden-Württemberg and the Basel-Mulhouse twin city region*. On the North American side, 4 ports are incorporated in the model as well; New York, Norfolk, Montreal and Halifax complemented by the ports of Cleveland and Toledo as new potential transportation nodes. For hinterland destinations, 5 major areas in the U.S. Midwest have been chosen, based on their position as economic center in the U.S. Midwest; Chicago, Detroit, Cleveland, Minneapolis and Columbus. Paragraph 5.1 will thoroughly discuss the reasoning behind the regions in this model.

A problem encountered in the data collection procedure is that data for the transport rate-model is much diversified in terms of container size. For the economic analysis however it is assumed that shippers use a 20” (TEU) ISO Tank container for transportation of chemical products and a 40” (FEU) container in case of high valued goods and car parts. For hinterland transportation, publicly available rates quoted by the three largest European shipping lines on the transatlantic route, MSC, Hapag Lloyd and Maersk Line are being used. Moreover, these rates are compared to price quotes by the various price quotes provided by requesting information at trucking and rail companies on both the European and North American side. For ocean rates, price quotes have been requested at the three previously mentioned shipping lines operating between Europe and North America. These rates include detailed information on terminal handling, Bunker Adjustment Factor and governmental charges.

The time-model dataset uses the data from multiple sources. A complication in this respect is that, as opposed to the European side where all necessary data is publicly available on various websites, data sources on the American side are limited and often expensive to obtain. To measure the time of hinterland transportation on the European side, data provided by the Dutch public relations office ‘Bureau Voorlichting Binnenvaart’ on scheduled inland container barges is used. For inland rail-traffic, a schedule of frequency and transit time provided by the Dutch Rail Cargo Nederland and rail carriers are used. Finally, for the input of road transportation times, Google maps route planner is used for both a direct delivery as well as a delivery from rail or port terminals.

The time-model additionally contains data on ocean going vessels, between Europe and North America. This data has been compiled by consulting the websites of North American ports that are implemented into the model, namely New York/New Jersey, Norfolk, Montreal and Halifax, as well as from the websites of the various shipping lines. This dataset also contains the average dwell time of containers in the ports on both sides of the Atlantic Ocean, provided through various sources of data and academic papers. The final dataset in this model contains data on North American hinterland connectivity.

The interviews, combined with in-depth analysis of academic literature, policy plans and published news articles, generate enough information to determine barriers to trade intensification not only between Northwest Europe and the Great Lakes area, but also on the Great Lakes itself. After creating both conceptual models, outcomes can be used to analyze the current transportation connection between Europe and the U.S. Midwest in a quantitative way.

2.4 Practical and academic relevance

As this research aims to combine the institutional and economical aspects of container transport opportunities and barriers on the Great Lakes and the limited number of studies in this specific field, it has both a practical and academic relevance.

2.4.1 Practical relevance

Speaking in terms of Saunders et al. (2009) this research is of an applied nature, meaning that it is practice oriented intending to provide solutions to managers in organizations. Based on the findings in this report the recommendations that are provided in the final section may serve as recommendations for decision-makers of individual importing and exporting businesses, in the shipping industry, and in governmental transportation departments.

Despite the fact that the U.S. Midwest is characterized by large markets suited for potential short sea shipping and inland barging of containers; the preference of shippers, consignees and shipping lines currently lies with rail and truck companies as hinterland transport service providers. From a geographical perspective the closest U.S. ports for Northwest Europe are not those situated on the East Coast but the ports along the Gulf of St. Lawrence, into the St. Lawrence Seaway and onto the Great Lakes and would likely lead to the fastest transit times. One should note however that upon entering or exiting Lake Erie, which provides direct access to ports close to large manufacturing areas, vessels have to transit through a system of locks which may offset the proximity advantage in terms of transit time. The larger ports that are accessible without lock transits, Montreal and Halifax, are capable of loading and unloading relatively large ocean going container vessels and could thus serve as main hubs for transport between Northwest Europe and North America, thereby potentially exploiting economies of scale. If proven significant in terms of transportation rate and time efficiency, the effect is likely that shipping rates decrease for importers and exporters on both sides of the Atlantic ocean, leading to benefits in terms of purchasing and investment power, tax income, and job creation.

With an analysis of the institutional barriers that impede development of the GLSLS system, authorities are encouraged to have a close look at the system's potentials and to investigate the extent to which regulation can be synthesized with the needs of local markets. Additionally, by creating an economic model on transportation rates and time, relevant users can become aware of the economic benefits for their company to save money on transportation and/or warehousing costs.

2.4.2 Academic relevance

Because of little development in short sea shipping practices and feeder services in North America, most of the academic literature in this field focuses on the European and Asian feeder service network. With a focus on the potential of a harbor maintenance tax-free feeder service from Montreal to the ports of Cleveland and/or Toledo, this research aims to contribute to the insights that have been drawn up to date. Additionally, the study on the potential of a direct service hopes to contribute to the academic literature on the role of economies of scale on a wider scope, involving both the ocean as well as the hinterland part of the transportation chain. Another important part in its academic relevance is the fact that this research is an independent study; studies conducted previously often involved parties funded by port authorities or pro-Great Lakes institutions with an interest in the system's development. Whether or not the outcome of this thesis has positive outcomes for the maritime industry in the area, this research will contribute to an independent assessment of the potential.

2.5 Scope of research

The scope of this research will be rather narrow given the fact that this research only focuses on three major institutional bodies – those of Canada, the U.S.A., and the European Union –, on four key barriers to overcome, on three key industries identified as ideally suited to spur the system's development and an economic model based on the factors transportation rate and time under the assumption that demand and supply stay stable during time. The use of 20" ISO tank containers (for liquid chemicals) and 40" containers (for high valued goods and car parts) as a given standard and the limited input from truck and rail service providers further narrows down the scope of this research.

2.6 Research framework

In this paragraph the research setup is outlined together with its framework to create a better understanding of the necessary stages of this research in order to comply with the objective.

First, an exploratory study is conducted by means of a literature study such that current transport patterns between both regions are identified. An outlook for future trade potentials is incorporated as well by looking at policy plans of governmental institutions and port authorities. Secondly, interviews with experts from the local shipping industry and trade agencies are conducted such that specific barriers to trade and to transportation of traded products are identified. Of particular interest in this respect is to gather information regarding opportunities for a container service into the Great Lakes from the port of Rotterdam. By applying theories from the field of port and maritime economics specific ways to overcome the identified barriers can be suggested. The third stage of this research focuses on developing a decision model by linking all the quantitative data, creating the necessary outcomes upon which the main research question can be answered.

By developing a conceptual decision model of transport rates and time, adaptations can be made by adding ports and changing continents of origin/destination as long as data is easy accessible and convertible into the model. By analyzing the different transport chains, inefficiencies can be tracked down and improved by the responsible stakeholders.

Chapter 3 – Basic Information

This chapter will focus on providing basic information on the maritime characteristics of the lakes in the Great Lakes – St. Lawrence Seaway system and the major ports on Lake Erie and the North American Atlantic coast in the context of Northwest European – U.S. Midwest trade.

3.1 Characteristics of the Great Lakes – St. Lawrence Seaway system

This paragraph will discuss the maritime characteristics of the Great Lakes – St. Lawrence Seaway system. This overview will focus on the main characteristics of the system, in the context of Northwest European – U.S. Midwest trade.

Saint Lawrence River and ocean access

To access the Great Lakes from the Atlantic Ocean, vessels have to sail through the Gulf of St. Lawrence towards the 774 miles long St. Lawrence River. Already before the 1800's the St. Lawrence River has been a commercial highway for vessels destined for the Canadian market but rough waters would not allow commercial shipping beyond Montreal. In 1825, the development and opening of the Lachine Canal created the opportunity for commercial ships to pass these rough waters which improved the position of the port of Montreal, by becoming more visited and passed by commercial vessels. As ships grew over the later decades, the Lachine Canal grew with it, by building larger locks and providing deeper waters by dredging the canal, but after the 1950's the Canal was no longer able to serve the newly build vessels and after the opening of the new St. Lawrence Seaway Locks in 1959, the Lachine Canal was no longer used by most commercial vessels.

After ships cross the two locks in Montreal, the ships are still required to pass four more locks In Beauharnois (Quebec), Massena (New York) and Iroquois (Ontario). These six locks lift the vessel from 6 meters above sea level to 75 meters above sea level, which matches the first lake in the basin, Lake Ontario. Compared to the other lakes, Lake Ontario is the smallest in terms of surface area and houses the ports of Oshawa, Hamilton and Toronto on the Canadian side and Oswego on the American side. With its draft of 283 feet, Lake Ontario is the second deepest lake on the Great Lakes, but as a result of the dimensions of the locks, the operational draft is only 26 feet for transiting vessels. While on the eastern side Lake Ontario is connected to the St. Lawrence River, it is connected with the Welland Canal on the other side of the lake.

The St. Lawrence Seaway project consisted not only of new locks in the Welland Canal, but also along the St. Lawrence River. Like mentioned before, the creation of a new lock system in the area of St. Lawrence river did not came without a restriction. When developing the new St. Lawrence Seaway locks, engineers chose for a standard size of 766 feet long, 80 feet wide and 30 feet deep, but in order to give ships enough space, the maximum size of vessels capable to sail through the locks is set at 740 feet long, 78 feet wide and 26 feet deep, the so-called Seawaymax size.

The Welland Canal is a 26 mile long canal with two functions: providing a connection between Lake Ontario and Lake Erie, and raise the ships to the same water level as Lake Erie. Because of the height difference between Lake Ontario (75 meters above sea level) and Lake Erie (174 meters above sea level), shipping was not possible before the construction of the Welland Canal and its locks. Since the creation of the first Welland Canal in 1829, the lock systems have been redeveloped and rebuild several times. The current Welland Canal opened in 1932 after 19 years of construction and contains 8 locks from St. Catherines at the shore of Lake Ontario to Port Colborne on the shore of Lake Erie. As these locks are built on Canadian ground, they are managed by the St. Lawrence Seaway Management Corporation, responsible for the maintenance and operations of these locks, but also as institution in the business development of the entire system together with its partners in the HWY H2O organization. The locks in the Welland Canal are, like the ones in the St. Lawrence River restricted to the Seawaymax size. Because these locks are almost 80 years old, a lot of maintenance is necessary. Together with maintenance, the heavy winter period between January and March, are reasons for the St. Lawrence Seaway Management Corporation to limit the sailing season to 10 months, from March till December. For further details on this issue, Haazen (2012) provides a better overview of the implications of maintenance on the Seaway operations and the winter closure.

Because safety is important within the Welland Canal, grounding of vessels could result in a blockage of the entire system, while generally vessels are taking around 8 to 12 hours to pass the locks in the Welland Canal. After sailing through the Welland Canal, vessels reach Port Colborne and the entrance to Lake Erie. In the building process of the Welland Canal, the shallow waters near the shoreline of Lake Erie have limited the depth of the canal. Although Lake Erie is larger than Lake Ontario, it has the shallowest draft of all lakes in the system, 48 feet on average. Although this seems high, compared to draft necessary to receive large container ships, they are not capable to reach a port due to shallower waters of 28 feet near the coast line. Because of its convenient location for international traffic, a lot of ships make a call at the ports of Toledo and Cleveland in Lake Erie.

After Lake Erie, the system connects itself through the Detroit River and the small St. Clair Lake on the Canadian side to the second largest lake in the system, Lake Huron. Lake Huron is with its 23,000 square miles, the third largest fresh water lake in the world and is like Lake Erie leveled on 175 meters above sea level and connected to each other without the usage of locks. Lake Huron characterizes itself in being a transit-lake, as its coastlines are sparsely populated, not a lot of maritime activity takes place. Compared to Lake Erie, Lake Huron is able to offer a deeper draft of 195 feet, but due to the restrictions in the Detroit River, the ship size is limited.

Lake Huron is connected with the two final lakes, Lake Michigan in the West, through the Straits of Mackinaw and Lake Superior in the North, through St. Marys River and the Soo Locks. Lake Michigan is the third largest lake in the system, covering 22,300 square miles in total, close behind Lake Huron in terms of surface area, but when measured in water volume, Lake Michigan is larger than Lake Huron, due to its deeper draft of 279 feet on average. Because of its proximity to the U.S. Midwest and cities like Chicago and Milwaukee, Lake Michigan is unlike Lake Huron more important in terms of commercial shipping on the Great Lakes. Shipping on Lake Michigan is focused in two regions, the Northern part, with the port of Green Bay as most important gateway and the Southern part, located around Gary, Indiana and Chicago, Illinois, primarily for steel slabs.

The largest lake in the Great Lakes basin in terms of volume and surface area is Lake Superior, making it the largest fresh water lake in the world. Unlike Lake Huron, Lake Michigan and Lake Erie, Lake Superior is located at 185 meters above sea level. To reach this level, vessels have to sail through the St. Marys River and through the Soo Locks. Unlike the locks in the Welland Canal, the Soo Locks offer the capability to be used by larger, inter-lake vessels, called lakers. Currently, the Soo Locks are capable of accepting vessel that are 1,200 feet long, 110 feet wide and 32 feet deep, but over the last 25 years, plans have been created to increase the maximum size by building a new lock replacing two of the four parallel locks. Because of its farm-orientated hinterland, Lake Superior characterizes itself by its focus on grains and houses the 2 largest ports on the Great Lakes, Duluth-Superior and Thunder Bay on the American and Canadian side of the border.

3.2 Port Information

This paragraph will discuss the most important ports on the Atlantic seaboard and in the Great Lakes basin. This overview will focus on the main characteristics of the ports, in the context of Northwest European – U.S. Midwest trade.

Port of Halifax

	Port of Halifax
TEU handled	435,461 (2010)
Bulk (Tons)	5,612,957 (2010)
Rail	CN

As one of the largest Canadian ports, but also one of the largest ports on the East Coast of North America, the role of the port of Halifax with regards to transshipment and intermodal connections towards the hinterland is very important. The port of Halifax is under control by a non-profit organization influenced by the Canadian government in their policies through the appointment of several chairs in the board of directors.

The port of Halifax is mostly focused on the transshipment of freight, since its nearby hinterland is not a sustainable market for port operations. Nonetheless, the port of Halifax has a big influence on the local economy by creating a large amount of jobs and an economic impact of over $ 1.5 billion U.S. dollar each year (Port of Halifax, 2011). The port of Halifax consists of multiple, private owned terminals with the focus on grain, oil, containers, cars and forest products like lumber. These terminals are all served by on-dock rail and are capable for double stacked transportation.

The location as the first port on the Europe-North America market in combination with its hinterland rail network has strengthened the role of the port of Halifax in the competition with U.S. East Coast ports for container traffic. Since its location is strategically positioned on the global circle route between Northwest Europe and the U.S., vessels will have a limited detour. This strength has contributed to the decision for most of the major container lines to plan a stop at the port of Halifax as their first and last stops before heading towards Europe. Also one of the strengths for the port of Halifax is its deep draft. For the upcoming six or seven years, only the port of Halifax will be able to provide the ships larger than 7,000 TEU enough capacity and reliability. As discussed previously, other ports in the U.S. East Coast corridor, like Baltimore, Norfolk and New York have their limitations due to various circumstances related to the maritime specifications of the port and terminals (Mercator International, 2010).

Nonetheless, the port of Halifax has a big weakness. Since the port of Halifax has a small population and manufacturing base in its near surroundings, the port of Halifax is reliant on transportation towards the hinterland, especially to Quebec, Ontario and the U.S. Midwest region. Because of the large distance between Halifax and these markets, the only viable option would be either inland shipping with regards to bulk products and containers, but also the usage of rail. Since the ports in the Great Lakes are not capable of handling container volumes, shippers will, in order to quickly distribute containers to the hinterland (US Midwest), rely completely on the rail connection from the port, operated by CN rail only. Statistics have shown that 80% of the container traffic move by rail (Port of Halifax, 2010). But, for shippers rail could be an unreliable factor in the transportation network and the supply chain of their products. Whenever CN rail would go on a strike, extreme weather conditions, delays or accidents which result in the temporary closure of this rail route for instance, their entire supply of goods will come to a stop. In order to cover this unreliability, shippers will need to create a large stock, resulting in higher stock holding costs. But also the capacity of CN rail is currently not capable of increasing hinterland traffic. The CN rail intermodal facility is able to lift and reorganize 150 containers on a daily basis, 52,000 on an annual basis, which is very limited. Furthermore, the port of Halifax is under pressure of decision-making by the CN rail management. Over the last three years, CN rail has moved it schedule from a flexible, vessel-call minded schedule towards a fixed schedule to create a more reliable capacity and scheduling across their network. This has led to longer dwell times of the containers at the port eliminating the previously discussed advantage of its location.

Because the potential of a large amount of container freight coming to Halifax, as first major port of call for new-Panamax sized vessels, the Melford International Terminal Inc. is planning to develop a privately funded container port in Melford, Nova Scotia, Canada. The original plan was to open this terminal early 2010, but due to the economic downturn and the difficulty in getting the required funding has led to a postponement into 2013. Compared to Halifax, the proposed location of the Port of Melford has a large benefit in case of transshipment into feeder services into the Great Lakes: It is located within the Strait of Canso, with direct access to the Gulf of St. Lawrence, but the long sailing distance into the Great Lakes would require four vessels for a weekly service, while its main competitor Montreal, would only need one vessel.

Port of Montreal

	Port of Montreal
TEU handled	1,331,351 (2010)
Bulk (Tons)	13,736,075(2010)
Rail	CN, CP

Although the port is located further inland compared to the other North American ports and not directly on the major shipping routes, the port of Montreal is currently the largest Canadian Atlantic container port. The port of Montreal plays an important role in the supply chain towards the U.S. Midwest region which is the most important origin-destination markets for the port. Like most Canadian ports, the port of Montreal Authority is an independent non-profit organization controlled by the national, province governments and municipality by appointing the board of directors.

When looking into detail at the container flows, Montreal is by far the most important port for transatlantic cargo to and from Canada. Northwest-European imports and exports are 55% of the total amount of container cargo each year. If also the Mediterranean is added to this equation, 81.5% of the imported containers arrived from Europe (Port of Montreal, 2011). Next to this aspect, the port of Montreal has another specific advantage over the U.S. East Coast ports, namely the fact that it has more export than import. For shipping lines, this result in lower costs involved for shipping lines in transporting empty containers back. Also the geographical location of the port of Montreal is an important advantage. Compared to the U.S. East Coast ports, the port of Montreal can be reached within 7 days sailing from Northwest-Europe, compared to 9 days in the case of New York. But its location is also a potential weakness. Because the port of Montreal is located 1,400 kilometers inland, container service differs from the regular, multiple call container services (Slack, 1989 and Guy, 2004) as it is used as a single call port on the North American continent. Nonetheless, historical statistics have proven that the port of Montreal has been able to outperform and compete with the largest East Coast port; New York/New Jersey and the port with the largest drafts, Hampton Roads and Halifax (Guy and Urli, 2006) for transatlantic cargo.

One of the explanations for this could be the fact that the port of Montreal is the closest to the U.S. Midwest compared to the U.S. East Coast ports. Statistics from the Port of Montreal (2007) show 25% of container imports are destined, by rail, for the U.S. Midwest. Based on 2010 numbers, this would imply nearly 165,000 TEU each year. Although the port of Montreal is currently very good connected to the hinterland connection by both CP and CN rail, this is also a weakness of the port of Montreal. This vision is shared by Guy and Alix (2007) and argues that the lack of regional cargo base results in a high dependency of rail for hinterland transportation. Not only is the hinterland connection an important aspect in future developments of the port of Montreal, Guy and Alix (2007) are also mentioning the increasing ship size as an potential threat for the port of Montreal. Because of the economies of scale and hinterland improvements for U.S. East Coast ports and Halifax, Montreal is potentially losing their competitive advantage.

To strengthen its position as container port for the U.S. Midwest and Canadian regions, the port of Montreal is currently is the process of redevelopment as part of the Vision 2020 plan (Port of Montreal Authority, 2008). Over the upcoming ten years, the Montreal Port Authority expects a raise from 1.3 million TEU in 2010 to 3.6 million TEU in 2020. To handle this amount of cargo, the port authority has set up a 4-phase expansion project which focuses on optimization of existing infrastructure, transformation of existing land into container terminals in its second phase, before the construction of a new container terminal located on the east bank of the St. Lawrence River.

Port of New York/New Jersey

	Port of NY/NJ
TEU handled	5,292,020 (2010)
Bulk (Tons)	49,153,149(2010)
Rail	CSX, NS

When looking at the Northwest-Europe – U.S. Midwest market, the port of New York/New Jersey is by far the largest in the U.S. East Coast Mid-range. Not only is the port of New York/New Jersey focused on local traffic (Boston-Washington corridor) also hinterland has proven to be a large target market for the port. Like other U.S. and Canadian ports, the port authority itself is overseen by state appointed commissioners. The port authority acts as landlord, mainly focused on operating, building and maintaining infrastructure.

The main advantage of the port of New York/New Jersey is the extensive rail hinterland connection and the large experience in container handling, resulting in quick ship handling and hinterland transshipment. The heavy competition within the U.S. Mid-range is also important for shipping networks. Because of the large local market and its excellent geographical location, the port of New York/New Jersey are receiving the most vessels on the Northwest-Europe to North America market, with most of them using New York as their first North American port of call. Not only is this visible when looking into the shipping line schedules, also trade statistics prove the dominant position of New York/New Jersey as one of the main gateways between both continents. After analyzing the trade statistics, it is obvious that, after Chinese trade, the Northwest-Europe trade is the second largest market for the port of New York/New Jersey. Germany, The Netherlands, France and the UK combine nearly 12.5 percent of the total volume. Another important import growth market for the port of New York/New Jersey has been the Belgium market. Between 2009 and 2010, this market grew 37.6%.

One of the largest disadvantages of the port of New York/New Jersey is not its draft in the water, but the air draft. To reach the 50”-depth terminals in New Jersey, vessels have to pass underneath the Bayonne Bridge. Currently, this is not a problem for the port of New York/New Jersey, but the new-generation post-Panamax vessels will not be able to call fully loaded at the port of New York/New

Jersey. In order to accommodate these vessels, the port authority, who even owns the bridge, has requested the U.S. Army corps of engineers (2009) to investigate several options to eliminate this problem. It has proven to be the cheapest and fastest option to jack the bridge up 40 feet by 2019.

Ports of Virginia

	Ports of Virginia
TEU handled	1,895,018 (2010)
Bulk (Tons)	13,900,520(2010)
Rail	CSX, NS

One of the largest competitors of the port of New York/New Jersey in terms of volume and draft are the ports in the state of Virginia. The ports of Virginia authority manages several ports, located around the Hampton Roads metropolitan region, consisting of several terminals in the ports of Portsmouth, Norfolk and Hampton. Currently, the ports of Virginia are considered to be one of the most modernized large ports in the United States. Due to the current expansion project at the Panama Canal, the ports of Virginia Authority has invested in the development of their port in terms of capacity, hinterland connectivity (in conjunction with CSX and NS) and the natural characteristics in their port. Currently the A.P. Møller group (well-known as the owner of Maersk and APM Terminals), has heavily invested in its new facility in the port of Portsmouth, resulting in the largest privately owned terminal in North America with a capacity of 1.4 million TEU on annual basis with the potential of further expansion.

When looking at the total amount of trade on the major trade-lanes, the ports of Virginia are very focused on the Northern-European and Mediterranean market for its exports, while South-America is the main market of imports, together with North-Europe and Northeast-Asia. The top commodity for imports and exports for the ports of Virginia is the coal-trade. Furthermore, the top import commodities in the port of Virginia mainly consists of fertilizers, machinery, furniture and beverages, while its prime export markets are fruit and seed, food waste and animal feed, wood pulp, paper and iron.

One of the large advantages of the Virginian ports over the other U.S. East Coast ports is the fact that there is no need to further dredge the harbor and there is no air-draft restriction on the height of vessels that enter the harbor, compared to the Bayonne Bridge situation in New York/New Jersey. Also the capability of further growth is a very large advantage for the ports of Virginia.

Next to these advantages of the ports of Virginia, CSX and NS are also shifting their focus towards the ports of Virginia, with the railway development programs of the Heartland Corridor and the National Gateway aiming to get more containers from this port into Ohio and the U.S. Midwest, by raising tunnel and bridge clearance and the ability to double stack trains. As part of the National Gateway project, CSX has invested in a new intermodal container facility in North Baltimore, Ohio which is located just south of Toledo. By building such a facility in Ohio, the need to interchange intermodal containers in the Chicago-area will decrease, resulting in lower congestion on rail tracks into Chicago. Also for NS, investments in their infrastructure have led to better service for their customers by reducing the hinterland transportation time from four to three days. This recent developments in rail transportation has also led to changes for container shipping lines. Next to the commitment of the A.P. Møller group in the port of Portsmouth, Maersk has made a shift from NS to CSX by for container hinterland transportation towards the U.S. Midwest indicating a potential large shift of operations from west-coast to east-coast operations as CSX provides a more extensive and better optimized rail connection.

Compared to New York/New Jersey, the ports of Virginia have one disadvantage based on its location, the ocean travel time. Compared to New York/New Jersey, container lines take an extra of 2-3 days to get to the ports of Virginia, which also influences the decision-making process for shippers of high value or highly time-dependent goods.

Port of Cleveland

One of the major ports on the Great Lakes is the port of Cleveland. Over the recent few years, the port of Cleveland has started to redevelop its business as a result of the declining industrial manufacturing in its surrounding areas and the lower consumption of goods due to the financial crisis. Like other U.S. ports, the port of Cleveland is being governed by both the county and city, but managed as independent institutions.

Although the location of the port of Cleveland is considered to be an advantage for international trade, the port of Cleveland is facing a lot of competition from the port of Toledo, further west from the Welland Canal. When looking at current trade in the port of Cleveland, it is clear that it is influenced by the industrial facilities in Ohio. The top import commodities in the port of Cleveland mainly consist of bulk products like iron ore (destined for ArcelorMittal steel plants), cement and limestone, destined for iron mills and construction industry in Ohio. But also finalized products like specialized steel slabs and plating from foreign countries are an important source of import for the port of Cleveland. One of the major users of the port of Cleveland, Tata Steel has been transporting this specialized steel from Ijmuiden to The Netherlands over the last decades. Also the exports of the port of Cleveland are very focused on local industry, in particular machinery and steel. Although the port of Cleveland is one of the largest Great Lakes ports, around 75% of the tonnages of goods that are being transport through the port of Cleveland are destined for a domestic market. In 2009, the port of Cleveland has moved 4.6 million metric ton, with only 1.3 million metric ton with a foreign origin or destination. When looking at these 4.6 million ton, it is also clear that the port of Cleveland has a large disadvantage in terms of commercial shipping, namely the import/export misbalance of 3.7 million ton of imports versus 0.9 million ton of exports.

One the advantages of the port of Cleveland can be found in its natural characteristics. Because of its close proximity to open water, the port of Cleveland is able to offer a 28 feet draft, which is close the Seawaymax draft of 26 feet. Not only does the proximity to open water have its advantages in terms of draft, also the necessity of dredging is abundant. In the case of the port of Cleveland, the only annual dredging operations are focused on the part of the lower Cuyahoga River in order to maintain transportation 5 miles upriver to the ArcelorMittal Cleveland Steel Plant and other bulk-orientated companies. Compared to the major U.S. East Coast and Canadian ports, the ports in the Great Lakes are not specialized in container transportation. In order to further develop the port, the Cleveland – Cuyahoga County Port Authority has set up a new strategic plan to determine potential markets and research the opportunities to improve current markets, by aiming for new international markets in order to spread risk of economic setbacks due to its domestically focused orientation. With this strategic plan, the port of Cleveland aims to “foster job creation and economic viability in the greater Cleveland area” (Strategic plan Port of Cleveland authority, 2011).

To diversify their cargo base, the port of Cleveland has determined three potential markets: Container feeder service to Montreal, wind-energy components and starting a cross-lake ferry service to Canada. In order to create an economical sustainable container feeder service, the port of Cleveland, together with Martin Associates has determined the critical issues for setting up this potential market. Although traffic volumes could be enough to sustain a feeder service, terminal charges have proven to be a critical factor in order to compete with U.S. East Coast ports and Montreal, in combination with rail hinterland connectivity. Next to this, the frequency of service must be maintained in order to prove its commitment. If service proves to be unreliable, shippers will not consider this feeder service. Also the commitment of a major ocean carrier to this service would be critical as they control large parts of the supply chain and have enough market power to “force” the creation of these new routes. In order to address this potential market, the port of Cleveland recently invested in the purchase of new quay cranes, capable of making 20 to 25 container lifts per hour, financed through the TIGER Grant program of the United States federal government.

Another new market for the port of Cleveland could be the transportation of project cargo, especially the transportation of wind-turbine components. Although there is still a lot of uncertainty in the market with regards to off-shore wind energy in the greater Ohio region (Sanchez, 2012) a lot of land-based wind energy parks are being developed. Not only does this require a lot of specialized steel into the region, also the blades and turbines could be a significant growth market. Especially for the transportation companies involved in this process, the closer parts are able to reach the destination by maritime transportation, the better, because the blades are not very easy to transport inland.

Port of Toledo

One of the largest competitors of the port of Cleveland in terms of volume, accessibility and hinterland-connectivity is the port of Toledo. The competitive position of the port of Toledo is very much related to its geographical location at the far-west shoreline of Lake Erie near industrial hubs like Detroit together with the existing infrastructure around the port. Not only does this location have geographical advantages, also the proximity of the new CSX rail facility in North-Baltimore, Ohio is an important asset for the port of Toledo. But the location of the port of Toledo is also one of its main disadvantages in terms of extra sailing time compared to Cleveland. Another disadvantage of the port of Toledo is the constant required dredging operations. In 2010, the U.S. Army Corps of Engineers estimated that around 850,000 cubic yard will have to be dredged on annual basis to keep the required channel clearance of 28 feet in the Maumee bay. To finance these dredging operations, 5 to 6 million USD are required on annual basis, received through the national government and the U.S. Army Corps of Engineers.

Compared to the port of Cleveland, the port of Toledo is more internationally oriented. Out of the 8.8 million metric ton, 60% is based from foreign markets, but one remark has to be made, that this could also be cargo originating or destined for Canada. The main markets for the port of Toledo are coal exports, followed by the import of iron ore. These markets are very strong on both domestic and foreign trade, but another distinctive foreign export market for the port is the export of grain and soybeans.

As a reaction to the potential development of a container market into the Great Lakes, the port of Toledo has invested in its rail connectivity and productivity by purchasing 2 new state-of-the-art mobile Liebherr cranes, financed with funds from the national government "American Recovery and Reinvestment Act 2009". One of the large advantages of the Liebherr cranes is their ability to handle both bulk and container cargo, with 1,000 ton or a speed of 35 container lifts per hour.

Port of Rotterdam

The port of Rotterdam is well known as the largest European container port and currently the 10th largest container port in the world. The strength of the port of Rotterdam is mostly based on its location. As seaport, the port of Rotterdam is able to offer a draft of 75 feet which gives the port the opportunity to welcome the upcoming category of Ultra-Large Container Carriers, which are not capable of calling at other ports in the Hamburg-Le Havre range when fully loaded.

Currently, the majority of container traffic is handled at the Maasvlakte I area, by ECT and APM Terminals, but in order to cope with expected container volumes the port of Rotterdam, with the help of national and local government institutions the port authority has been developing the Maasvlakte II area. This newly developed area, created from landfill, will offer extra space for container activities and more competition within the port of Rotterdam by expanding current terminals and the entry of a new terminal operator. In order to cope with the extra traffic towards the hinterland, terminal operators on the Maasvlakte II are facing strict rules with regards to the modal split, imposed the Port of Rotterdam Authority.

When looking at the main markets for the port of Rotterdam in terms of container origins and destinations in Europe, Belgium, Germany and Switzerland are the most important markets. In order to serve these locations more effectively compared to competitors, hinterland connectivity is very important. Over the last decade, the port of Rotterdam has heavily invested in establishing better hinterland connections with the development of the Betuweroute-railtrack from the port towards the German border and by improving inland and short-sea shipping connections. Also terminal operators became more involved in the transportation chain and its pressure on existing infrastructure. To improve dwell times of container, ECT has set-up several inland terminals with customs clearance which enable them to move containers further into the hinterland by barge and rail, to relieve pressure on the ECT terminals in the port of Rotterdam.

With regards to the intercontinental market, Asia is the #1 market for the port of Rotterdam with a 47.9% share of total container traffic with Singapore and China as main trade partners, followed by the United States. While comparing the import and export numbers between these three main trade partners, there is a clear example in the role of misbalance in the transportation relationships with regards to empty containers. While between Rotterdam and the North American market the amount of empty containers that are being transported is only minimal, the Asian export market consists of 30-35% of empty containers.

Port of Antwerp

One of the largest competitors of the port of Rotterdam is the port of Antwerp. Because of its close proximity to each other, the ports of Antwerp and Rotterdam are quite complementary to each other for both shippers and container lines in their decision making process. Unlike the port of Rotterdam, the port of Antwerp struggles with attracting Ultra-Large Container Carriers (ULCC) due to its location. The port of Antwerp is a hybrid of a seaport and a river port. To access the port of Antwerp, ships have to sail through the Westerschelde, limiting the draft of the port to 47.5 feet in the recently developed Deurganckdock, requiring dredging activities each year costing the port 20 to 25 million euro's annually. Another big impact for the port of Antwerp in terms of their maritime limitations is the presence of a lock, to reach the container terminals on the right-bank of Antwerp operated by MSC and DP World.

While Rotterdam has a larger focus on Asian container traffic versus North American container traffic, the contrary is visible in the port of Antwerp. Out of the 8.6 million TEU, in 2011, that has been imported and exported through the port of Antwerp, 1.7 million TEU or 20% is destined for North American markets, shortly followed by the Middle-Eastern and Asian markets. When comparing these numbers with the other ports in the Hamburg-Le Havre range, there is a clear competitive advantage for the port of Antwerp on North American markets. Further research shows that this could be traced to the operations of MSC in the port of Antwerp. The MSC NA (North-Atlantic) route has been the leading route in terms of volume on the North-Atlantic corridor between Europe and North America. The strong market power for MSC is also visible on the other side of the maritime operations, in the terminal sector in Antwerp. MSC has committed to the port of Antwerp with a large investment in the MSC Home Terminal, capable of 3.6 million TEU on annual basis.

Port of Hamburg

Over the last decade, the port of Hamburg has grown in terms of volume to become one of the largest competitors for the port of Rotterdam. Unlike Rotterdam and Antwerp, the port of Hamburg characterizes itself by being a free port, reducing the customs duties for imported goods. Also in terms of terminal operations the port of Hamburg had a distinctive difference with the other ports. Till 2007, the majority of container terminals in the port were under government control, but with an independent control over the terminal operations by HHLA. In order to develop the company and be able to compete with the other ports, the state decided to partly privatize the company by offering stocks on the public markets. Although HHLA has been publicly offered on the market for 5 years now, the city of Hamburg still owes 68% of the stocks of the company and 100% of the real-estate subdivision of HHLA.

One of the largest disadvantages of the port of Hamburg is it location, 110 kilometers inland from the North Sea, but unlike the port of Antwerp, the port of Hamburg is still able to offer a 55 feet draft, enough to serve the Ultra-Large Container Carriers sailing on Asian-European routes, but under a tidal constraint . Although this is a disadvantage in terms of speed, it takes an extra day compared to Rotterdam and Antwerp, Bremen is better positioned for transshipment into the Scandinavian and Baltic markets.

At the port of Hamburg, there is a clear focus with regards to its market: Asia. Based on 2010 numbers, Asia is origin or destination for 60% for container traffic in the port of Hamburg, while the North American market is a slim 4.1% or about 250,000 to 300,000 containers on annual basis. Although the port of Hamburg is not well located in Europe in terms of hinterland connectivity towards the Ruhr-Area, Swiss and Belgium markets, it offers an excellent position for upcoming central-eastern economies like Poland, Czech Republic and Russia, but also for Scandinavian ports to use Hamburg as transshipment port.

<u>Port of Bremerhaven</u>

Over the last decade, the port of Bremerhaven has developed itself more and more as a competitor for container traffic in the Hamburg- Le Havre range, both on a national level and an international level. Since 2000, the volume of container traffic has nearly doubled. Unlike the port of Hamburg, the port of Bremerhaven is located near open sea giving oceangoing vessels a quicker turnaround time without losing valuable hinterland, as Hamburg and Bremerhaven are only 130 kilometers apart. But, because of its draft of 47.5 feet in tidal water, the port of Bremerhaven is not capable of receiving the largest container vessels.

This fact is also visible in the decision making process in terms of focus markets. When looking at statistics from 2010 it is clear, out of the 4.9 million TEU that the port annually handles, 1 million TEU are destined or originated from Far Eastern ports, while its second market, the North American market manages an annual volume of around 731,000 TEU. Although the port of Bremerhaven faces heavy competition from the port of Hamburg, there is a distinct strength of the port of Bremerhaven. When looking at the percentage value of transshipments in the Hamburg – Le Havre range, the port of Bremerhaven is outperforming all ports, with a 61% transshipment volume.

Chapter 4 – Literature Review

This chapter gives an overview of the research performed by various authors about the different aspects involved in the container shipping lines services. The purpose of this literature review is to provide a better overview of all factors involving the maritime network structure for existing and new ocean services. First of all, the network structures in ocean and hinterland transportation will be discussed to get a better understanding of the role of the network structure on the development of current ocean services in relationship to the role hinterland transportation plays. By addressing this topic, a clear view on how the network is structured by using models from the literature and clear examples from the business environment.

After that, the general port selection factors and the role of divergence on the U.S. East Coast market are being discussed in order to provide a better understanding in the next stage of the development of a shipping network: how is being decided which port(s) to call on either side of the service. Also the process of divergence is being discussed in the context of the decision-making of shipping lines. The third paragraph will discuss the third stage of network development, the decision-making on the optimal ship size and the role of economies of scale in the network structure and port selection process. This paragraph will also discuss the influence of terminal efficiency on the network development. In the final paragraph, literature on short sea shipping in Europe and the United States is being discussed. Because of both geographical differences and the existing operations in Europe, it is interesting to compare these regions to each other and understand the role of (bi-) national policy has contributed to gain a competitive advantage over land based transportation.

4.1 Network structures in ocean and hinterland transportation

Ocean and hinterland network structures have been an important issue for container lines in order to create a competitive advantage over their main competitors in terms of speed, port selection and network strength. Malchow and Kanafani (2004) show with their research on the U.S. import and export market that the manufactured goods transportation market is very focused on the network structure of both the ocean and hinterland, but that there is not a very big difference in the preference for one of the two. Clearly, in order to provide good service, the network structures of both ocean transportation and hinterland transportation are dependent on each other from both a carrier's perspective and a shipper's perspective.

In the development process of a liner service schedule, Fagerholt (2004) and Notteboom (2006) have identified three specific factors that contribute to the structure of the network. First of all, the service frequency is very important in both the economical aspect of container shipping, but also time aspect of container shipping. Shipping lines have to make a trade-off between offering a frequent service and potentially a lower occupancy rates or a less frequent service, with higher occupancy rates and the potential economies of scale. Secondly, optimal vessel size and fleet size is an important factor in the start-up, but also in the mature stage of liner services. Container shipping lines prefer to have an equal sized fleet per loop in order to create a homogeneous operation. Because of the large investments involved in the purchase of vessels, this also reduces the flexibility of a carrier to react on exponential growing or declining demand. Finally, Fagerholt (2004) and Notteboom (2006) also mention the number of port calls as crucial aspect in the liner service schedule. A reduction of port calls leads to faster transit times and gives the shipping line the possibility to have either more roundtrips or sail slower, reducing capital investment and operational costs. Although this direct routing has its advantages on the transportation rate, it reduces the potential catchment area of cargo. The rule of thumb for this decision is the additional costs of an extra call versus potential revenue growth because of an increased catchment area. This factor is further researched by Gilman (1999). Although his numerical analysis shows that for super post-Panamax vessels, additional calling is less expensive than making only a single call, many factors have changed over the last decade in terms of bunker fuel price, fuel efficiency of container and barge vessels, hinterland efficiency and port competition, Gilman emphasizes that also the land-based operations, such as crane performance could influence the liner shipping network.

Fremont (2007) has analyzed the maritime network of a large carrier, in this case Maersk. First of all, Fremont assumes a system with 3 ports on each side of the ocean (PO1/PO2/PO3 as ports of origin and PA1/PA2/PA3 as ports of destination) with 3 hinterland destinations on both sides as well. Fremont has determined 4 main configurations of containerizes maritime networks, with taking hinterland transportation in mind. His first configuration, the hinterland port with two maritime services shows a good example of specialization of origin/destination pairs.

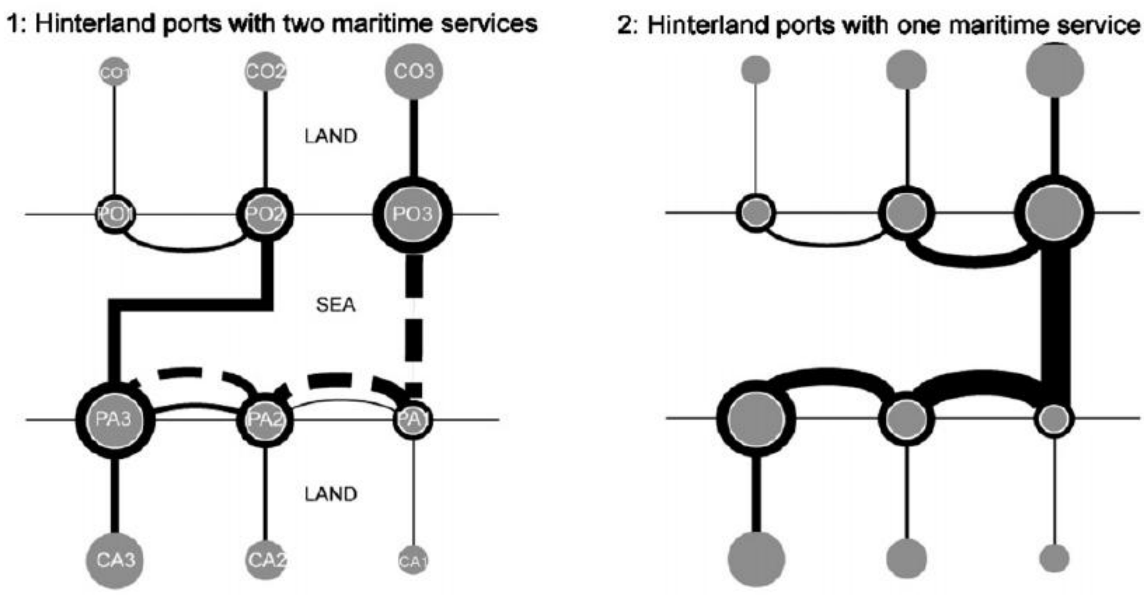

Figure 4.1: Structure of container shipping networks with direct services (Fremont, 2007)

In this case, as explained in example 1 of figure 4.1, the container shipping line operates 2 different loops offering more flexibility for the shipper in their decision making. This phase could have two explanations. First of all, it could be possible that the market between PO1, PO2 and the ports on the other side of the ocean has limited demand for transportation services, but could sustain a liner operation. Secondly, it could also be a viable explanation that the market that has been generated around PO3 would sustain a direct connection without the need to call at other ports to generate enough volume. This is also the case in configuration 2 in figure 4.1, but an important aspect in this configuration is economies of scale. By making a single loop, container lines can operate larger, more efficient vessels and reduce the number of maritime links between ports on both sides of the ocean. But this configuration also has its disadvantages. First of all, this configuration will have serious implications on the competitive position of the port as time-sensitive cargo will most likely go to the port which is the last call before the long voyage or the first port of entry on the other side of the ocean. Another disadvantage of this configuration is that although economies of scale are achieved, larger vessels require deeper drafts which are not possible in some of the smaller ports or that it would be economically more interesting to use smaller feeder vessels as additional costs of an extra call could be more expensive than using these feeder vessels.

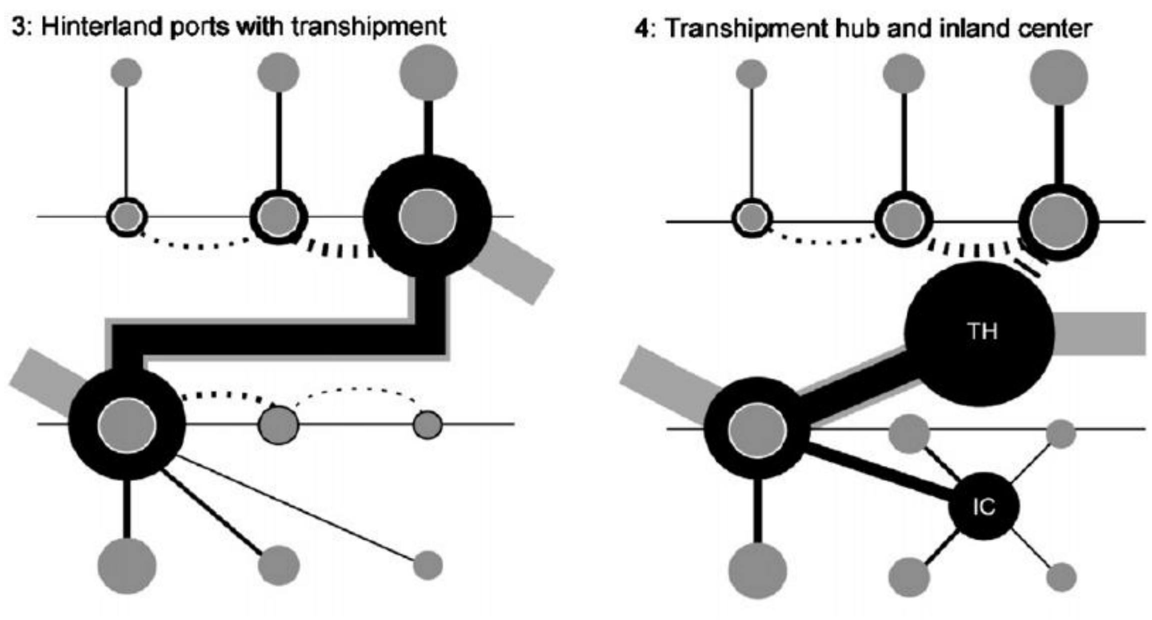

Figure 4.2: Structure of container shipping networks with continuing (single-call) services (Fremont, 2007)

Configuration 3 in figure 4.2 shows how this feeder service could be operating. Both ports PO1 and PO2 are being served by a feeder vessel which transports the containers to PO3 to be transshipped onto a larger vessel which transfers it to a single port PA1, where it will be once again transshipped onto feeder vessels to PA2 and PA3. Although this setup could be efficient in terms of the achieved economies of scale, congestion of the hub port could result in lower reliability and a longer transit time. The final configuration is the usage of a transshipment hub and an inland center as visualized in configuration 4. This configuration is very common in Southeast Asia, around the ports of Tanjung Pelepas and Singapore, but also the port of Salalah in Oman is considered a big transshipment hub. Transshipment hubs are visible in regions that do not have sufficient port infrastructure to handle the large vessels or without a large market to sustain these calls. Secondly, the usage of an inland center to divide containers could be an option to solve these problems.

Notteboom and Vernimmen (2009) also pay attention to another important factor, the price of marine oil on the routing configuration. Between 2001 and 2007, the price of IFO 380, which is being used by basically all marine vessels, has risen by 300% on average. This price increase led to an important change in the network configuration of container shipping lines. Next to the deployment of larger vessels, which are considered to be more efficient in its fuel consumption, shipping lines have started to slow steam in order to save costs on fuel. Based on their calculations with AXS-Alphaliner data from 2005 and 2007 on Far East - Northwest-Europe container trade, Notteboom and Vernimmen are able to conclude that the rising price of IFO 380 led to a slight decrease in the number of port calls and a larger average vessel size. Another effect that is visible is the significant change in the number of vessels used per loop, indicating a potential slow steaming trend.

The view of Notteboom and Vernimmen (2009) is also shared by Verboon (2009) in his essay on the Far East - Northwest-Europe container trade during 2009. Verboon researches the consideration of container shipping lines to either slow-sail through the Suez-Canal, risking the potential chance of being attacked by pirates, versus sailing along the Cape of Good Hope at regular speed. He concludes that there is clear evidence that slow sailing could have an effect on the sailing speed and therefore also the network configuration of container shipping lines.

Another important implication in shipping line networks is the creation of the so-called alliances. Also these alliances have shown influence on the configuration of shipping line networks. Gilman (1999) shows in his research on the Asian market, that within these alliances, a strategy of multiple services with a specialized regional focus is applied. For the container shipping lines within the alliances this has certain advantages, but also disadvantages. The formation of shipping alliances is very advantageous for shipping lines in order to compete against the large, independent-operating container shipping lines in terms of network coverage and specialization on certain markets, but also gives the shipping lines in these alliances the opportunity to jointly achieve economies of scale. But the implementation of alliances in container shipping could also face disadvantages in terms of constant renegotiation on the port calls and joint strategy on routes calling in that region. Also the risk of a shipping line stepping out of the alliance due to bankruptcy or other circumstances could lead to a loss of cargo and unreliable service could be a challenge for this shipping lines. If one of the vessels operated by carrier A copes with a delay, carrier B gets a bad image, although they did not operate this vessel by themselves.

Not only are ocean operations an important factor in the lines service scheduling, also the connectivity of the hinterland on the ocean services is very important. In this context, the role of ports is changing from a single port perspective towards port regionalization, first introduced by Notteboom and Rodrigue (2005). In figure 4.3, from the paper of Notteboom and Rodrigue (2010) the 6 phases of port hinterland development and the influence on liner shipping services are shown. In the first 3 phases, all ports in the model are being served by a deep sea liner service, while hinterland connectivity is being developed. Already in phase 2, ports with an optimal position towards the hinterland, so port #2 and #5 are already attracting additional cargo for the hinterlands of ports #1, #3, #4 and #6. Eventually this leads to a concentration of cargo in phase 4, by the further development of the hinterland, reducing the necessity for shipping lines to call at all ports. Because of increasing volumes and decreasing hinterland transportation rates, the two ports are able to provide rate-competitive hinterland services into each other's hinterland, but eventually the additional cargo flow cause congestion in the main ports. To cope with this congestion, ports either divert (if the port authority controls multiple ports) to other ports or loose cargo to close competitors within the region, causing a port regionalization trend. According to Notteboom and Rodrigue (2005), the creation of inland terminals and the creation of corridors towards the hinterland are crucial parts in the creation of a port regionalization trend.

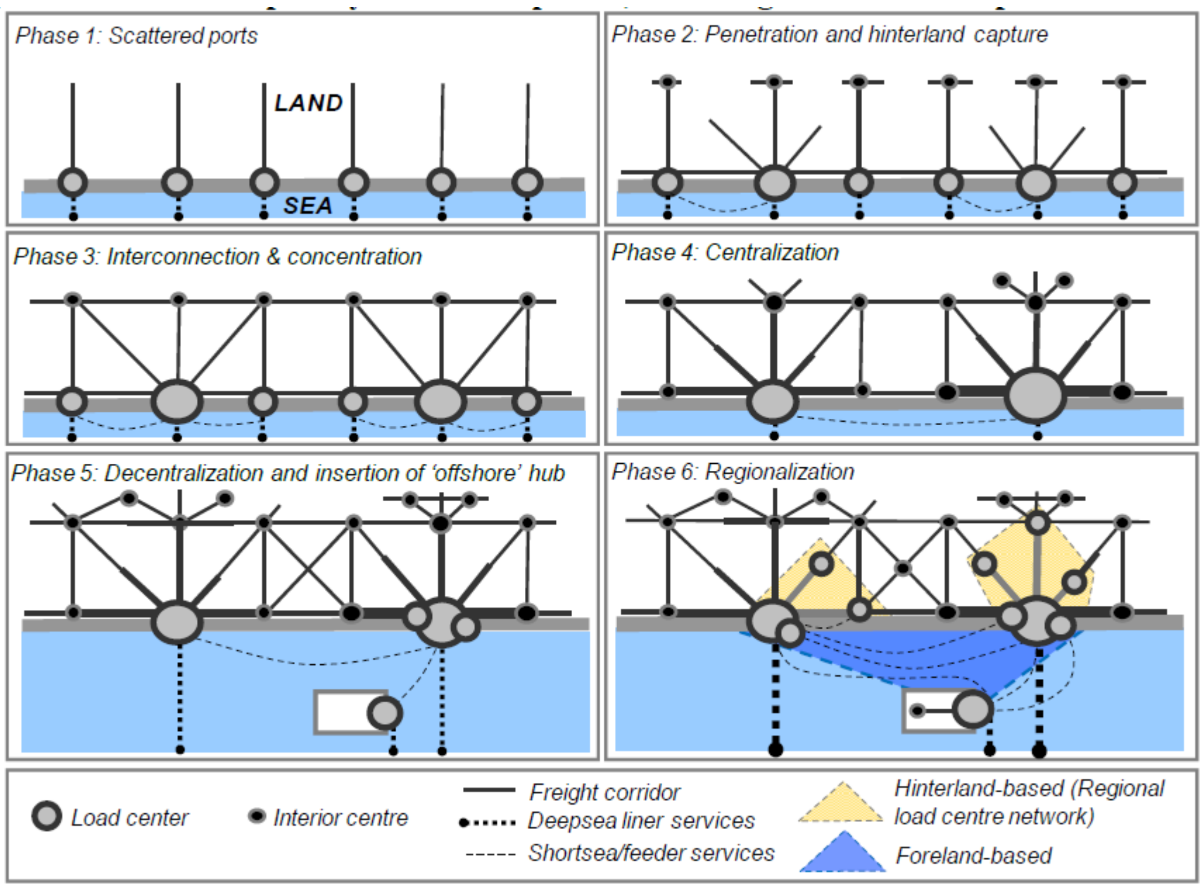

Figure 4.3: 6 phases of port (network) development by Rodrigue (2010)

By deferring the pickup and delivery of containers to these inland terminals, containers are able to move faster from the dock to the hinterland, creating the opportunity to realize a higher terminal throughput, but requiring the integration of intermodal hinterland transportation modes as rail and barge. Not only does this regionalization trend relieve the pressure on the port infrastructure, also economically does this regionalization have its effect as shown in figure 4.4. By using additional ports in the regionalized port network, shippers are able to reduce the extra costs caused by congestion and the diseconomies of scale, resulting in lower transportation rates.

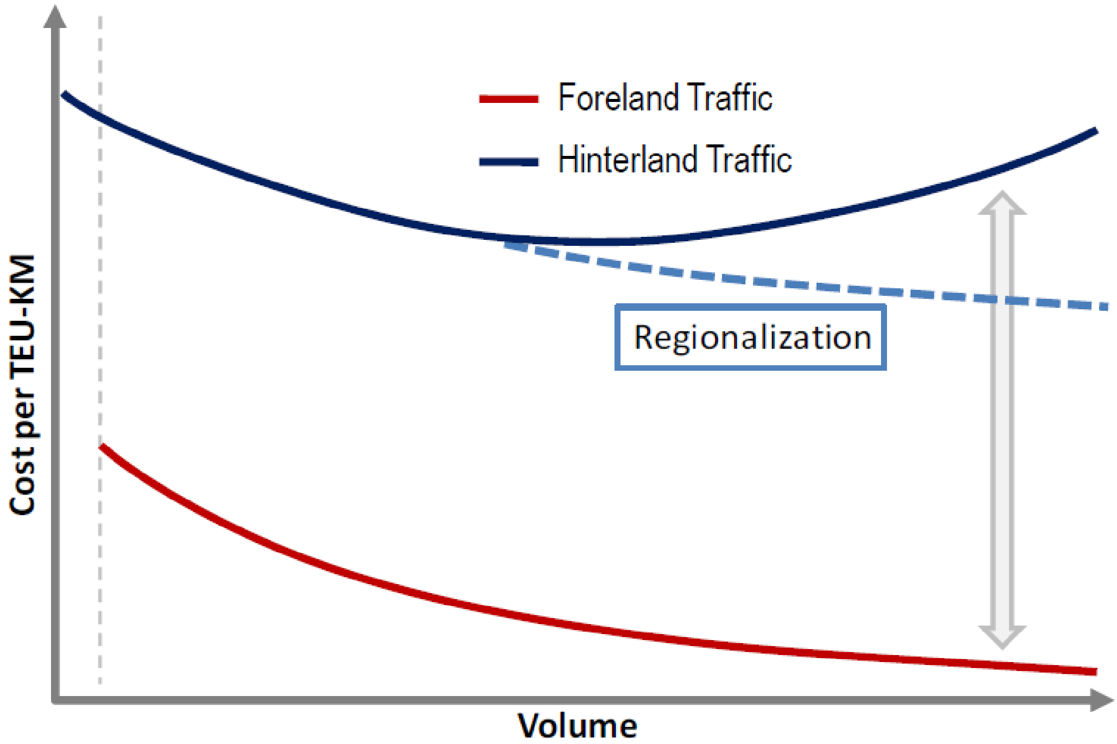

Figure 4.4: Cost per TEU-KM for hinterland and foreland (Ocean) traffic versus volume (Notteboom and Rodrigue, 2010)

When looking at the current structure of ocean networks there is a clear difference between the various shipping lines, but also in terms of port calling. Traditionally, Maersk and Hapag Lloyd have been focused on serving a market on a frequent basis, where transportation rates are an important factor, but quality the thriving factor. In contrast with these two carriers, the Swiss carrier MSC has a more monetary-orientated focus, by offering limited sailings, but at a lower price and quality. When looking at the North American network of MSC, Maersk and Hapag Lloyd there are very large differences. While MSC uses a single route on the transatlantic trade, using only Antwerp and Bremerhaven. Tables 4.1, 4.2 and 4.3 provide an overview of the transatlantic services between Northwest-Europe and the North American East Coast.

Maersk	Ports Europe	Ports East Coast North America	Frequency	Transit time in days between last port Europe and first port in North America
Ta1	Antwerp, Felixstowe, Bremerhaven, Rotterdam, Le Havre	Newark, Norfolk, Charleston	1x week	7 days
Ta2	Felixstowe, Bremerhaven, Rotterdam	Newark, Norfolk, Charleston, Savannah	1x week	10 days
Ta4	Rotterdam, Bremerhaven, Antwerp	Montreal, Halifax (export only)	1x week	11 days

Table 4.1: Transatlantic services operated by Maersk (Source: Maersk Website)

Hapag-Lloyd	Ports Europe	Ports East Coast North America	Frequency	Transit time in days between last port Europe and first port in North America
AES	Hamburg, Antwerp	New York	1x week	8 days
ATA	Hamburg, Gothenburg, Antwerp, Liverpool	Halifax, New York, Baltimore, Norfolk	1x week	8 days
ATX	Rotterdam, Hamburg, Le Havre, Southampton	New York, Norfolk, Charleston	1x week	8 days
GAX	Antwerp, Thamesport, Bremerhaven	Charleston, Miami, Savannah, Norfolk	1x week	11 days
PAX	Antwerp, Thamesport, Hamburg, Rotterdam	Halifax, New York, Norfolk, Savannah	1x week	7 days
SLCS1	Antwerp, Bremerhaven, Le Havre, Liverpool	Montreal	1x week	9 days
SLCS 2	Antwerp, Hamburg	Montreal	1x week	7 days

Table 4.2: Transatlantic services operated by Hapag-Lloyd (Source: Hapag-Lloyd Website)

MSC	Ports Europe	Ports East Coast North America	Frequency	Transit time in days between last port Europe and first port in North America
NA	Bremerhaven, Felixstowe, Antwerp, Le Havre	New York, Boston, Philadelphia, Baltimore, Norfolk	1x week	7 days
SLCS1	Antwerp, Bremerhaven, Le Havre, Liverpool	Montreal	1x week	9 days (Vessels operated by Hapag-Lloyd)

Table 4.3: Transatlantic services operated by MSC (Source: MSC Website)

4.2 Port selection and divergence

Over the recent century, the hinterland transportation systems, as well as the entire transport chain have developed themselves into a continental perspective. Already in 1938, A.J. Sargent was one of the first authors to start thinking about the hinterland of a port, in particular the ports of Antwerp, Hamburg and Rotterdam. Not only does this prove the historical role of these ports to determine hinterland boundaries, but also the geographical role. For determining the hinterland of a port, a distinction can be made between captive hinterland and contestable hinterland. Captive hinterland is the area where a single port has a competitive advantage over another based on generalized transportation costs, while contestable hinterland is the area where no particular port has a clear cost advantage. Next to the arguments of Sargent, Morgan (1952) argued that also one of the factors for determining the hinterland is the type of cargo that is being moved. Needless to say, the introduction of standardized containers has led to a diminishing captive hinterland and increased the contestable hinterland for geographically well located ports with good hinterland connections. This vision is shared by Haralambides (2002), who argues, that for the most ports, the captive hinterland has diminished to a minimum, due to the removal of trade barriers, improved hinterland transportation networks and the increased efficiency of ports. As figure 4.5 shows, generalized transportation costs are important to determine the captive and contestable hinterland of a port.

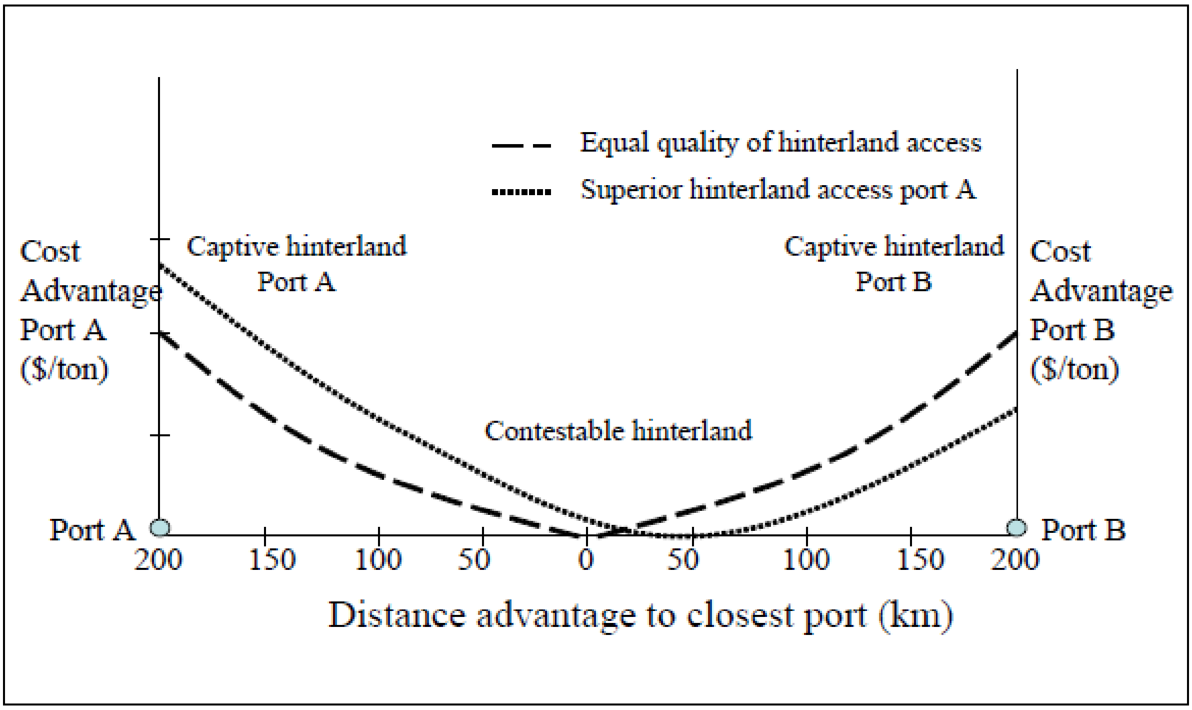

Figure 4.5: Captive vs. Contestable hinterland (De Langen, 2007)

These effects are especially important for the ports within the Hamburg – Le Havre range in Europe. Not only do they compete with the ports within this range, also the port-ranges itself compete for the same European bound amount of cargo. A good example for this is given by De Langen (2007) on the Austrian container market. Although Austria is geographically positioned near the Mediterranean range of ports (Consisting of Genoa, La Spezia, Trieste and Koper to name a few), the majority of cargo comes in through the ports in the Hamburg – Le Havre range. To come up with an explanation for this, he collected data from a survey to determine the most important factors for shippers and freight forwarders in their port selection process. It shows that for both parties, the decision is based on the quality and level of service of a port, as long as it do not exceeds the willingness to pay from the company. Nonetheless there is also a significant difference between the forwarders and shippers in their decision making. Because forwarders are only acting as intermediary, they do not care much about the service as long as it is reliable, while shippers care significantly more about the level of service, compared to the price. Also, De Langen looked at the reasons for selecting a more expensive port. His research shows that forwarders are more location oriented with keeping the hinterland connections in mind.

This competition is also visible in the U.S. and the Midwest in particular. With regards to Chinese imports and exports, competition for contestable hinterland is shown by the ports of LA/Long Beach and Vancouver; U.S. East Coast ports and the two Canadian Atlantic ports Halifax and Montreal for

European cargo and the Gulf coast ports for cross trade cargo (De Langen, 2007). The main reason for the large part of contestable hinterland is the structure of the infrastructure network in the US. Historically, the U.S. East Coast has been sea-cargo orientated because of the colonial history with the United Kingdom. Also the high density of population plays an important role. Over 60% of the U.S. population lives on the East Coast. Not only do the U.S. East Coast ports compete with each other, also the role of Canadian ports is significant. O' Keefe (2001, and revised version in 2003) look at the Canada-US container port rivalries by statistically analyzing origin/destination information for ocean containers.

Malchow and Kanafani (2004) have a very good example of this on the U.S. West Coast. There example focuses on the market share a port has and the role of distance towards the hinterland.

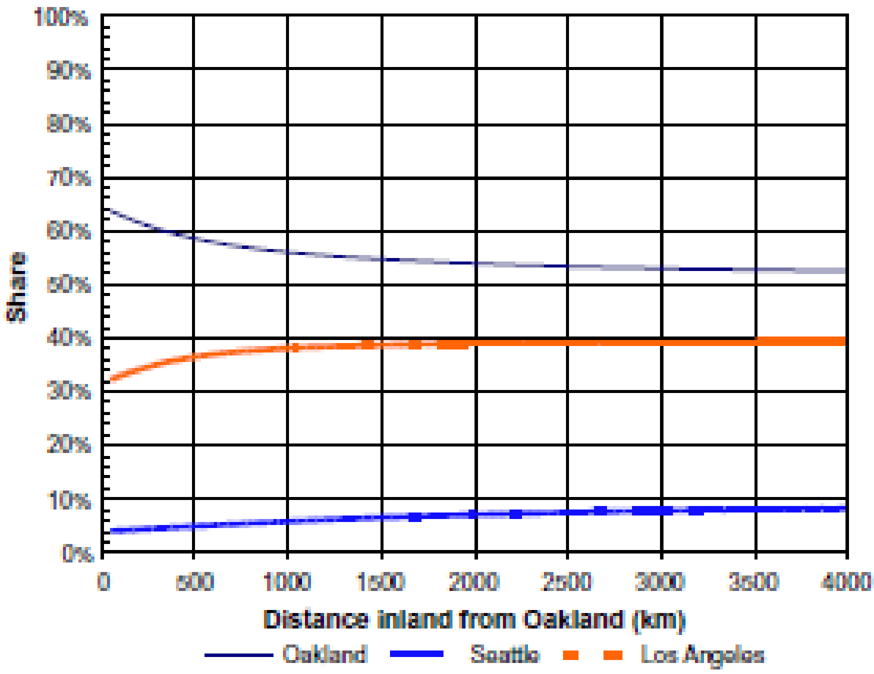

Figure 4.6: Influence of distance on market share for a single market, Malchow and Kanafani (2004)

Figure 4.6 shows that the area close to the port of Oakland, creates a competitive advantage for this port, but that also ports like LA and Seattle have a (significant) market share in the cargo originating and destined for this region. Clearly, as hinterland distance increases, the captive hinterland quickly vanishes into a more competitive situation where LA and Seattle gain market share. Based on this example, it is also clear that not only distance to the hinterland is an important factor for the supply chain in the port selection process.

The paper by Malchow and Kanafani (2001) discusses the factors influencing port selection by building a multinomial logit model, specified into four different types of commodity: Bulk, food, fabrics and other manufactured goods. Malchow and Kanafani argue that it is not the shippers that care about port selection, but that this role has been the primary concern of the carrier. In contrast to their expectations, the model shows that for manufactured goods the size of the vessel has a negative effect on the port selection process. But in line with their expectations they show that both oceanic and inland distance is a significant factor influencing the port selection process from a carrier's perspective. But as they conclude, they also give important critique on their model. Not only does the set of ports show a strong preference for the local market, a low R^2 value (0.38) of their model is also very an important point of critique.

In their follow-up paper from 2004, Malchow and Kanafani once again tried to research these factors, with an improved model and additional data. In their new model, Malchow and Kanafani also specifically look for statistical significance for discretionary cargo, in other words, cargo that originates from a region without a port. Their results show that not only the inland distance is very important but also the decision by the shipping line when to call this port. Also, in contrast to their previous research, Malchow and Kanafani show that for both bulk and manufactured goods shipments, the size of a vessel is of positive significant importance for the port selection process. This means, that larger vessels would result in a more concentrated port selection, achieving economies of scale. This trend of port selection in combination with growing vessel size is also part of the divergence process that North American East-coast ports have been facing the last decade and is also discussed by Rodrigue and Guan (2009) in terms of consolidation of container traffic along the North American East Coast. This consolidation has been ignited because of multiple factors.

First, the major ports have been heavily investing in better infrastructure at the port, particularly in new high-tech cranes and on dock rail facilities in order to increase their port throughput. Secondly, the U.S. market has redeveloped itself from production to consumption, creating a heavier amount of traffic through ports that dominated imports. The role of divergence on the port side has also impacted the economics for the individual shipping lines. Because of the concentration of cargo through a limited amount of gateways, shipping lines have been able to achieve economies of scale. With regards to economies of scale, a remark has to be made. Although vessels achieve economies of scale while at sea, diseconomies of scale are applied to in the port itself. Not only do these vessels require a deep draft, port throughput rate and efficiency is crucial.

Not only does divergence characterize a concentration process in capturing incoming cargo, it also influences the role of the hinterland networks. In the divergence process, the hinterland network of a port has to be able to cope with the transportation of high volumes of containers through several inland terminals, in order to relieve the port of road congestion and maintain a high throughput speed to reduce the container dwell time, which influences the port capacity.

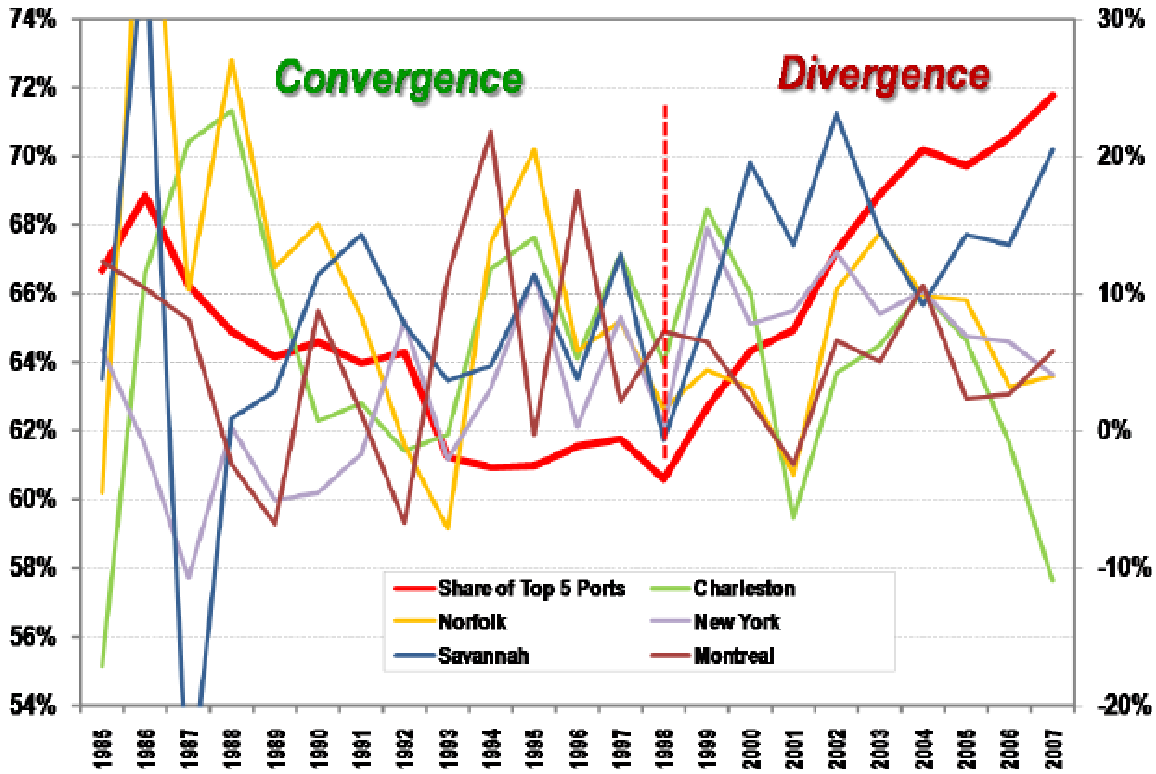

Figure 4.7: Market share of the top 5 ports on the East Coast of the USA (left-axis) versus annual growth/decline in 5 main U.S. East Coast ports (right axis) Rodrigue and Guan (2009)

Figure 4.7, from Rodrigue and Guan (2009) shows a clear trend of both convergence and divergence for the U.S. East Coast ports between 1985 and 2007. While the top 5 ports have been declining in market share during the 80's and 90's, there is a clear view on the effect of the increasing ship size on the consolidation of cargo by the steep climb during several economic downturns and increasing bunker fuel prices.

Magala and Sammons (2008) discuss the role of port choice and the diminishing influence of the shipper on the port decision making process. They claim that the role of the shipper in this process is diminishing by the upcoming position of third-party logistics service providers and supply chain integrators, but also by the shipping line themselves. Their model aims to generate a new analytical framework for port choice modeling, with respect to the changing role of the shipper choice decisions in mind. In their paper, Magala and Sammons argue that major clients of ports, shipping lines, integrators and third party logistics providers are no longer focused on the efficiency and location-specific advantages of a port, but that this view has shifted to the quality and reliability of the entire supply chain. According to Magala and Sammons, the supply-chain oriented view has its history in the economic theories about bundling, which gives the consumer, so in this case the shipper, an opportunity to internalize consumer surplus under the expectation that the price of the bundle is lower than the price of both products (Port service and shipping service) separate.

The view of Magala and Sammons are also shared by Guy and Urli (2006) in their paper on the port selection for the Montreal- New York corridor, but characterizes itself from other papers by looking both from a shipper's point of view and a carrier's point of view. Based on their multicriteria-analysis, Guy and Urli show that although the use of larger ships and larger ports create advantages, it does not make the smaller ports uninteresting for both parties and they question the general accepted assumption that economies of scale would be an important factor for the current container shipping network configuration. Based on their analysis, Guy and Urli conclude that location and intermodal connectivity are more important factors, contributing to the role of a port in the hinterland network.

Like Europe, North America also has specific port ranges in which multiple ports compete for the same hinterland. Rodrigue and Guan (2009) divide the ports along the North American Atlantic coast into four classifications. First of all, the St. Lawrence Seaway Range. This range consists of two ports, Montreal and Halifax to a lesser extent and is characterized by niche market shipping. All container traffic that enters the St. Lawrence Seaway is destined for Montreal, where the entire vessel will be loaded and unloaded. Next to the St. Lawrence Seaway range, Rodrigue and Guan (2009) mention the upper range ports, Halifax and Boston. This range characterizes itself due to their weak position on the market. Traffic going to these ports could be easily transferred to either Montreal or ports in the U.S. mid-range.

The strongest and most competitive port range is the U.S. mid-range. The dense populated and well-connected hinterland is mainly focused around two ports: New York/New Jersey and Hampton Roads. Within this range, a lot of competition between these ports is visible, with the focus on improving hinterland connectivity by rail. Also the port of Baltimore could be considered to be a competitor in this range, due to its central location, but to reach the port of Baltimore, a 1-day extra detour along the port of Hampton Roads is necessary, shipping lines prefer to call at Hampton Roads instead (Starr, 1994). The final range that the authors mention is the lower-range ports, containing the southern ports: Savannah, Charleston and Miami. These ports are especially a competitor for traffic through the Panama Canal as well as transatlantic trade. The expansion of the Panama Canal is projected to change shipping routes. Because of the strong dockworker labor union on the west coast and potential closure of the ports of LA/Long Beach due to strikes and lock-outs, shippers and ocean carriers are considering using U.S. East Coast ports as port of call. Unlike the ILA, which is the dockworker labor union on the East Coast, the ILWU has a large history with regards to strikes and a very high bargaining tolerance with regards to labor contracts, making it difficult to assure long term-stability of services under a stable price level. Another big reason for this shift is the rail congestion near Chicago and St. Louis. Several rail companies, like CSX and Norfolk Southern have invested in new facilities from the East Coast, to surpass the congested rail area and be able to cope with the expected rise of demand for rail cargo towards the hinterland.

4.3 Economies of scale in container transportation

4.3.1 Economies of scale for ocean liner services

One of the most important factors for creating and maintaining an economic sustainable shipping network is the deployment of vessels and the (dis)economies of scale involved with this decision. Research done by Cullinane and Khanna (1999) prove that ships up to 8,000 TEU will achieve the best economies of scale for the long Asia – Europe/Asia – North America voyages. When looking at the transatlantic market, the optimal size of vessels is approximately 5,000 – 6,000 TEU. A critical note has to be made, although this article has been one of the most quoted articles on this topic, data is the model on costs are based on the situation in 1999. Recent developments on technological improvements, but also the rising fuel price, are crucial to be noted. Another conclusion by Cullinane and Khanna (1999) is on the development of shipping networks. Because of these economies of scale, the concept of load centers will become increasingly important. The transition to this model has been proven in Europe already. Between 2000 and 2006, as the ports of Algeciras, Spain, Gioia Tauro, Italy and Marsaxlokk, Malta has nearly doubled their volume.

Next to the research performed by Cullinane and Khanna (1999) a lot of researchers have been focusing on the role of economies of scale in ocean liner services. Already in 1999, Wijnolst et al. argued that economies of scale are crucial for container shipping lines to achieve a competitive advantage. Based on his assumptions on fuel consumption, 1999 bunker fuel prices and engine efficiency, Wijnolst et al. calculated an advantage of 16% for 18,000 TEU vessels in terms of costs over 8,000 TEU vessels. Although his input factors have changed over the last decade, it is still safe to assume, that under the assumption of equal utilization rates, these larger vessels still create competitive advantages when being compared to the smaller vessels, comparable to research performed by Axaliner in 2008 (ELAA, 2006) as illustrated in figure 4.8.

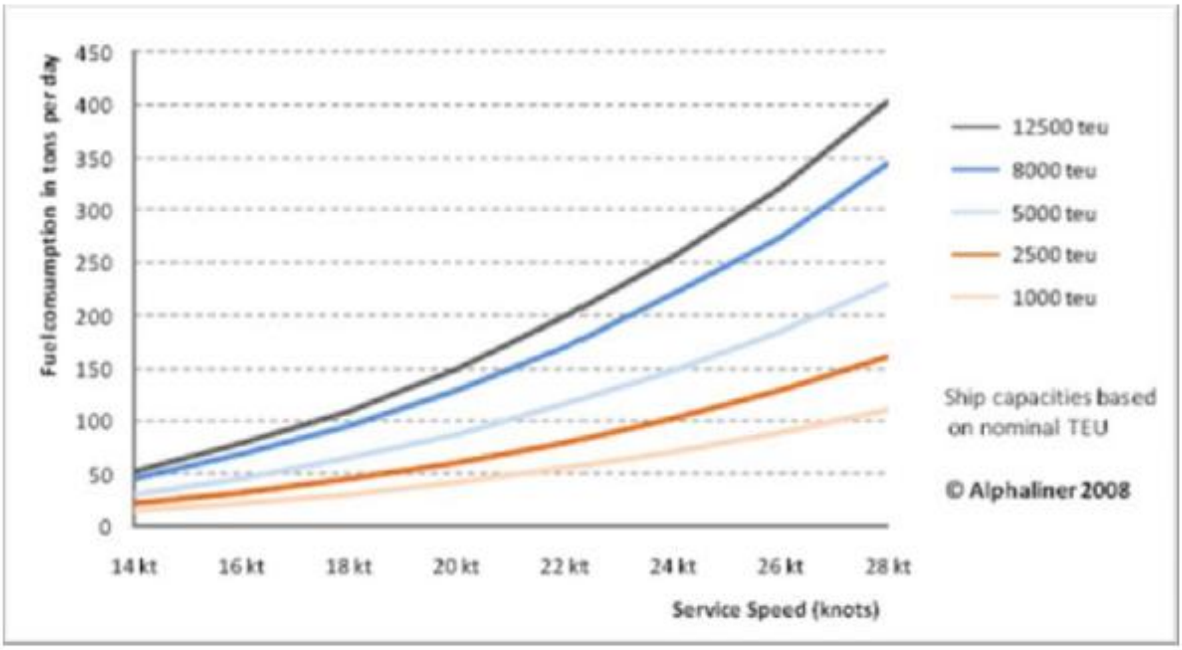

Figure 4.8: Fuel consumption as function of speed with variable capacities (ELAA, 2006)

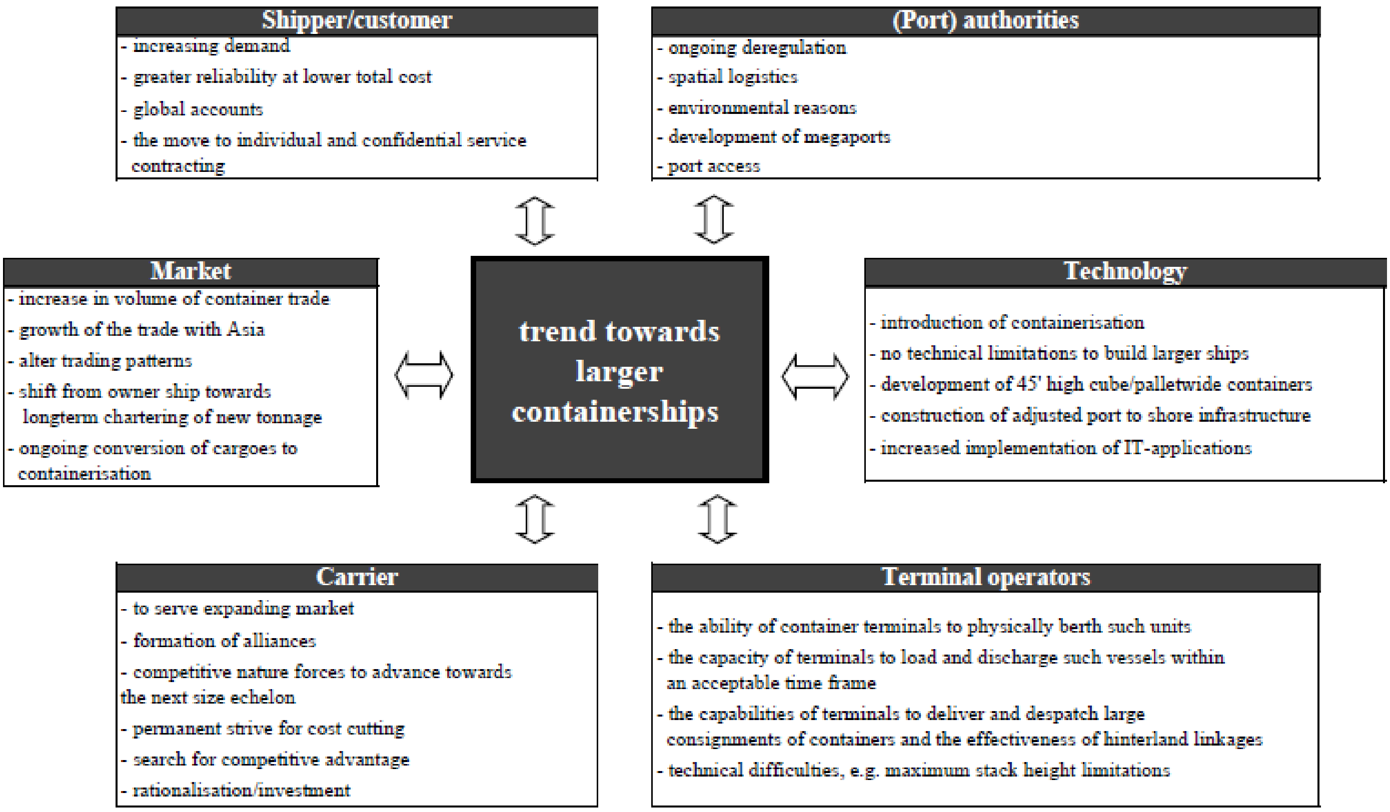

Figure 4.9: Factors inducing the trend of larger containerships, Sys et al. (2008)

Also Sys et al. (2008) have been looking at the link between ship size and operations. Sys et al. determined several factors influencing the economies of scale in container vessel decision making by reviewing academic literature, but also by interviewing important stakeholders like shippers and container lines. Their broad research has led to the creation of a multiple stakeholder model illustrated in figure 4.9 showing the most important factors for each stakeholder, but also take the perspective of a market and technology based view. Not only the market, but also other parties like the providers of technology, terminal operators and port authorities have played a role on the development of the larger vessels. Without their efforts to facilitate these large vessels, the trend would not even have started.

Like Cullinane and Khanna (1999 and 2000), also Stopford (2009) mentions that economies of scale are the determinant of the optimal ship size, but also mentions that although larger ships can achieve economies of scale, it is the combination with the ocean network decision-making that determines the optimal ship size.

The research by Sys et al. (2008) also shows the economies of scale that have been mentioned by Cullinane and Khanna (1999 and 2000) and ELAA (2006) are very focused on a vessel-level, while Sys et al. looks more specific at the unit costs per TEU per day.

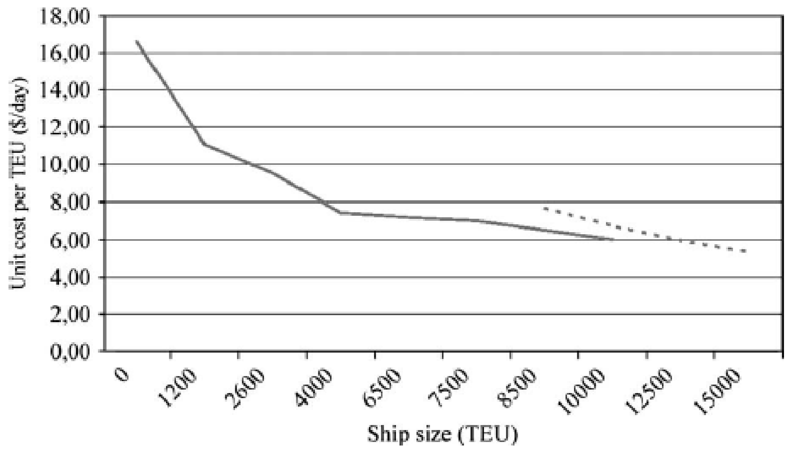

Figure 4.10: Role of ship size on the unit cost per TEU (in $/day), Sys et al. (2008)

Figure 4.10 shows that especially in the first phase of economies of scale, roughly from 1,200 TEU to 4,000 TEU, the most economies of scale are being achieved. But in their research, Sys et al. (2008) also determined the optimal size on all maritime routes, specified per region and the expectations of future optimal sizes.

	Transport segment	Deepsea					SSS
	Terminal type	Hub+hinterland				Hub	
	Trade lanes	Main trades			Other		
Technology	Eu/Asia/Eu	Intra Asia	Transatlantic	Transpacific	North/South		
2005 – up to 10,000 TEU	7500–9500	1000–1500	3000–5500	7500–9500	1500–3000	7500–12,500	1500
2012 – up to 15,000 TEU	10,000–12,500	1500–3000	3000–5500	10,000–12,500	3000–4500	7500–15,000	3000
>2012 – up to 18,000 TEU	12,500–15,000	1500–3000	4500–6500	12,500–15,000	5500–6500	7500–18,000	4500

Table 4.4: Optimal ship size on all trade routes from 2005 till 2012 and above, Sys et al. (2008)

Table 4.4 shows a clear trend on the main trades, but also for short sea shipping services. Not only does this affect future port investments, but also the competitiveness of smaller ports will be challenged.

But not only in terms of fuel consumption do the economies of scale have an effect. Also the deployment of personnel results in an economical advantage. When looking at the Maersk operations, it shows that while ship size exponentially increases from +- 4,000 TEU to +-18,500 TEU (Maersk Triple-E class) the necessary amount of crew goes down from 20 to 19, due to modern technology and the economies of scale that are being achieved in terms of crew productivity.

Based on research between 2004 and 2009 by the U.S. Bureau of Transportation on the size of container vessels, it is possible to assume that consolidation and economies of scale also play an important role in American ports. While the amount of container vessel calls have been reduced with 0.4%, the average ship size have been showing a double-digit growth in an economic downturn.

	2004	2009	Percent change, 2004–2009
Calls by all vessel types	59,885	55,560	-7.2
Calls by container vessels	18,279	18,206	-0.4
Calls by containerships 5,000 TEUs and over	1,734	4,434	155.7
Containerships as percent of total vessel calls	30.5	32.8	NA
Containerships 5,000 TEUs and over as percent of total vessel calls	9.5	24.4	NA
Average containership vessel size per call (TEU)	3,221	3,848	19.5
Average containership vessel size per call (dwt)	43,610	50,202	15.1
Average age all vessel types	11.8	10.3	-12.7
Average age container vessels	10.5	10.1	-3.8

Table 4.5: Container port statistics (US DoT, 2011)

Also the number of calls nationwide, by containerships that are 5,000 TEU and larger, have dramatically changed from 1,734 in 2004 towards 4,434 in 2009, a 155.7% increase in just 5 years time. It is also clear from table 4.5 that these increasing sizes of ships are related to new investments in the ocean shipping industry when looking at the average age of the container vessels.

But a major issue for increasing ship size is the pressure on the physical specifications of the ports. Because of their size, newly developed post-Panamax ships like the Maersk E-class and Triple E-class are not able to call at smaller ports due to their draft restrictions. In combination with the economies of scale, this results in more implications in determining the shipping network for a carrier.

Although shipping lines achieve economies of scale with increased vessel capacity, it is also based on several unpredictable factors. Because demand is based on external factors for a shipping line to control, economic downturns and seasonality can have significant effects on the potential economies of scale gained by a container vessel. In order to fully capture the economies of scale, utilization rates of vessels should stay stable when increasing vessel size. As Notteboom (2012) already mentions in his book, container lines have not been able to realize a consistent level of cargo, therefore resulting in an overcapacity situation and are not able to profit from the effects of economies of scale to their full extent. Because of the lack of collective action by shipping lines during economic downturns, overall capacity is barely reduced, resulting in lower utilization rates and in the worst case the bankruptcy of an entire shipping line. To tackle this problem, shipping lines have been actively developing alliances to share vessel capacity and strengthening their network.

To stabilize utilization rates and create market specialization, some container lines are currently operating in an alliance. By leasing out slots on each other's vessel, the container shipping lines are able to take collective action in terms of their port call decision making and creating a more equal balance between demand and supply by reducing overcapacity while keeping the flexibility to offer the customer an optimal routing. Another important effect is of vessel sharing that as a result of higher utilization rates, it will become more effective for certain vessel operators to deploy the large container vessels in order to lower transportation costs per TEU and creating a competitive advantage by lower transportation rates versus shipping lines that are not part of the alliance. Also the potential cost savings and overcapacity reduction due to slow steaming is being considered effective by many container shipping lines. Research by Notteboom and Vernimmen (2009) show that although slow steaming was considered as a temporary measure to reduce fuel consumption, container shipping lines are considering slow steaming as the way to go for the future, because of the high bunker fuel prices and the cost reduction when comparing fuel consumption costs versus the deployment of an extra vessel on a maritime service based on the Asia-European market. By slow steaming, container shipping lines can achieve higher utilization rates, while achieving economies of scale and lower fuel consumption, which is very advantageous in terms of profit-maximization.

Another very important diseconomy of scale is the pressure on the terminal operations. In order to create revenue, a ship has to maximize its time on the sea, while reducing the time necessary to load and unload the cargo. The deployment of larger container vessels is therefore a heavy burden on the terminal operators in terms of capital investment. Not only does dredging have to be sufficient to serve these vessels, also the quay operations should have sufficient capacity to cope with loading and unloading large volumes. Ideally, the large container vessels are being loaded and unloaded by using multiple cranes in order to reduce port time. But during loading and unloading cargo, the diseconomies of scale are visible in the hinterland flow to and from the port. While container lines are used to deploying smaller (6,000-8,000 TEU) vessels with several calls in a region, larger vessels (8,000+ TEU) are very dependent on limited calls, sometimes even only one call in a region. With the combination of larger volumes and less calls, hinterland flows has to be optimized in order to prevent diseconomies of scale in ocean liner shipping.

Not only are the dimensions of the locks in St. Lawrence Seaway a very important factor in determining the economies of scale for services from and to the Great Lakes, also the draft of the water restricts the size of the vessels. Theoretically is the maximum size of a container vessel up to 1,000 TEU, compared to the 4,000 TEU which are able to sail to Montreal and other East Coast ports. With the increasing bunker prices, economies of scale have been a very important aspect in the viability of container shipping and also a very big threat to the development of direct container services to this region. Because of this size restriction, container shipping lines are not able to able to respond to higher demand based on ship size, but will have to increase the frequency of services, which requires a large capital investment in vessels. When looking at the previous mentioned model from Sys et al. (2008), a direct container connection would not be able to follow in the trend of larger container ships to achieve full economies of scale if demand for this service will grow. Also from a carriers perspective the economies of scale are very important. In order to gain a competitive advantage and optimize its services by cost-cutting, a potential feeder or direct service must create a positive economical result when being compared to the existing modes of transportation. In other words, the feeder or direct service must be cheaper than a service to Montreal plus the additional expenditures of land based hinterland transportation.

4.3.2 Economies of scale in terminal operations

Not only do the economical rules apply to ocean container shipping in terms of economies of scale, also terminal operations are facing these developments in terms of size and the economic competitiveness of a port. Although the port authorities prefer the existence of multiple competing terminal operators in a port, traffic volumes and productivity are crucial in determining the competitiveness of the entire port.

From a terminal operator's perspective, the minimum efficient scale is its main determinant whether or not to offer a bid for a new terminal operation. This minimum efficient scale is focused on several characteristic of the port operations, but also to the implementation of, capital-intensive, modern technology in the port. Following the definition from Kaselimi et al. (2011), the minimum efficient scale in container operations is defined as the lowest scale of output that can be produced at the level of the minimum average costs on the long run. From a terminal operator's perspective, the minimum efficient scale is equal to the amount of containers handled, without occurring increasing marginal costs. This minimum efficient scale should be, due to long term capital investments in terminal infrastructure, determined on a long range scale.

Although this minimum efficient scale would lead to the lowest marginal costs for a terminal operator, it differs from the preferred scale, also mentioned by Kaselimi et al. (2011). In many occasions, terminal operators are operating under the amount of cargo defined by minimum efficient scale, in the so called preferred scale. Although the long range average costs are higher in the preferred scale, there are many determinants why terminal operators are still interested to operate under the minimum efficient scale, but this requires several entry barriers to prevent new entrants in the market, creating a monopoly position in a port and the potential to grow capacity towards the minimum efficient scale. Also from a port authority's perspective, the terminal operator could be bounded to operate under the level of the minimum efficient scale, because of the implication of social costs related with the terminal operations.

As mentioned before, the minimum efficient scale and preferred scale are being influenced by the technology used. Especially in port operations, the implementation of technology to the terminal operations leads to a high burden in the capital expenditures of an operator. Not only does this new technology influence the long range average costs, but also for short term costs, technology is a very important factor. Like all other equipment, modern terminal equipment like automatic guided vehicles requires a lot of maintenance expenditures over the years, together with the initial investment of these high-tech vehicles, compared to terminals that are mainly using human operated vehicles. Also the decision on the amount of quay cranes, which are one of the largest capital expenditures for terminal operators, is important in deciding the minimum efficient scale of the port based on their performance and costs.

Not only is the preferred scale decided by independent terminal operators, but also the vertical integration of shipping lines into the role of terminal operator has played an enormous role over the last decade. By being able to use an own network of terminals, shipping lines are able to compete more effectively with competing shipping lines that are using independent terminals. In the independent situation, both the terminal operator and the shipping line are focused on making a profit out of moving the container. By internalizing terminal operations, the shipping line is able to offer a lower price and more competitive price to the customer by internalizing the profit that the terminal operator should have made. Recent new terminal tenders in the port of Rotterdam with the development of the second Maasvlakte has led to a larger involvement of shipping lines into the terminal operations. Together with the shipping lines of the New World alliance, CMA CGM and container terminal operator DP World are developing the new Rotterdam World Gateway terminal with a capacity of 4 million TEU on annual basis. By operating through their own Rotterdam World Gateway terminal, the shipping lines are able to transport this amount of cargo, traditionally handled by ECT in the port of Rotterdam, on a more cost-effective, lower price basis. Also the A.P. Møller group, already present in the port of Rotterdam through their terminal operating company APM Terminals, will be able to increase its capacity in the port of Rotterdam and create a more competitive basis in the port of Rotterdam for cargo.

Although the amount of containers transported through the port of Rotterdam is expected to grow over the upcoming decade, current terminal operator in the port of Rotterdam, ECT, part of Hutchinson Port Holding, is facing a large threat in terms of a cost effective terminal operation. Based on research from the Policy Research Corporation (2011) ECT argues that due to the opening of the previous mentioned terminal, utilization rates at the ECT Delta terminal will collapse from close to 100% to a position where less than 65% is utilized. Because of the high amount of automatic guided vehicles, automatic stack-cranes and productive quay-cranes, it is necessary for ECT to have a utilization rate of 90% or higher in order to reach their preferred and minimum efficient scale. Although it is expected that these utilization rates will come back to the required level, ECT predicts a though period and potentially a price-war, due to overcapacity in the start-up years of the second Maasvlakte. Another important fact is that not only intra-terminal competition will become stronger; also the inter-port competition within the Hamburg-Le Havre range, where an increase of 40% in capacity by investments in new superstructure and infrastructure during the upcoming decade is planned, will contribute to the competitive position of ECT.

When looking at the Great Lakes, it is important to mention that the ports are not specialized in the transportation of containers creating the assumption that although potential traffic flows exist, it is not comparable to large ports where the minimum efficient scale allows multiple terminal operators in a competitive role. Especially research done by Wiegmans et al. (2009) is specialized in the minimum efficient scale in small ports, based on a case study on the potential container port in Vlissingen (Flushing) in The Netherlands. Historically, the port of Vlissingen has been focused on transportation of bulk goods, like coal and oil, in a limited amount destined for a local European market, but the growing importance on other commodities, has changed the view to attracting more containerized cargo. Over 2007, the total amount of containerized cargo equaled around 70,000 TEU. Locate between the ports of Antwerp and Rotterdam, the port of Vlissingen is considered to have a good position in order to divert traffic from either Antwerp or Rotterdam. Over the last few years, the port of Vlissingen has started to develop its, previously non-existent, container operations by the development of several new container facilities, targeted to be fully operational at 2013, with a capacity of 1 million TEU. Next to this terminal, two other container terminal plans, with a combined annual capacity of 4.9 million TEU, have been shelved, due to the economic downturn and the lack of investors. Although an increase from 70,000 TEU to 5,900,000 TEU in capacity would be possible, the port of Vlissingen currently lacks ocean services. Based on different researchers, Wiegmans et al. (2009) and Notteboom (2007) concludes that it is clear that in order to economically compete for deep-sea cargo with the other ports in the Hamburg-Le Havre range, the new container terminal in the port of Vlissingen requires a critical mass volume of 900,000 TEU annually to enable the development of hinterland connections by other modalities than truck and the ability to attract deep-sea container lines. As an alternative, the port of Vlissingen could be used as feeder port of the port of Antwerp and therefore requiring only 350,000 TEU on an annual basis.

4.4 Short Sea Shipping/Feeder

4.4.1 Short Sea Shipping/Feeder in Europe

During several decades, the European Union has been actively promoting feeder and short sea shipping through its Marco Polo program and the TEN-T program to achieve a better modal split. As part of TEN-T, the European Union hopes to achieve an environmental, more sustainable, alternative for hinterland transportation as well as improving the competitive position of the European industry by giving the new members of the European Union an opportunity to broaden their market (Medda and Trujillo, 2010). Because of the increasing focus of the European Commission on the implementation of short sea shipping initiatives, a lot of research has been conducted to determine the advantages and disadvantages of short sea shipping. An extensive overview has been provided Medda and Trujillo (2010) as shown in table 4.6, as an extension of the research from Paixão and Marlow (2002).

Advantages
Sustainability: Efficient and environmentally friendly transport mode.
Cost-effective: To shift long-distance traffic off roads.
Flexibility: Increase in volume does not require infrastructure improvement.
Provides a new alternative:
Attracts freight from other modes.
Stimulates additional shipping.
Reduces pressure on other modes.
Disadvantages
Perception: Old-fashioned mode of transport:
Low frequency.
Low reliability: Departure and arrival times.
Quality and safety: Higher risk of damages to goods.
Complicated shipping logistics: Integration into door-to-door.
Complexity of documentary and administrative procedures.
The efficiency of ports, port services and port-hinterland connections needs to be strengthened.
Goals
Reduce costs and times of nodes (increase the efficiency in ports).
Unitize (standardize) cargo.
Management and control of the transport chain handled by a single entity.
Integrate shipping more fully into door-to-door of freight transport services.
To be both substitute and complement of other transport modes.

Table 4.6: Advantages, Disadvantages and goals of short sea shipping (Medda and Trujillo, 2010)

It is clear that although short sea shipping has a lot of advantages in terms of cost-effectiveness and sustainable transportation, there is a negative perception of shippers on it as being old-fashioned, slow, unreliable and complex. To change this perception and in order to strengthen the network, the European Union is actively investing in the development on the so-called "Motorways of the Sea" to improve the image and increase transport efficiency throughout the entire European Union.

Ng (2009) researches the difference in the role that short sea shipping plays on the Liege – Baltic market (shipped through Antwerp) versus the usage of road-haulage to 4 ports in the new member countries of the European Union. To research the potential of the TEN-T program in the new member states, Ng decided to use a different set consisting of 10 destinations, 5 within the new member countries (Poland, Lithuania, Latvia and Estonia) and 5 outside of the European Union (Russia, Ukraine and Belarus) while using short sea shipping to Gdynia (Poland), Riga (Latvia), Tallinn (Estonia) and Klaipeda (Lithuania). Based on the generalized transportation costs, it is clear that road haulage has an advantage for distance <1,700 km and >2,500 km, while the short sea shipping option of using Riga or Tallinn has an competitive advantage between 1,700 km and 2,500 km. Ng concludes that it is not only the short sea shipping that contributes to the development of a more competitive advantage over road haulage, but that also the port efficiency is an important aspect to take into account. Table 4.7 shows that if the port of Riga is able to achieve the same level of efficiency as the port of Antwerp, it could increase its catchment area and decrease the level of competitive advantage for road haulage.

Centre	SSS Riga (before improvements)	SSS Riga (after improvements)	Road haulage
Klaipeda	79.79	**74.71**	76.11
Minsk	86.13	**81.05**	82.16
Moscow	114.97	**109.90**	110.19
Riga	**69.17**	**64.09**	80.92
St. Petersburg	**101.88**	**96.80**	105.64
Tallinn	**79.88**	**74.80**	97.69
Vilnius	79.61	74.53	64.44

Table 4.7: Implications of changes in Riga's port efficiency on the generalized costs of SSS against road haulage (expressed in Euros per ton) (Ng, 2009)

4.4.2 Short Sea Shipping/Feeder in the USA and Great Lakes – St. Lawrence Seaway system

Unlike Europe and Asia, the USA has not been actively promoting transportation of usage of short sea shipping and feeder services as a way to reduce congestion. Because of the geographical location of the United States, a clear trend of specialization is visible on all three coasts. While the West-Coast mainly focuses on Southeast-Asian cargo, the East-Coast is more orientated on European and Middle-Eastern traffic flows over the Atlantic and together with the Gulf-Coast orientated on the South-American trade. Because of the long detour from the East-Coast to the West-Coast, which could only be done by sailing through the Panama-canal, much cross-country trade is being transported overland by rail. Mainly due to this development, the efficient rail transportation has proven to be one of the biggest barriers that the short sea shipping industry is facing, not only for the cross-country trade, but also for shorter hinterland-connectivity. Also on the short distance market, short sea shipping is being challenged by another way of transportation, road haulage due to the high geographical density on the East-Coast, primarily around the Boston-New York-Washington corridor. Currently, the short sea shipping operations in the United States are regionally focused on serving distant markets like Alaska, Hawaii and the Caribbean, which either a have limited catchment area or lack proper equipment for large port operations. Also the existence of a container feeder service in order to consolidate cargo is, especially compared to Europe and Asia, barely existing, due to several barriers. Not only are the barriers important in this comparison, also the geographical structure of European industrial clusters are influencing the role of short sea shipping. Paixão and Marlow (2002) mention that in comparison to the USA, around 60-70% of the European industrial capacity is either located near open sea or an inland waterway. According to the same authors, short sea shipping in Europe also profits from strict anti-congestion policies, but still copes with its negative image.

When looking at it from an American perspective, based on Mulligan and Lombardo (2006), the economic feasibility of short sea shipping in the United States mainly depend on the potential to offer lower freight rates than current modes of overland transport. It is clear that although the potential of short sea shipping exists, it will require a lot of effort by national and local government to implement it in the transportation network within the United States and gain the attention of shippers. Although the potential exist, there are a few considerations that have to be made when implementing short sea shipping. First of all, short sea shipping will not be automatically considered being the best solution in reducing road congestion. Because of its limited reach, short sea shipping should be developed as being another mode of transport instead of aiming to replace overland transport. Another important consideration is the potential of joint partnerships between shipping lines, overland transportation companies and large consumers of transportation services, but this is only possible when short sea shipping proves to be an economic feasible alternative over other ways of transportation for all parties involved. Especially for overweight and hazardous containers, short sea shipping could contribute to more cooperation from overland transportation companies to free up capacity and reducing the risks involved. Mulligan and Lombardo also mention the idea of providing tax benefits for short sea shipping companies, but also the customers of this service, in order to create a shift from road/rail towards short sea shipping. Although this would be economically possible, governments have been facing severe budget cuts, especially in the United States in order to reduce government spending. Although improving short sea shipping networks would lead to a better economical competitive advantage of exporting companies, it also gives foreign companies a better competitive position to increase its catchment area. Furthermore, the implementation of short sea shipping could also result in a decreasing demand for existing companies in the rail and road industry; potentially this could even lead to bankruptcy and an increase in unemployment in these sectors.

To gain a better insight on the image of short sea shipping on the American market, a survey has been conducted by Perakis and Denisis (2008). This survey shows that although short sea shipping has been acknowledged as an alternative to current modes of transportation, there are several obstacles which prevent an effective country wide implementation. Two of these obstacles are based on institutional policies, the Harbor Maintenance Tax and the Jones Act. These obstacles will be covered more into detail in the other part of this paper, from Haazen (2012). Like mentioned before, image plays a very important role for short sea shipping. As indicated, American shippers see short sea shipping as an unreliable, slow and abundant mode of transportation. Another important obstacle is the extra handling costs involved by adding extra nodes in the network which require extra moves of the cargo, but the containerization of cargo has been very important in this aspect, to increase the simplicity of the handling operations. It is also clear that additional paperwork could contribute as an extra obstacle for the development of short sea shipping. Already mentioned by previous mentioned researchers Perakis and Denisis (2008), Paixão and Marlow (2002) and Medda and Trujillo (2010), the administrative paperwork could be, compared to the European one-market situation be considered to be a threat to the potential.

Another survey has been done by Brooks and Trifts (2008). Based on this survey, the authors have been able to confirm the importance of transit time and rates to have a significance importance in the decision making process for shippers. Furthermore they concluded that there is a clear distinction in the competitive role of different modes of hinterland transportation based on the range. Next to these two factors, it is possible to conclude based on the survey that reliability is also a major factor in order to commence a shift from land based to water based transportation for shippers in the USA. Another important result from the survey is focused on the volume of the transported goods. While most respondents in the survey are focused around a single distribution center, one of the respondents also mention the possibility to have multiple delivery stops in an area, which is not possible with short sea shipping. From this statement it is clear to assume that volume in combination with the distribution network of a company could also play an important role in the modal choice, although this will not have a significant effect as this only a niche volume. The research also determined under which conditions a shift from land based to water based transportation would become an option for shippers. Brooks and Trifts concludes that the usage of price incentives, by taxing road haulage or a tax benefit for companies that use short sea shipping are a good way to facilitate a modal shift. Also the removal of the Harbor Maintenance Tax for short sea shipping is being considered as a positive way to induce a modal shift.

The potential of a Great Lakes feeder service has also been researched by several authors. Winebrake et al. (2008) has developed a model to predict the routing of containerized cargo based on three factors: costs, time and environmental friendliness. Although this concept model gives a good understanding on the competitive hinterland transportation market based on time and environmental friendliness, it lacks a sharp economic analysis. On the short-haul trip between Toronto and Cleveland, rail proves to be a very hard competitor in terms of travel time which is equal to each other, but is being inferior to the speed of road haulage.

4.5 Conclusion

This chapter has provided an overview on the structure of ocean and hinterland networks, the port decision factors, economies of scale and the short sea shipping industry. Based on many articles, it is evident that over the last decades the shipping line industry has changed on both the landside and the ocean side of their operations. On all these topics, the increasing size of container vessels has played a crucial factor.

As a result of higher bunker prices and increased engine efficiency, many shipping lines have opted to invest into new vessels to develop a competitive advantage over its main competitors in terms of profitability and the possibility to reduce ocean freight rates. Already in 1999, a paper written by Cullinane and Khanna and one by Wijnolst et al. (1999) has mentioned the potential cost advantages by increasing vessel size. This trend has developed itself further as a result of increased demand from upcoming manufacturing markets in Asia, the global increasing volume of container transportation and the changing focus for shipping lines towards a cost cutting/lower freight rate focus. This has also been evident on the U.S. market. Based on statistics from the U.S. Department of Transportation (2011), clear evidence is visible on the focus of the shipping lines. While the amount of calls by container vessels overall has been stable, the amount of calls of container vessel of 5,000 TEU or more has nearly tripled in just 5 years' time to 25% of the market.

But with this increasing vessel size, the pressure on the port operations and hinterland transportation has increased, leading to a more competitive market for this type of cargo. Because more containers are required to be lifted on and off the vessel, quay cranes are required to make more moves and increasing the time spend on the loading and unloading process of the vessel, unless terminal operators use more or more modern quay cranes, which are able to handle a vessel quicker. With this increasing vessel size, it is more difficult for smaller ports to compete for container traffic unless investments are being made in the terminal operations. But for a terminal operator, its main concern is its internal minimum efficient scale. While investments in modern equipment could lead to quicker port operations, it proves to be a heavy burden for the breakeven level of its operations. Also for ports in the Great Lakes, the minimum efficient scale of terminal operations will be crucial in order to compete with the North American Atlantic coast ports of Montreal, New York/New Jersey and Norfolk for cargo originating or destined for the U.S. Midwest.

The increasing pressure on terminal operations and the increased volume of cargo also influences another issue, the hinterland and ocean network of the carrier. Based on articles from Fagerholt (2004) and Notteboom (2006) it has been possible to determine the three most important factors in developing a liner service schedule. Clearly, frequency, optimal vessel size and the number of port calls prove to be crucial factors in deciding a liner service schedule as cargo has become more transportable throughout the hinterland as a result of the increased containerization and the removal of trade barriers between, primarily European, countries. Not only in academic literature in this theoretically described, also in the operations of a large container like Maersk, there is a clear evidence of a structured network. Fremont (2007) has researched the network of Maersk and discovered 4 patterns in ocean liner networks, discussed in figures 4.1 and 4.2. These patterns are also visible in the port specific literature by Notteboom and Rodrigue (2005), Rodrigue (2010) and Notteboom and Vernimmen (2009). In these articles there are clear examples of the phases ports follow in being part of the ocean liner network. While historically each country had their own ports, governed by the national or local government, centralization and concentration of volume has led to a decrease in ports actively accepting deep-sea-vessels, particularly after removing border control within Europe. Because of this trend of concentration and the growing importance of economies of scale, a lot of investments in the hinterland connectivity have been done by port authorities and terminal operators. As the growing size of container vessels results in a severe impact on the port operations, not all ports are able to handle these vessels. In order to still effectively serve these markets in Europe, shipping lines have developed, next to the traditional modes of hinterland transportation by road and rail, another option, by barge or short-sea-shipping. Unlike the existing modes, maritime hinterland transportation in characterized by being energy efficient in terms of fuel consumption and a mode which has a large flexibility as increasing volume does not require extra infrastructure.

Although this mode of transport proves to be an ideal solution for congested ports and a green alternative to existing modes, short-sea-shipping and barges have the perception of being an old-fashioned mode of transportation and being a more complex mode of transportation. Based on research on the Central and Eastern parts of Europe, road haulage is considered to be a viable solution if distances are less than 1,700 kilometers or exceeding 2,500 kilometers, if rail haulage is not taken into account. Also in the United States, shippers have been considering implementing short sea shipping, but unlike Europe, this has not proven to be an ideal solution due to the geographical set-up in the United States and strong market position of the large Class I rail companies Norfolk Southern and CSX Rail on the East Coast of the United States.

Chapter 5 – Economic Analysis

This chapter will provide an economic analysis based on the door-to-door transportation rates of 4 major regions in Northwest-Europe and 5 major regions in the U.S. Midwest.

The first paragraph of this chapter will start off with providing more information on the regions researched in the direct-service, feeder-service and existing-service model. For more detailed information, Appendix A will provide a comprehensive overview on all used assumptions. After this paragraph 5.1, paragraph 5.2 will go into depth on the transportation-rate part of the various models. In subparagraph 5.2.1 will start off with providing a transportation rate analysis of the baseline of the existing services on the transatlantic market. After this, paragraph 5.2.2 provides the transportation rate analysis in the baseline situation of a direct service from Rotterdam into the Great Lakes. After this, paragraph 5.2.3, will provide an economic analysis based on 4 scenarios that have been developed. First of all, these scenarios will be further explained in detail, while the scenario specific assumptions can be found in the corresponding appendices. The paragraph will start off with the scenarios on the Harbor Maintenance Tax, followed, after which the effect of changes in the price of North American hinterland transportation will be discussed; the final scenario that will be discussed is the role of terminal handling charges on the port selection process in Europe. The concluding paragraph will provide the main conclusion on the transportation rate analysis.

After this paragraph 5.2, paragraph 5.3 will represent the time-aspect of the model. Like the transportation rate model, the time-aspect model also starts off providing a solid overview of the baseline of existing services in subparagraph 5.3.1, giving more information on its transit time. After this subparagraph, a more in-depth analysis on the role of transit time by the implementation of a direct-service and feeder-service is provided in paragraph 5.3.2. The next subparagraph will focus on the different scenarios in the transit time model. Each of them will be described at first, after which it will be analyzed based on transportation time throughout the entire transportation chain. Following this, 5.3.4 will provide a final sub-conclusion on this topic.

5.1 General model information

Hinterland Europe cities

The model and analysis of this research project will focus on both the European and U.S. Midwest region as origin and destination market. For this model, four major European regions have been selected on various criteria like location, accessibility, local industry and size. In order to provide a good overview on the supply chain of goods, the four regions that are selected are being matched with the specific characteristics from important industrial regions within the U.S. Midwest. Furthermore, these four regions are located in the contestable hinterland of the four major European container ports. To provide a good overview on transportation rates and time, from a shipper's perspective, these regions will be considered as part of the entire transportation chain.

Rhine-Ruhr Region

The Rhine-Ruhr region is considered to be the largest metropolitan region of Germany, containing over 11 million inhabitants creating an estimated gross regional product of $ 330 billion U.S. Dollar on an annual basis, which is larger than the budget of several EU-member states. When looking at maritime trade, the inland port of Duisburg is considered to be the most important in the region in terms of volume and connectivity. With an annual volume of 2.5 million TEU, the inland port of Duisburg is outperforming large seaports like Le Havre, Zeebrugge and Barcelona which is an indication of the importance of Duisburg in the transportation network for this region.

As a result of the industrial specialization within the Rhine-Ruhr region, it is a preferred location for various industrial conglomerates. Especially within the steel manufacturing, the upper-Ruhr region (Duisburg-Dortmund corridor) is home to many production sites of major companies as ThyssenKrupp, Klöckner and Hochtief, specialized in the production of steel and processing this to (semi-)final products. In contrast to the upper-Ruhr region, the lower-Ruhr region around Düsseldorf and Cologne, the largest city in this region, have been specialized on the chemical industry with the presence of approximately 65,000 employees at 230 companies and multinationals like Cognis and Evonik.

As the Rhine-Ruhr area is a true polycentric region, it is difficult to set a single origin or destination for this region, but because of the importance of the port of Duisburg for the region, the model will assume Duisburg as the center of economic gravity for the Rhine-Ruhr region.

Rhine-Neckar Region

The Rhine-Neckar region is Germany's 8th largest region based on population. Located between the major cities of Frankfurt in the North and Stuttgart in the South, the region characterizes itself because of its diverse economy. The region around Mannheim and Ludwigshafen diversifies itself by being a car manufacturing region with major vehicle manufacturers like Daimler, John Deere, Bombardier, Siemens and various suppliers of car parts, while it also contains a high presence of production sites of major chemical companies like BASF (35,000 employees in Ludwigshafen and multiple spin-off companies) and Fuchs Petrolub AG. Also Heidelberg has developed itself as one of the largest cities within the region, but in comparison to the Ludwigshafen/ Mannheim twin city it is more focused on the service industry. Furthermore, Ludwigshafen and Mannheim are very accessible in terms of hinterland transportation to the four ports in this model. Because of its economical center of gravity within the Rhine-Neckar region, the twin cities of Mannheim and Ludwigshafen are considered as the center of economic gravity for the Rhine-Neckar region.

Baden-Württemberg

The Baden-Württemberg has been one of the most important manufacturing regions for the Germany economy over the last centuries. Like the Rhine-Neckar Region, Baden-Württemberg characterizes itself because of its high presence in the automotive sector. Within the Baden-Württemberg, the region around Stuttgart is considered to be the economical center of gravity when looking at the size and composition of the industrial economy. Because of its importance to the European economy, it is considered as one of the four motors of Europe, as highly industrialized region. Within the Stuttgart region, many large automotive manufacturers like Porsche and Daimler have several productions sites and attracted also many producers of car parts like Bosch and Behr to this region, both with large operations in the U.S. Midwest. Because of its importance to the regional economy and location, Stuttgart will be considered as the center of economic gravity for the Baden-Württemberg region.

Basel-Mulhouse twin city region

The Basel-Mulhouse industrial sector has been very important for the development of diversification of the French Alsace and Swiss Basel regions over the last decades. While Mulhouse is more focused on the automotive industry with the Peugeot facility as largest employer in the Alsace with several dedicated suppliers of car parts, Basel has characterized itself as a specialized chemicals cluster. With the presence of chemical multinationals Novartis, BASF and Clariant in the specialized chemical industry and Roche, Basilea and Actelion in the pharmaceutical industry, Basel have been able to attract academically skilled inhabitants and actively invested in the bio-tech, life sciences and health industry, becoming one of the leading regions in the world on this topic. Because of its excellent position for hinterland transportation and size of its local economy, Basel will be considered in the model as the economic center of gravity for this region.

Hinterland U.S. Cities

Comparable to the European locations, five U.S. Midwest regions have been selected for this model on various criteria like location, accessibility, local industry and size. In order to provide a good overview on the supply chain of goods, the five regions that are selected have been matched with the specific characteristics from important industrial locations within the U.S. Midwest. The only exception to this is the inclusion of Minneapolis as destination. As the Minneapolis market is only a very small niche in terms of volume and demand, it could prove to be an interesting market to serve in order to scavenge for cargoes on the return voyage like grain. Furthermore, these five regions are located in the contestable hinterland of the major North-American East Coast ports. To provide a good overview on transportation rates and time, from a shipper's perspective, these regions will be considered as part of the entire transportation chain.

Chicago

The economic activity within the region of Chicago, stretching from Gary, Indiana to Milwaukee, is considered to be much diversified. Also Chicago itself is considered as one of the largest cities in the U.S. and historically a hub of economic activity. With its local GDP of $ 532 billion dollar, the metropolitan region of Chicago exceeds major countries like Belgium, Switzerland and Sweden, symbolizing its large consumption market. Like other major U.S. cities, Chicago is home to a large financial sector. As an airline hub for American Airlines and United and as rail hub for all major Class I railroad operators, Chicago is considered to be the top transportation hub of the United States together with New York. As centralized hub, Chicago has developed itself as a transportation hub with many rail connections to all three U.S. coasts and is considered as one of the largest "ports" of the United States in terms of handled containers in TEU (Hull, 2012).

Next to these sectors, the OECD has identified the chemical industry and the manufacturing of metal products as strongest sectors in the local economy (OECD, 2011). With steel manufacturing along the south shoreline of Lake Michigan in Gary, Indiana, Chicago is also a very interesting location for the production of finalized products, ready to be transported throughout North America by rail or as exports by plane or ocean container to all regions of the world. Next to this steel cluster, the chemical sector has also been a significant part of the Chicago economy, by presence of Akzo Nobel and Univar in the region.

Although the local economy of Chicago has a much diversified economic structure, it has faced challenges during the economic downturn in the late 2000's and has not been able to reduce the unemployment rate. One of the largest opportunities for the Chicago metropolitan area currently is the nanotech, bio-tech and ICT sectors, outperforming an impressive group of OECD regions by far. By attracting a young labor force consisting of highly skilled employees, Chicago hopes to diversify its economy even further. Because of its importance in the American economy, its position as transport hub and its economical center of gravity for Illinois, Chicago is being considered in the model as the economic center of gravity for this region.

Detroit

Over the last century, Detroit has developed itself as the global automotive capital in the world, being home to the three large car manufacturers in the world: Ford, General Motors and Daimler-Chrysler. The position of Detroit in the car industry has led to the creation of a large cluster of car producing companies and local suppliers. Although this cluster is being considered as strength of Detroit's economy, it is also a weakness on the other hand. The global economic crisis and rising price of gasoline have hurt the Detroit car manufacturing industry heavily, leading to bailouts of the major car producers GM and Chrysler in order to prevent a collapse of the local economy. Although GM and Chrysler have been growing steadily, unemployment in the Detroit metropolitan area exceeds national levels. Unlike other redeveloped industrial regions in the USA, Detroit has not been able to attract diversify its economy significantly from a car manufacturing focused economy towards a service focused economy. But in order to defend their competitive position on the global market and under public pressure because of the bailouts, car manufacturers in the Detroit region has been investing in fuel efficient technology for vehicles. Next to the car manufacturing industry, Detroit is also home to one of the largest chemical companies on a global scale, Dow.

As border city, Detroit has attracted a lot of vehicles crossing the US-Canadian border and vice versa through the 82-year old Ambassador Bridge, leading to congestion on the major routes to and from the city. Detroit is also part of one of the major Class I rail routes between the ports of Montreal, Halifax and the U.S. Midwest. As first point of entry in the United States and its good location for Ohioan bounded cargo, Detroit is also a hub for many trucking and logistical companies.

Because of its importance in the local manufacturing sector, its position as cross-border transportation node and its global specialization in the production of cars, Detroit is being considered in the model as the economic center of gravity for Michigan.

Minneapolis

The state of Minnesota is like other U.S. Midwestern states specialized in the production of forest products, grain and mining. Although its importance to the U.S. economy is smaller than the regional economy of Chicago, Minnesota is responsible for providing ingredients of many food products and wood products. Especially the export of grain, soy beans and corn to Europe and Asia has proven to be one of the main drivers of the state economy. Because of the importance of these bulk products, the ports of Green Bay, Wisconsin and Duluth, Minnesota, have specialized in these goods as export trade flow. Unlike finalized products, these agricultural products are mainly transported by bulk vessels. Technically, it is possible to transport these products by container, but because of weight restrictions, lacking container service on the Great Lakes and the value of the product, this trade flow is considered a very small niche market. Because of its importance in the production of agricultural sector and its economical center of gravity for Minnesota, North Dakota and South Dakota, Minneapolis is being considered in the model as the economic center of gravity for this region.

Cleveland

Cleveland has historically been a city with a lot of history in the production of steel production. But over the last decades, Cleveland has diversified its economy from a steel-based economy towards a service-based economy by investing heavily in the health care and bio-tech industry. As a result of these investments, the health care sector in Cleveland has become one of the leading regions within the United States. Next to the involvement of state and local institutions, the private sector has also actively been investing within this sector. The corporation between Case Western University, the Cleveland Clinic and the University Hospital of Cleveland has led to the development of a newly build biotech R&D facility in order to work as an growth pole for new start-up companies within the biotech industry.

Because of the specialization in health care R&D within the Cleveland area and the large (potential) customer base, one of the leading Dutch medical companies, Philips Medical, has been actively operating within the region as one of the major players in the field of R&D and production.

Also the chemical industry has acknowledged Cleveland as a good location for both the manufacturing of products, but also as headquarter. Sherwin-Williams, America's largest paint manufacturer and globally on the second place after the Dutch Akzo Nobel group, has been one of the major employers in the Cleveland chemical industry, but also Lubrizol, PolyOne, RPM International and the German BASF are very important for the chemical cluster around Cleveland. Another large producer in both chemical and product manufacturing is the globally renowned Goodyear, with a specialization in tires for diverse use. This multinational has historically been present from 1898 onwards with several production facilities in the proximity of Cleveland.

Because of its industrial history, Cleveland has been home to the manufacturing of steel and other fabricated products, but over the last decades this sector has been declining. Nonetheless, production of steel is still a large sector in the region. Also the manufacturing sector in Cleveland has been highly dependent on the production of steel in the region for their finalized products. Although the local steel manufacturing companies are shifting their focus from basic to specialized steel, demand for steel has been exceeding the supply leading to the import of steel from Tata Steel Ijmuiden and the Swedish SSAB group. With regards to the manufacturing sector there is a specialization in the production of car (spare) parts and hydraulics, especially by Eaton and Applied Industrial Technologies. Because of its importance in the manufacturing sector, its shore side location and its economical center of gravity for Northeast Ohio, Cleveland is being considered in the model as the economic center of gravity for this region.

Columbus

The local economy of Columbus has been identified as one of the most diverse economies in the United States. As state capital, governmental services are the largest employer within the Columbus region. Next to government services, financial services have been a major sector for the Columbus economy, with the presence of several Fortune 500 banks and insurance companies. But also the chemical and manufacturing industry has a significant presence. Worthington Industries, one of the Fortune 500 companies in the steel-processing industry and Columbus Steel Castings, which operates one of the largest steel manufacturing facilities in the United States, are important for the local manufacturing sector. Also Momentive and Ashland have been actively producing specialty chemicals for export and national markets.

Columbus is also home to a large logistical sector. With the presence of the Rickenbacker intermodal terminal, Columbus has been an important transport hub for Norfolk Southern, but also for CSX Columbus is an important market as stop along the Norfolk-Chicago route. Also the presence of a large operation by FedEx at Columbus Airport has led to the attraction of many logistical and trucking companies. Next to this, the U.S. Department of Defense has one of its three major supply centers located in Columbus.

Like Cleveland, Columbus has been home to many institutions in the health care and medical research sector. Although Columbus is larger than Cleveland in terms of population, the private sector has preferred Cleveland for its production and R&D sector, while R&D in Columbus is mainly done by the Ohio State University and other public institutions. As main city for the Central Ohio region, Columbus is being considered in the model as the economic center of gravity for this region.

Models

This research will focus on three aspects in the maritime transportation chain between both regions. First of all, the rates of existing services by the major ocean carriers are being compared to each other in the rate model for existing services. This model looks at the existing services for door-to-door transportation for the previously mentioned regions and cities, through the four major ports of Northwest Europe and four major ports on the Atlantic coast of North America. Secondly, a new ocean service is introduced between Rotterdam and Cleveland/Toledo, based on the “direct model” with various inputs like terminal productivity, fuel price levels and other crucial inputs which will be mentioned later on in appendix A. Although it is common for ocean services to call at several ports on both continents, shipping into the Great Lakes and the St. Lawrence River is presumed to be a single port call route on the North-American side of the Atlantic. In Europe, the ports of Rotterdam and Antwerp are presumed to be a near-perfect substitute for each other, as shown in Tables 4.1, 4.2 and 4.3 as they are mostly being used as either the first or last port of call due to their position as gateway to the market. The analysis of the direct service also focuses primarily on the Europe to North-America route. As this leg is dominant in terms of volume, with a 65:35 U.S. import-to-export ratio pre-crisis in 2005 and 2006 (UNCTAD 2011), the dominant leg is decisive in the viability of a direct service into the Great Lakes. Although the financial crisis in the U.S. and Europe as well as the Euro crisis have impacted the volumes severely and resulted in a 60:40 U.S. import-to-export ratio, it is assumed that these levels will return to their historical state. Next to the direct service model, the feeder model looks at another new service, but in this case it is a feeder service between Montreal and Cleveland/ Toledo under the condition of a HMT-free regime between Canada and the US, in order to research a potential benefit with this final step of the transportation chain.

Analysis

In the transportation rate analysis, the outputs from the existing services and the direct service from Rotterdam into the Great Lakes are compared to each other on a rate-orientated focus. In this analysis, a distinction has been made with regards to the type of goods that are being transported between the European and American hinterland, based on the previously described characteristics of the local economy.

The main focus in paragraph 5.2 and 5.3 will be on the following trade routes:
Mannheim-Chicago (Chemicals)
Mannheim-Detroit (Chemicals, Car parts)
Mannheim-Cleveland (Chemicals, Car parts)
Mannheim-Columbus (Chemicals)
Duisburg-Chicago (Chemicals, High Valued Goods)
Duisburg-Detroit (Chemicals)
Duisburg-Cleveland (Chemicals)
Duisburg-Columbus (Chemicals, High Valued Goods)
Stuttgart-Chicago (High Valued Goods)
Stuttgart-Detroit (Car Parts)
Stuttgart-Cleveland (Car Parts)
Stuttgart-Columbus (High Valued Goods)
Basel-Chicago (Chemicals)
Basel-Detroit (Chemicals)
Basel-Cleveland (Chemicals)
Basel-Columbus (Chemicals)

The transportation rate analysis is being done on three levels. First of all, the existing services are being discussed for the specific trade routes. After this step, the door-to-door transportation rates of the potential direct service from Rotterdam into the Great Lakes and HMT-free feeder service to and from Montreal are being discussed. The final step focuses on differences between the cheapest option provided by the baseline and the direct rates. This final step also analysis the viability of the direct and feeder service by taking into account the additional costs shippers would be facing, when switching modes in the winter as a result of the seasonal closure of the St. Lawrence Seaway system. Table A.29 in Appendix A and Haazen (2012) will provide a thorough background on these switching costs for Great Lakes shippers in the different categories of goods.

5.2 Transportation rate scenarios

This paragraph will discuss the different scenarios based on the transportation rate throughout the door-to-door chain between previously mentioned locations in Northwest-Europe and the U.S. Midwest. The first 2 sub paragraphs will start off with analyzing the transportation rates in the baseline situation for existing and direct services. For more information on the specific inputs and assumptions, Appendix A will provide a comprehensive overview. After these first two sub paragraphs, paragraph 5.2.3.1 will provide an analysis of the impact of a change in Harbor Maintenance Tax percentage. In sub paragraph 5.2.3.2 and 5.2.3.3 the impact of an increasing hinterland transportation rate is researched, follow by the impact of equal terminal handling charges between the port of Antwerp and Rotterdam for the competitiveness of the Rotterdam port. This paragraph will be concluded in sub paragraph 5.2.4.

5.2.1 Baseline transportation rates for existing services

The baseline of the transportation rates for existing services are determined by combining the hinterland transportation rates between the European origins towards one of the four ports in the model with the ocean freight rates between the European ports and their North American counterparts are added, followed by the addition of the final hinterland transportation rate in North America and the Harbor Maintenance Tax. This baseline transportation rate is based on the data combined from the websites of the ocean carriers and Class I rail carriers CN and CP. With regards to the hinterland transportation rates of MSC in North America and Europe, these numbers have been based on the average rate provided by Maersk and Hapag-Lloyd as MSC generally does not organize their own hinterland services. As mentioned, this analysis looks at specific trade routes, for more data on the transportation rates for routes that are not covered in this analysis; Appendix B provides a comprehensive overview.

Chemicals

The chemicals baseline of both the existing as the services into the Great Lakes represents the usage of a standard 20" ISO tank container configured for ocean services and owned by the shipping line for the transportation of chemicals. Within the transatlantic chemical market, a clear distinction can be made on the market power of the shipping lines individually. With the exception of 3 trade routes, the market is dominated by Maersk and MSC, with the majority originating from the ports of Rotterdam and Antwerp. When looking specifically to the average transportation rates of the 1st 3 choices and the 1st 9 choices (3 per ocean shipping line) in table 5.1, it shows only a slight difference of approximately $ 100. This difference indicates that the rates for transporting a container between the specific trade routes are closely related to each other, without a large spread throughout the different carriers and ports. From Table 5.1 it is also possible to conclude that Maersk has a dominating role from Basel towards Midwest when looking at chemical transportation, while the markets of Mannheim and Duisburg are more equal divided between the two major shipping lines on the Atlantic. While the rates are important in this case, it is also interesting to look at the specific preference of shippers of chemical containers for port selection overall.

Within the door-to-door transportation chain for chemical containers between Europe and the U.S. Midwest, it seems that the port of Rotterdam is most favored as first choice by Maersk, while Antwerp and to a lesser extent Bremen by Hapag-Lloyd and MSC as shown in Figure 5.1. While the port of Antwerp has lower container handling charges, this economic benefit is offset because of lower hinterland transportation rates to Rotterdam. When looking at a carrier level, the port of Rotterdam is the preferred port for Maersk, followed by Antwerp, and while for MSC, the market is more equally divided between the ports of Antwerp and Bremen. It is interesting to notice that while the port of Rotterdam is the preferred option for Maersk; it is not competitive enough for other carriers as first, but also not as the second and third choice.

On the North American side of the market there is a clear preference visible in Figure 5.2. Montreal is for Maersk and MSC the preferred port of entry for trade into the upper part of the U.S. Midwest (Chicago/Detroit) while the cargo destined for Columbus and Cleveland has a stronger preference for the ports of New York/New Jersey and Norfolk as the in-depth analysis in Appendix B shows. Because of the low amount of HMT, $ 33.48 per container, chemical containers prefer to be transported through ports that are close located to the market. Although the port of Halifax is the closest to Europe and optimal located on the navigational route between Europe and the East Coast ports, its distance to the markets and the size of the local market proves to be a barrier for competing with other East Coast ports.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,039	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,924	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,147	$4,130	$4,181	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,158	$4,189	$4,215	$4,187	$4,276	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,901	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$4,012	$3,977	$4,057	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,997	$4,015	$4,041	$4,018	$4,116	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,656	$4,687	$4,637	$4,769	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,659	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,851	$4,861	$4,874	$4,862	$4,911	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,836	$4,925	$4,947	$4,903	$5,013	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 5.1: Door-to-door transportation rates for a 20" ISO Chemical Container (Data compiled from various sources: Company websites and the sales department of the shipping lines for select routes)

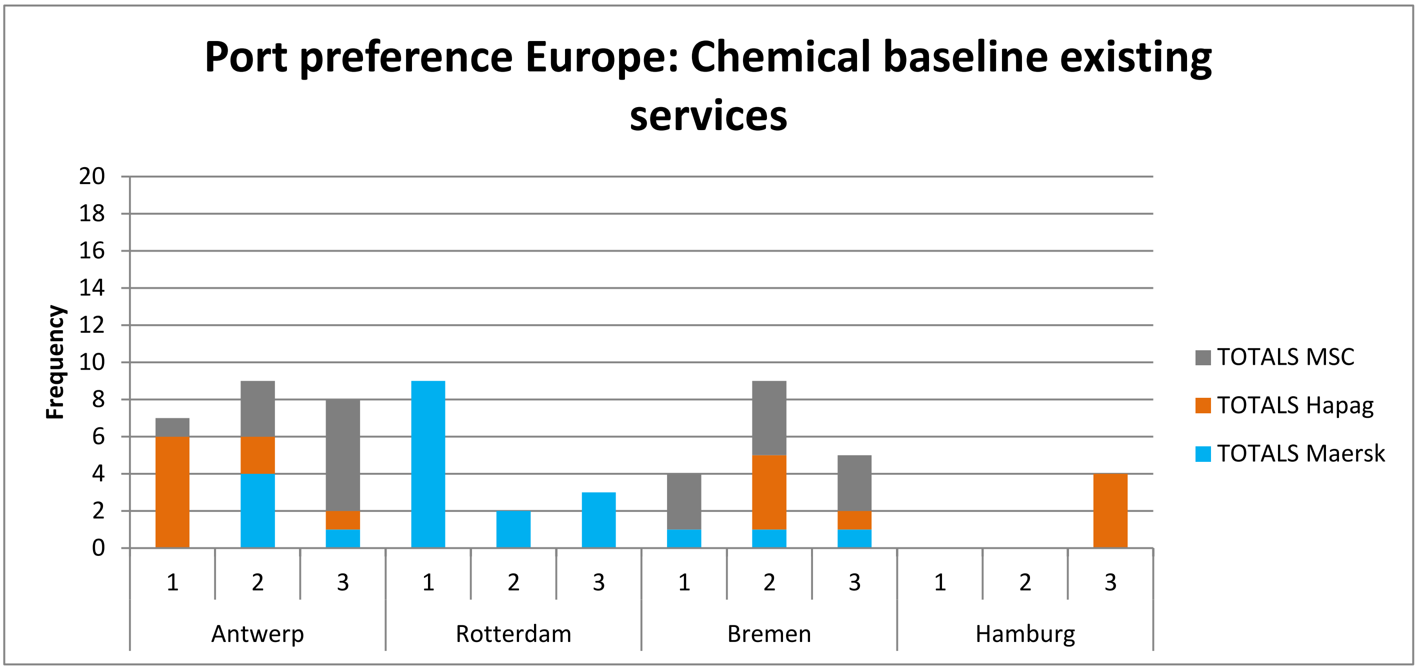

Figure 5.1: Port preference Europe for the Chemical Baseline for existing services

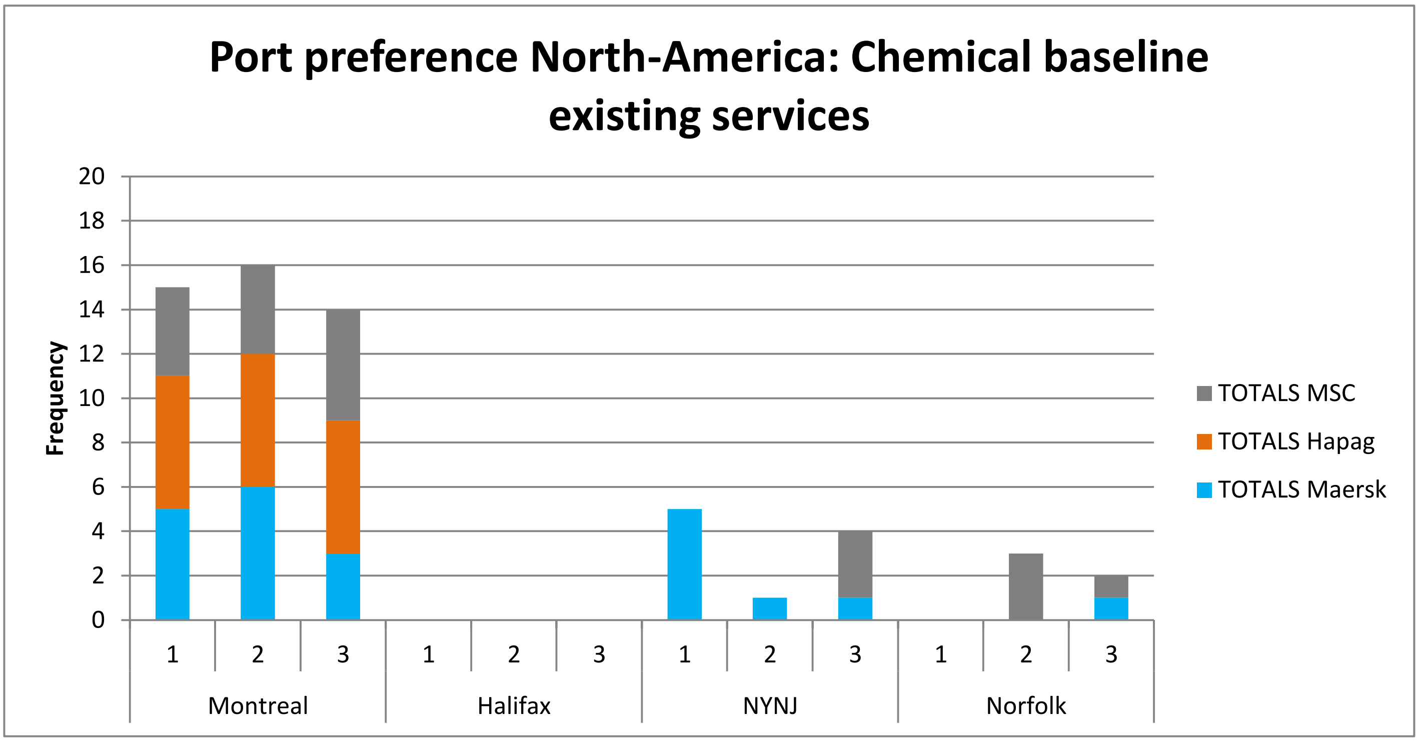

Figure 5.2: Port preference North-America for the Chemical Baseline for existing services

High valued goods

The next market discussed in the analysis of the baseline for existing services is the market of high valued goods. Compared to the transportation of chemicals, there are several differences with high valued goods. Unlike the chemical industry, this case assumes the usage of an ISO-standard 40” container for the transportation of goods. Also the burden of the cost of transportation for the shipper, measured by the transportation rate differs between these two goods. As a result of the higher value of the product in the case of high valued goods, the transportation rate is lower percentage-wise. This higher value also leads to another important difference compared to the chemical containers. Because the value of the goods in these containers is higher, the shipper faces a higher charge of HMT, when sailing through a U.S. port compared to a Canadian port. This can be explained because of the difference in regulation, mentioned in Appendix A and Haazen (2012).

When looking at the market itself, it is clear that for the transportation of high valued goods, Maersk and MSC are in a very strong competition situation with each other. Furthermore, it is interesting to notice in Table 5.2 that the spread between the 1st 3 and 1st 9 choices are further apart in the case of cargo originating from Duisburg (Approx. $ 250 per 40” container) in contrast to Stuttgart (Approx. $ 150 per 40” container).

When looking specifically at the port selection of these preferred routes, there is a similar effect as chemical containers when looking at the North American preference. Although the HMT of $ 288.93 is severe per container, shippers prefer to transport the container through Norfolk when destined for Columbus, while cargo bounded for Chicago prefers Montreal as gateway as shown in Table 5.2.

Like mentioned before, the value of the container influences the amount of HMT and therefore also the port choice. Figure 5.3 and 5.4 looks further into the transportation chain of the high valued goods in terms of port selection. Interestingly, the higher HMT does not only have its effect on North American port selection, also the European choice is influenced by this tax. As a result of a higher tax amount, there is an even bigger preference for Montreal, than with low valued chemicals, reducing the competitiveness of the ports of New York/New Jersey and Norfolk as the value of the container increases. As a result of this specific preference for Montreal, the position of European ports is also affected. Especially the port of Antwerp, which provides a connection with Montreal and the U.S. East Coast for all three carriers, has a preferred role for containers with high valued goods, while the port of Rotterdam loses its #1 position to Antwerp. Another interesting result is the carrier specific shift. As a result of the higher value per container, Antwerp becomes the preferred port for Maersk, placing Rotterdam on the second place. Overall, Maersk is able to improve its position on the transatlantic market at the expense of the position of MSC based on transportation rates.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,535	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,583	$4,615	$4,655	$4,618	$4,874	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,794	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,920	$4,986	$5,037	$4,981	$5,149	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.2: Door-to-door transportation rates for a 40" Container with High Valued Goods (Data compiled from various sources: Company websites and the sales department of the shipping lines)

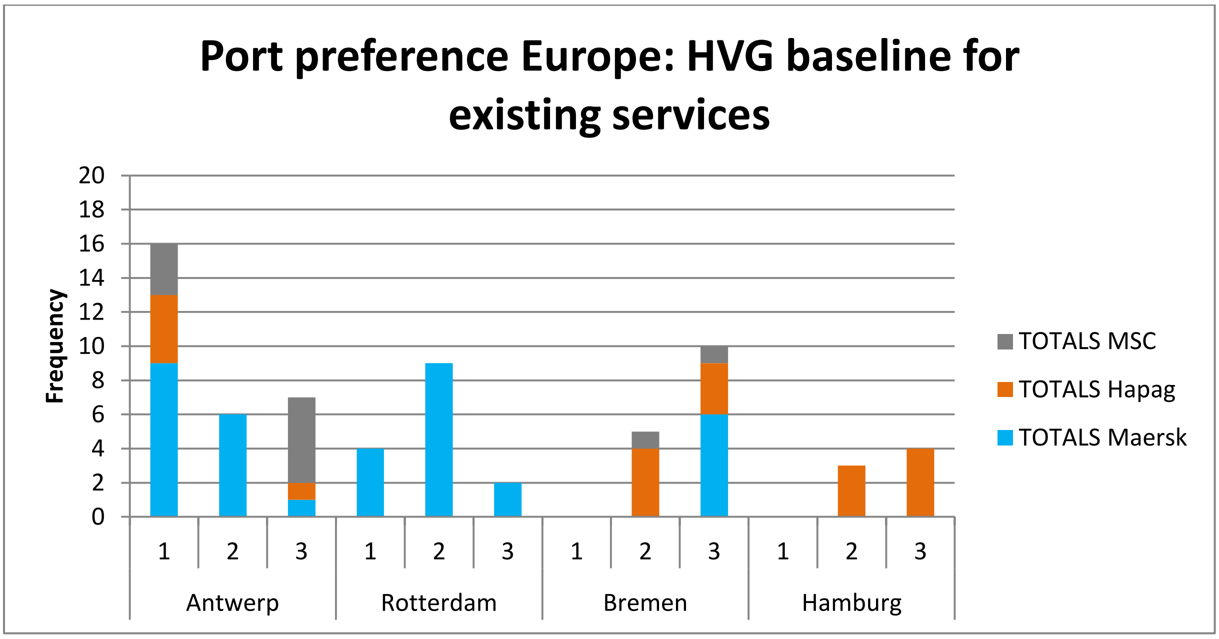

Figure 5.3: Port preference Europe for the High Valued Goods Baseline for existing services

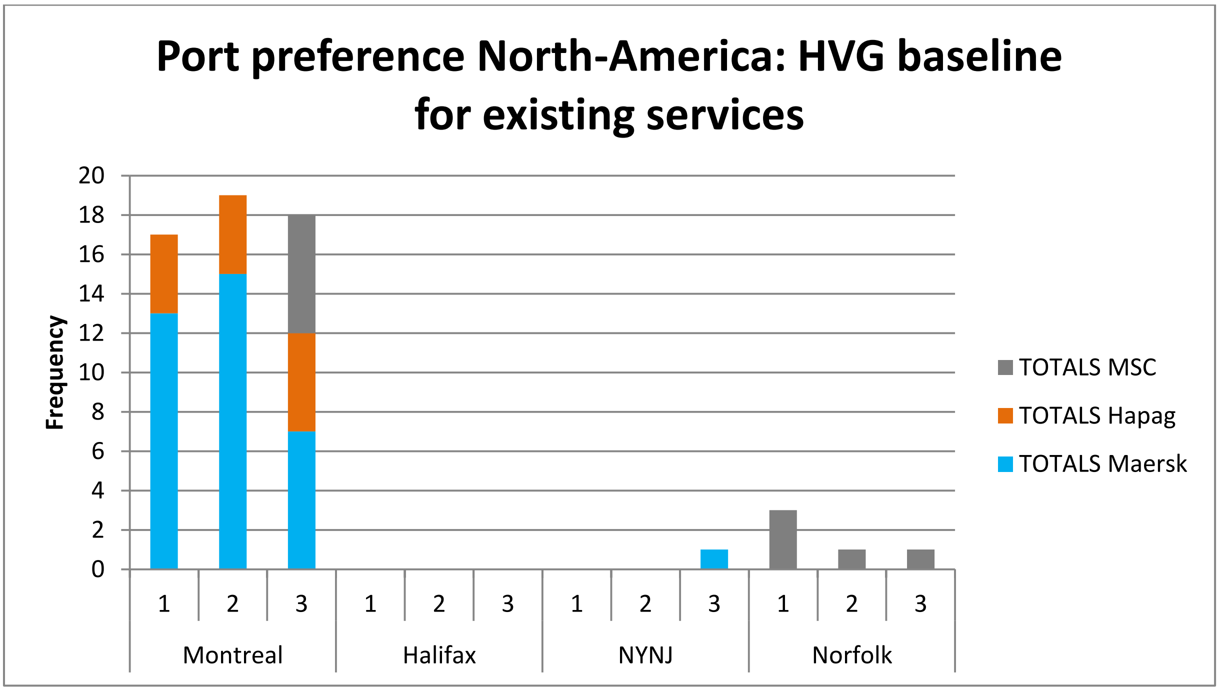

Figure 5.4: Port preference Europe for the High Valued Goods Baseline for existing services

Car Parts

Like the transportation of high valued goods, the transportation of car parts is also focused on high value manufactured goods. The next markets discussed in the analysis of the baseline of existing services are the containers containing high valued car parts. Like the other high valued manufactured products, this case assumes the usage of a standard 40" container. In comparison to the case with high valued goods, this car-parts baseline assumes a value of $ 250,000 per 40" container (Journal of Commerce, 2011). Because of the high value of the end-product, a car, the burden of the transportation rate is covered in the price of the final product, but as manufacturing of cars involve global manufacturing, the role of the HMT can have a significant effect on the profitability of the car manufacturer. If a car manufacturer imports 4,000 40" containers annually, the benefit of routing it through Canada could lead up to $1,250,000 by saving on the HMT. Especially, the region around Detroit is considered to be the car manufacturing hub of the United States. Because of its location, it could be interesting to send containers through the port of Montreal to avoid the HMT. When looking at Table 5.3, it is clear that Maersk is able to outperform MSC on all relevant trade routes, but faces limited competition on cargo originating in Stuttgart. Like previously discussed for Chemicals and High Valued Goods, there is only a very limited difference in the averages of the 1st 3 choices and the averages of the 1st 9 choices, indicating a very competitive situation based on the transportation rates. When looking at the specific trade routes, it is clear that the port of Montreal has a leading position for Detroit and Cleveland bound containers with Car Parts. This can be explained because of the burden of the HMT for Cleveland bound cargo, but also due to its optimal location for Detroit bound cargo.

As a result of the close differences between the value of a container with High Valued Goods and Car Parts, the effect on port selection is only very limited. With regards to the port selection in Europe in Figure 5.5, the position of Maersk is slightly improved, only a 3rd choice through Bremen with MSC is shifted to Rotterdam with Maersk. Like in the case of High Valued Goods, shippers prefer the port of Montreal as gateway. As the European side already showed, there is only a slight shift on carrier and port level, which is also visible in figure 5.6 containing the port preference in North America. Compared to the transportation of high valued goods, the port of Norfolk loses its 3rd position on MSC to Montreal with Maersk. When looking at the trend of increasing value of a container versus port choice, it is evident that as the value of a container rises, the preference in North American ports shifts from the U.S. East Coast to Montreal.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	**Detroit**	$4,335	$4,375	$4,428	$4,379	$4,594	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	**Cleveland**	$4,697	$4,737	$4,790	$4,741	$4,880	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	**Detroit**	$4,559	$4,599	$4,648	$4,602	$4,743	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	**Cleveland**	$4,921	$4,961	$5,004	$4,962	$5,029	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
MAERSK		**HAPAG-LLOYD**			**MSC**		**RAIL**		**ROAD**		**BARGE**	

Table 5.3: Door-to-door transportation rates for a 40" Container with Car Parts (Data compiled from various sources: Company websites and the sales department of the shipping lines)

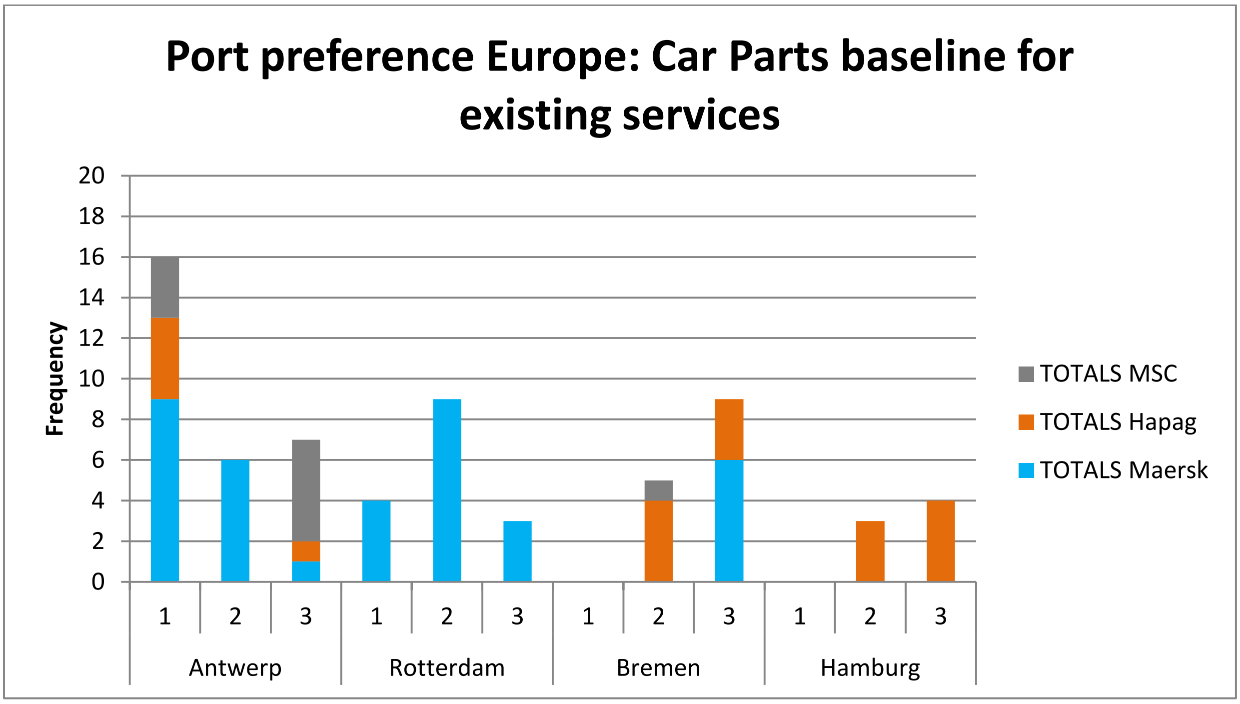

Figure 5.5: Port preference Europe for the Car Parts Baseline for existing services

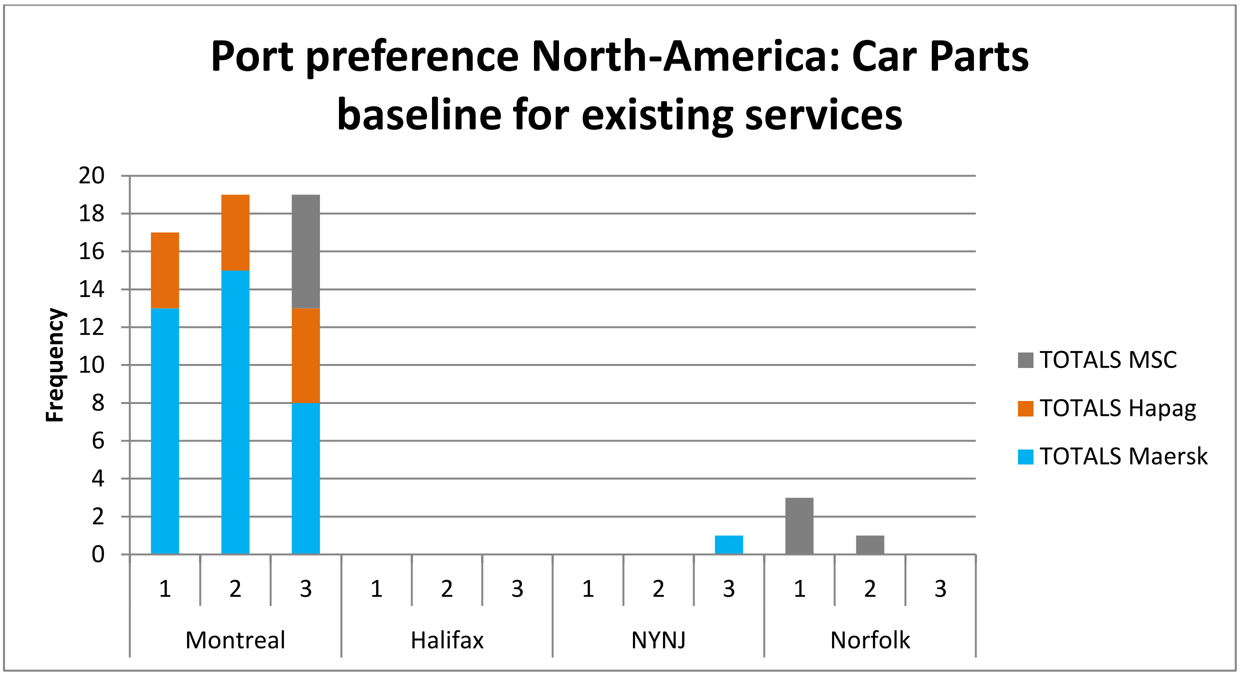

Figure 5.6: Port preference North America for the Car Parts Baseline for existing services

Conclusion baseline of existing services

In this analysis on the baseline of the existing services between North-West-Europe and the U.S. Midwest, a clear overview has been created on the current options for shippers and consignees to transport their containers between both continents. When looking specifically on the level of the port selection, a strong preference for the port of Montreal can be found as a result of increasing container values. As the three types of goods have shown, an increased value leads to a diversion of cargo towards Montreal, as a result of the ad valorem taxation with regards to the Harbor Maintenance Tax which depends on the value of the container as given in Appendix A. On the European side however, the situation is more complex. Although the higher values of the containers lead to a strong shift in the North-American port of choice, the port selection in Europe stays quite stable. Only the port of Antwerp is able to gain ground compared to the other three ports in the Hamburg – Le Havre range.

This effect of the container value on the port of choice can also be proven when looking at the average level of transportation rates for the existing services. When comparing the average of the first three choices for all carriers with the first nine choices (three time the first three choices per carrier) the difference between these two values show only a very small difference indicating the strong competition between the carriers on a wider scale.

Another interesting result is the proximity of the market to the port on the port selection process. Although the important chemical regions are closer located to Rotterdam than Bremen, the latter shows a stronger position, while Antwerp is also showing a strong position in this market. One of the explanations for this could be the competitive advantage of Antwerp above Rotterdam as also the port preference for high valued goods and car parts show a stronger preference for Antwerp than Rotterdam.

Not only on the port selection process a strong preference given, but also on a carrier level. Under the normal circumstances, neglecting the carrier specific discounts, the markets for the three types of goods are almost completely divided by MSC and Maersk, with a very minimal role for Hapag-Lloyd. On this ground, it is interesting to notice that unlike expected, the competition between the 2 larger carriers are not based on the transportation rate as it shows a strong relationship to each other.

5.2.2 Direct service model

Next to the transportation rates for existing services, this research focuses on the potential of a direct service between the port of Rotterdam and the port of either Cleveland or Toledo. The input for this direct service model is based on several factors, mentioned in Appendix A. Like the baseline of existing services, the direct model will assume the presence of HMT on all cargo arriving in U.S. ports.

Chemicals

As mentioned before, the U.S. Midwest is considered to be one of the most important industrial hubs. Especially the cities around Lake Erie, Cleveland and Detroit are being considered to be the chemical hubs for the U.S. Midwest industry. In a lesser extent, Chicago and Columbus are considered to be major industrial cities demanding base chemicals and specialized chemicals. In the case of Detroit and Cleveland, the proximity of the ports of Cleveland and Toledo prove to be an important contributor to the chemical supply chain, connecting the Great Lakes to the world and vice versa.

When looking specifically to the average transportation rates of the 1st 3 choices from the direct service versus the 1st 3 choices from the existing services in table 5.4, it is interesting to notice the large differences. While on the trade routes to Chicago the difference is approximately $ 900, the transportation rates to Cleveland and Columbus are more spread out towards a difference of $ 1,300-1,500 per 20" ISO Tank container. This difference can be explained due to two significant changes in the door-to-door transportation rate. First of all, the ocean freight rate is considerably lower at $ 1,519 on average versus $ 2,063 for existing services. Secondly, the closer location towards the hinterland also leads to a $ 350 lower hinterland transportation rate to Chicago and $750 lower to Columbus. When looking at the type of service, there is a clear preference for 14 knots direct service to the port of Toledo is given for cargo bounded for Chicago and Detroit, while a 14 knots direct service to the port of Cleveland is preferred for cargo to Cleveland and Columbus. The 18 knots direct services to the port of Cleveland and Toledo are considered to be a viable option, compared to existing services, but most of the time these 18 knots direct services are preferred as 2nd or 3rd choice after the 14 knots direct service to the respective ports. Another interesting result is that none of the existing services, discussed in the baseline is able to compete with a direct service into the Great Lakes. Unlike the theory on economy of scale assumes door-to-door transportation rate proves to be lower than existing services with larger vessels. This indicates that although economies of scale could be achieved, this benefit is offset as a result of selecting a less preferred gateway.

Based on the differences between the 1st three choices from the direct service model and the 1st choice of the baseline with the existing services, a clear benefit of a direct service is proven, but it is important to take into account the additional costs involved as a result of seasonality, the so-called switching costs. Based on the percentagewise difference between the first 3 choices (average) from the baseline of existing services and the first 3 choices from the direct service model, shown in Table 5.5 in the column marked with Percentage Direct / Existing, it is evident that for the transportation of 20" ISO Tank containers, a direct service would decrease the transportation rate for the shipper with as much as 20% to 40% maximum, outmatching the 5%-switching costs by far.

As a result of its geographical location and position as economic center in the U.S. Midwest, it is interesting to notice that the level of competition between the direct service and the existing is the heaviest on the trade routes towards Chicago. Another interesting result is visible in the case of Columbus. In the baseline, the market of Columbus is primarily served by Norfolk and New York/New Jersey, both ports that are subject to the HMT, while in the direct service, this market is served by the ports of Cleveland and Toledo.

When looking at the preference of shippers for a specific port in Figure 5.7, it is clear that the port of Toledo is the preferred port especially for Chicago, Detroit and Minneapolis bounded traffic. For shippers in Cleveland and Columbus, there is clear evidence that for them, the port of Cleveland is more strategically located. Interesting is the fact that also the port of Montreal plays no role as preferred port. Furthermore, it is interesting to notice that even with a low amount of HMT charged, the Great Lakes ports are able to become the preferred ports for cargo originating to Cleveland and Columbus, in comparison to the baseline, where also the ports of New York/New Jersey and Norfolk play an important role on the cargo market for these cities.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$2,955	$3,038	$3,101	$3,031	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,130	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,187	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,794	$2,877	$2,940	$2,870	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$3,977	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,018	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,695	$3,779	$3,841	$3,772	$4,637	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,862	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$4,903	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.4: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$935	-$852	-$789	-$859	76.9%
Mannheim	**Detroit**	-$1,239	-$1,156	-$925	-$1,107	70.9%
Mannheim	**Cleveland**	-$1,571	-$1,488	-$1,374	-$1,478	63.6%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.4%
Duisburg	**Chicago**	-$935	-$852	-$789	-$859	76.1%
Duisburg	**Detroit**	-$1,239	-$1,156	-$925	-$1,107	69.6%
Duisburg	**Cleveland**	-$1,571	-$1,488	-$1,374	-$1,478	62.0%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.2%
Basel	**Chicago**	-$873	-$789	-$727	-$796	81.3%
Basel	**Detroit**	-$1,177	-$1,094	-$863	-$1,045	75.9%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	69.3%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.5%

Table 5.5: Difference in USD between the cheapest option for the transportation of a 20" ISO Chemical container from the baseline vs. a direct service into the Great Lakes (Based on own calculations)

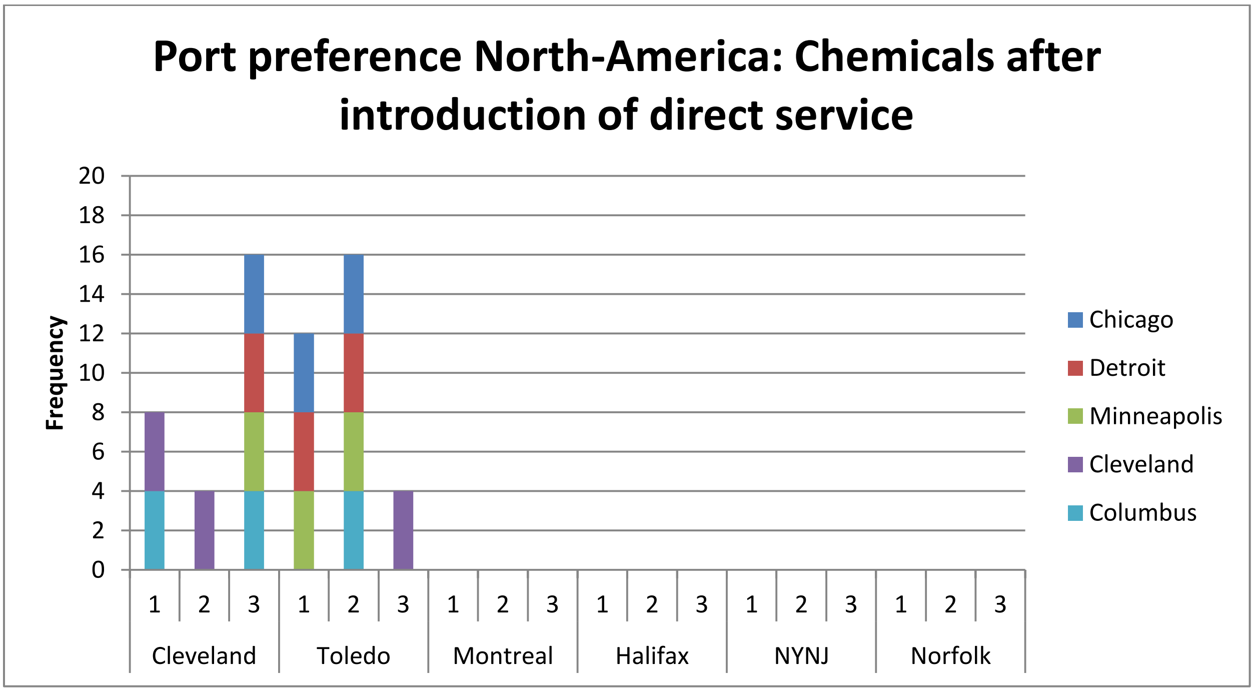

Figure 5.7: Port preference North America for the transportation for chemical containers with a direct service into the Great Lakes

High Valued Goods

The next market discussed in the analysis of the direct model is the market of high valued goods. Unlike the market of chemical transportation, the market for high valued goods is located further away from the shores of Lake Erie and the ports of Cleveland and Toledo. When looking specifically to the average transportation rates of the 1st 3 choices from the direct service versus the 1st 3 choices from the existing services in table 5.6, the competitive advantage of the Great Lakes ports have decreased as a result of the higher HMT per container in comparison to the chemical containers. Especially on the routes to Chicago a competitive situation is noticeable. While on the routes to Columbus a difference of approximately $ 1,000 is noticeable through the ports of Cleveland and Toledo, the competitive advantage of the Great Lakes ports diminishes to a $ 400 benefit per 40"container on the trade routes to Chicago. Like the transportation of Chemicals, the main reason for these lower door-to-door transportation rates can be found in the lower North-American hinterland rates and lower ocean freight rates. But as $ 288.83 is being charged for HMT, the financial benefit of using a direct service into the Great Lakes is lower.

Like the case of chemical containers, there is a clear preference for 14 knots direct service to the port of Toledo is given for cargo bounded for Chicago, while a 14 knots direct service to the port of Cleveland is preferred for cargo to Cleveland and Columbus, originating from German hinterland locations.

But although the door-to-door transportation rates per 40" container prove to be in the advantage of the direct service into the Great Lakes, it is not sufficient to cover the impact of switching costs with regards to seasonality for cargo destined for Chicago, the largest market for High Valued Goods as Table 5.7 shows. Research by the Tems Inc. and RAND Corporation (2007) under U.S. Midwestern shippers showed, the percentage of switching costs for finished goods is considerably higher at 14% compared to raw material like chemicals. This shows that for the transportation of 40" containers filled with High Valued Goods, destined for Chicago, the existing services, although more expensive on the short term, proves to outmatch the direct service into the Great Lakes. But, for cargo bounded for Columbus, the difference proves to be sufficient enough to cover the additional switching costs during the Seaway closure.

Overall, the competitiveness of the direct service of high value goods is less than compared to the transportation of chemical products. This can be explained by two reasons: as a result of a higher HMT more cargo is containers with high valued goods are diverted to Montreal resulting in a more competitive situation and secondly, the standard size container increases the competitiveness with all ports with existing services. Like the transportation of chemical containers, all routes prove to be cheaper when transported via the ports of Cleveland and Toledo in terms of absolute values, but after including the switching costs, transportation of high valued goods to Chicago will be cheaper on existing services. As Figure 5.8 shows, the division between Cleveland and Toledo is equal to the chemical transportation, with the port of Toledo being the gateway for the upper Midwest and area west of Lake Erie, while the port of Cleveland performs better on transportation markets to Cleveland and Columbus.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,743	$3,868	$3,881	$3,831	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,618	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,080	$4,205	$4,218	$4,168	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$4,981	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.6:Door-to-door transportation rates for a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$434	-$309	-$296	-$346	90.2%
Duisburg	Columbus	-$974	-$949	-$849	-$924	79.3%
Stuttgart	Chicago	-$519	-$394	-$381	-$431	89.8%
Stuttgart	Columbus	-$974	-$949	-$849	-$924	80.2%

Table 5.7: Difference in USD between the cheapest option for the transportation of a 40" container with high valued goods from the baseline vs. a direct service into the Great Lakes (Based on own calculations)

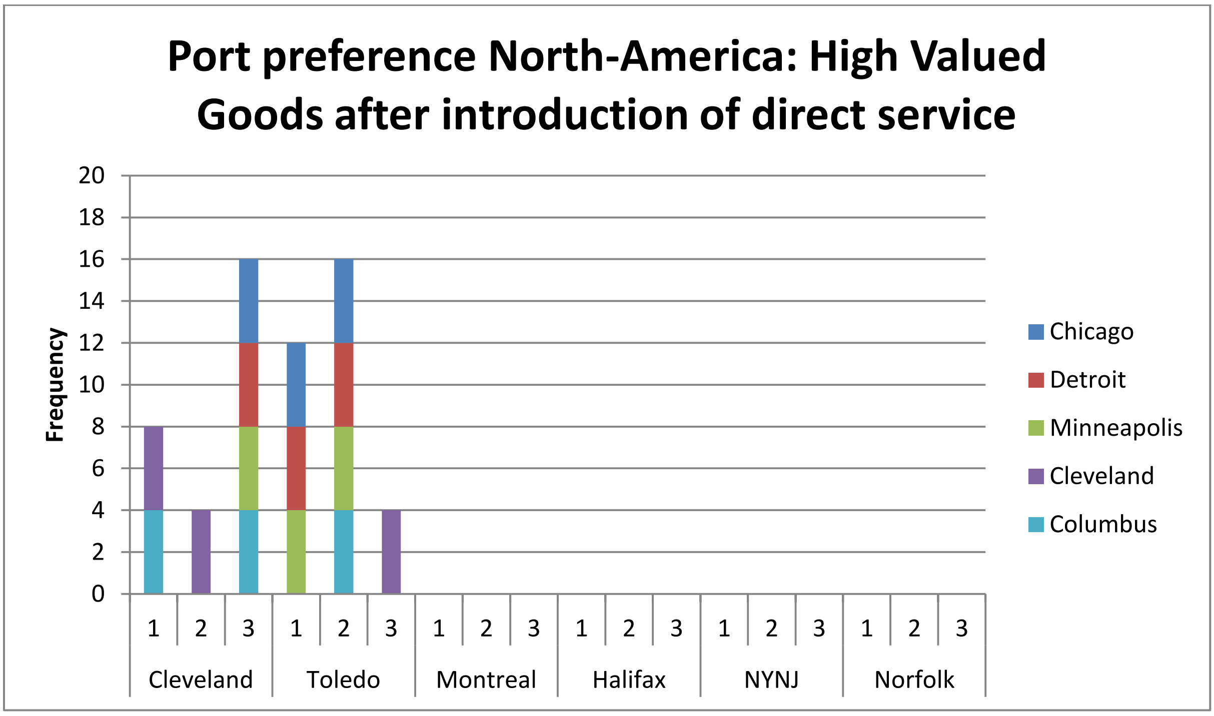

Figure 5.8: Port preference North America for the transportation for containers with high valued goods on a direct service into the Great Lakes

Car Parts

Like the market for High Valued Goods, the market for car parts is also considerable given the many production sites around Detroit for the major car manufacturers, but also their suppliers in the area around Lake Erie. For Car Parts, a HMT of $ 312.50 is charged in this research, which is only $ 23.57 more than for high valued goods. When looking specifically to the average transportation rates of the 1st 3 choices from the direct service model versus the 1st 3 choices from the existing services in table 5.8, the competitive advantage of the Great Lakes ports show a large difference between both types of service, already decisive in the competitiveness of the direct service compared to existing services. Interestingly, the difference for cargo bounded for Detroit is nearly half of the difference of cargo bounded for Cleveland. This can be explained due to the fact that Detroit is located on the main hinterland routes between the port of Montreal and the U.S. Midwest and is considered to be an important node in the hinterland transportation network. Because nearly all hinterland services from Montreal will pass Detroit, the extensive use of rail hinterland transportation result in a lower rate, while the hinterland transportation from Toledo and Cleveland is by truck, which has a higher rate per ton-mile. Therefore, the competition with existing services is higher compared to Cleveland, which is not optimally located for cargo originating from the port of Montreal.

Interestingly enough, the two markets are both served by truck, because of the proximity of the Great Lakes ports towards the final destination. Based on all three types of goods, it is clear that the distance between the port of call in Lake Erie and the final destination of the container is decisive in the choice of hinterland mode. While Detroit, Cleveland and Columbus are closely located to the shore, Chicago and Minneapolis are severely distant in terms of distance.

Although the difference for cargo bounded to Detroit is limited, it is sufficient enough to cover the extra switching costs as a result of the seasonality, but it is only very close to the required 14% advantage over existing services as shown in Table 5.9. The trade routes to Cleveland on the contrary produce a large difference of 23% which is sufficient enough to cover the switching costs of 14% as a result of seasonality. Also in the case of Car Parts, the preference of the port after introduction of the direct service stays the same as shown in Figure 5.9. Clearly, after the addition of a $ 300 charge for the HMT, the existing services through Montreal are not able to compete for cargo with a direct service into the Great Lakes.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$4,962	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.8: Door-to-door transportation rates for a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Detroit	-$767	-$642	-$461	-$623	84.8%
Mannheim	Cleveland	-$1,185	-$1,060	-$980	-$1,075	76.4%
Stuttgart	Detroit	-$828	-$703	-$523	-$685	84.2%
Stuttgart	Cleveland	-$1,247	-$1,122	-$1,042	-$1,137	76.3%

Table 5.9: Difference in USD between the cheapest option for the transportation of a 40” container with car parts from the baseline vs. a direct service into the Great Lakes (Based on own calculations)

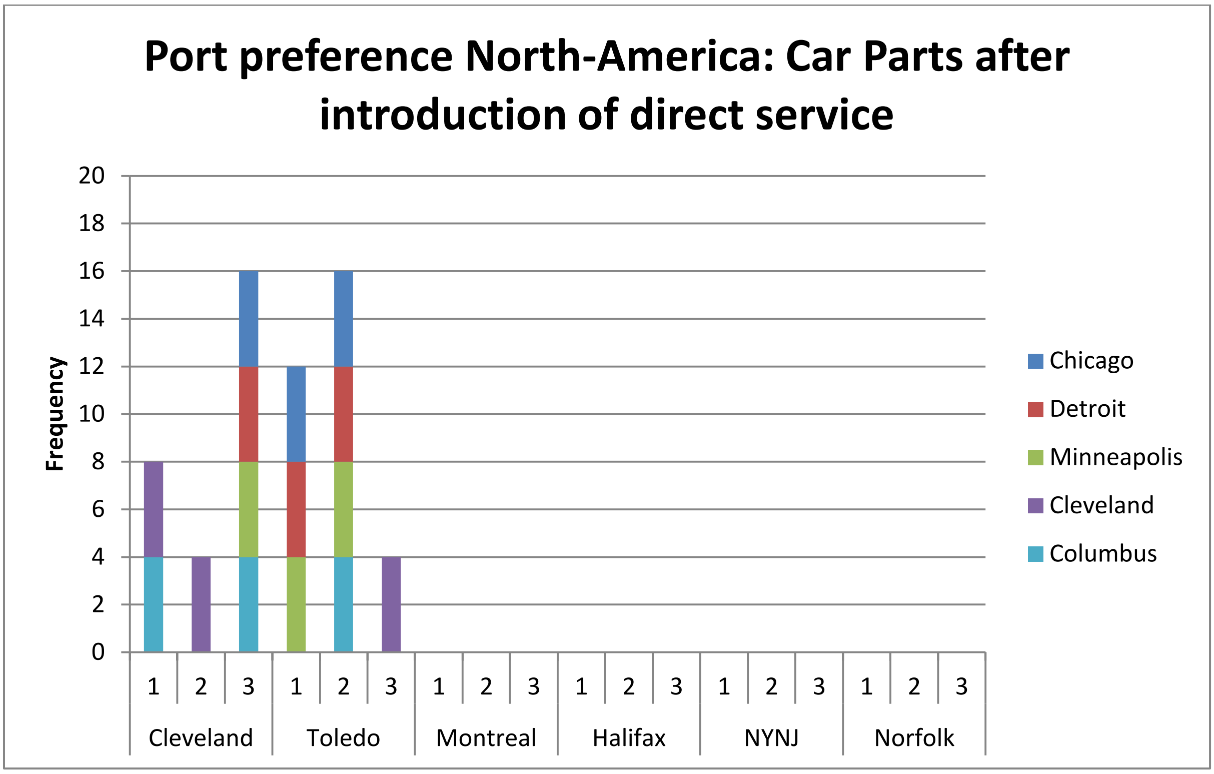

Figure 5.9: Port preference North America for the transportation for containers with car parts on a direct service into the Great Lakes

Conclusion baseline transportation rates for a direct service from Rotterdam into the Great Lakes

For the direct service into the Great Lakes, decision making on the port of choice prove to be stronger related to distance from the port to the final destination as the Harbor Maintenance Tax is applicable to both Great Lakes ports. In contrast to the existing services, the higher value of a container does not lead to a shift from the ports in the U.S. Great Lakes to Canada. As the results show, the direct service is able to outperform the existing services in terms of transportation rates after applying the impact of switching cost, with the exception of high valued goods transported to Chicago.

When looking further into the port preference in the Great Lakes, it is interesting to notice the role of geography as factor contributing to the port preference. Throughout the three types of goods, it is clear that Toledo is more optimally located for cargo destined for Chicago, Detroit and Minneapolis, while Cleveland is more optimally located for cargo destined for Cleveland itself and Columbus. Although Detroit shows an exception, the difference between the two ports in terms of door-to-door transportation rate is only limited at $ 100 - $ 200 on average between Cleveland and Toledo, so the effect could be considered to be quite limited.

Another interesting result than can be found when looking at the three types of goods is the weaker position on Chicago bounded cargo. As a result of efficient rail connectivity in conjunction to a competitive rail rate for cargo bounded to Chicago and the absence of a Harbor Maintenance Tax in Canada, the port of Montreal is able to effectively compete with the Great Lakes ports in terms of door-to-door transportation rate. Although in absolute measures, the route through the Great Lakes is considered cheaper, the additional switching costs penalize the potential of the direct service.

Based on the results of the direct service compared to the results of the existing services, there is a clear role that distance plays for determining the transportation rate. As the results from three categories of goods show, the closer the distance between the U.S. Great Lakes port and the final destination is, the larger the difference between direct and existing services. For example, the distance from the port of Cleveland to Cleveland as final destination is minimal, leading to the largest difference between direct and existing services. Also for Detroit this effect can be proven, while Chicago is an exception to this rule because of the strong competition with rail services.

5.2.3 Scenario analysis of the door-to-door transportation rates

This paragraph will discuss the various scenarios and their result on the baseline model and the direct service model. First of all, 5.2.3.1 discusses the highly debated Harbor Maintenance Tax and the effect of changed percentages on the different models. Secondly, in 5.2.3.2 the effect of higher trucking tariffs are discussed. After this scenario, 5.2.3.3 discusses the effect of higher rail tariffs, as a result of seasonal closure of the St. Lawrence Seaway system is discussed, followed by the analysis of an overall increase in the rail tariff. In 5.2.3.4 looks at the effect of equal terminal handling charges on the port choice for shippers, using existing services.

5.2.3.1 Harbor Maintenance Tax

The first scenarios to be discussed in the transportation rate analysis are the Harbor Maintenance Tax (HMT) sub scenarios. The HMT has historically been a large issue for shippers, ocean carriers in both the bulk and container business and policy makers. The HMT is considered an ad valorem tax, which means that the amount of the tax is based on the value of a certain good. Within the Harbor Maintenance Tax scenario, 3 different assumptions are made. First of all, the assumption of a 0.09% HMT-percentage, based on academic literature. After this, an economic analysis will follow on two scenarios of abolishment are discussed, based on existing plans to reform the HMT structure. First, a case of the abolishment of HMT for services between Canada and the U.S. is being discussed, followed by the case of total abolishment of the HMT on a national level is being analyzed. This analysis will only look at the economical side of the HMT. The political and institutional potential of changing the percentage of the HMT is being discussed in Haazen (2012). This analysis also looks at the specific trade routes mentioned in paragraph 5.1. For more detailed information, Appendix C provides an overview of the door-to-door transportation rates for all 20 routes.

0.09% Harbor Maintenance Tax scenario

The 0.09% HMT scenario is based on previous research on the height of the tax. In 2010, McIntosh and Skallberg published their article on the optimal height of the HMT taking into account the funds that already have been put in the Harbor Maintenance Trust Fund. McIntosh and Skallberg (2010) started off with discussing recent literature on the HMT. Over the last decade, there has been a lot of discussion on the height of this tax. Based on statistics in the period 1988-2005, the optimal HMT has been calculated at 0.09%, which is 0.035 percentage point lower than the current situation, but an important remark has to be made. Between 1988 and 1998, exporting shippers were also required to pay a HMT for the export of their product, but it this has been abolished in 1998 in order to boost exports. As a result, the authors also calculated the optimal percentage of HMT when excluding the exports, leading to an optimum of 0.092% of the value of the container as Harbor Maintenance Tax.

The 0.09% Harbor Maintenance Tax scenario will therefore assume a percentage of 0.09%, based on the value of the shipment, for direct and existing services with goods unloaded at U.S. Great Lakes and East Coast.

Based on the information previously given, the decrease from 0.125% to 0.09% will lead to the following effects on the level of HMT to be paid:

Goods	**0.125% HMT Tariff**	**0.09% HMT Tariff**	**Difference**
Chemicals	$ 33.48	$ 24.10	- $9.38
High Valued Goods	$ 288.93	$ 208.03	- $80.90
Car Parts	$ 312.50	$ 225.00	- $87.50

Table 5.10: HMT before and after reduction from 0.125% to 0.09% and the difference in USD per 20"/40" container

Chemicals

As Table 5.11 shows, compared to Table 5.1 from the baseline, changes in the HMT for chemical containers from 0.125% to 0.09% prove to have no effect on the existing services, due to the very limited effect of $9.38 on the total transportation rate from door-to-door. Even if it is decided to keep the HMT on 0.125%, it is highly debatable whether shippers will change their preferred ocean carrier or port for this limited saving. Also on the port specific level, no changes are visible for the 1st 3 choices in the baseline. The only interesting difference in the baseline is with regards to the average of the 1st 9 choices. Compared to the 0.125% baseline, a slight decrease with $ 3 or $ 4 is noticeable, except for the routes involving Columbus, which is decreased with $ 9. This indicates that in the case of Columbus almost all 1st 9 choices involve a U.S. port. The decreased HMT percentage also affects the transportation rates after introducing the direct model will not lead to a significant change compared to the situation discussed in paragraph 5.2.2 and Table 5.12.

Also on a door-to-door transportation rate level, the $ 9 decrease results in a minimal 0.2 percentage point improvement in terms of the rate comparison in Table 5.13. Another result of the limited effect of the decreased HMT charge, is that the selection of route and carrier has stayed stable compared to the baseline of existing services and also after implementing the direct service model as shown in Figure 5.10a,b and c. It is evident, that a slight decrease in the HMT will not result in a significantly changed situation.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,037	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,923	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,147	$4,130	$4,178	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,149	$4,180	$4,205	$4,178	$4,276	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,899	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,839	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$4,003	$3,974	$4,052	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,988	$4,006	$4,032	$4,009	$4,109	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,656	$4,678	$4,633	$4,767	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,658	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,842	$4,861	$4,874	$4,859	$4,908	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,827	$4,915	$4,938	$4,893	$5,004	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.11: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after reduction of the HMT to 0.09% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$2,945	$3,029	$3,091	$3,022	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,572	$2,656	$2,886	$2,705	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,524	$2,607	$2,721	$2,617	$4,130	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,820	$2,837	$2,903	$2,853	$4,178	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,785	$2,868	$2,930	$2,861	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,411	$2,495	$2,726	$2,544	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,363	$2,447	$2,560	$2,457	$3,974	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,659	$2,676	$2,743	$2,693	$4,009	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,686	$3,769	$3,832	$3,762	$4,634	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,313	$3,396	$3,627	$3,445	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,264	$3,348	$3,462	$3,358	$4,859	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,561	$3,577	$3,644	$3,594	$4,893	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.12: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo after reduction of the HMT to 0.09% (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$944	-$861	-$799	-$868	76.7%
Mannheim	**Detroit**	-$1,249	-$1,165	-$935	-$1,116	70.7%
Mannheim	**Cleveland**	-$1,581	-$1,497	-$1,383	-$1,487	63.4%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.3%
Duisburg	**Chicago**	-$944	-$861	-$799	-$868	75.9%
Duisburg	**Detroit**	-$1,249	-$1,165	-$935	-$1,116	69.4%
Duisburg	**Cleveland**	-$1,581	-$1,497	-$1,384	-$1,487	61.8%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.2%
Basel	**Chicago**	-$882	-$799	-$736	-$806	81.2%
Basel	**Detroit**	-$1,186	-$1,103	-$872	-$1,054	75.7%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	69.1%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.4%

Table 5.13: Difference in USD between the cheapest option for the transportation of a 20" ISO Chemical container from the baseline vs. a direct service into the Great Lakes after HMT reduction to 0.09% (Based on own calculations)

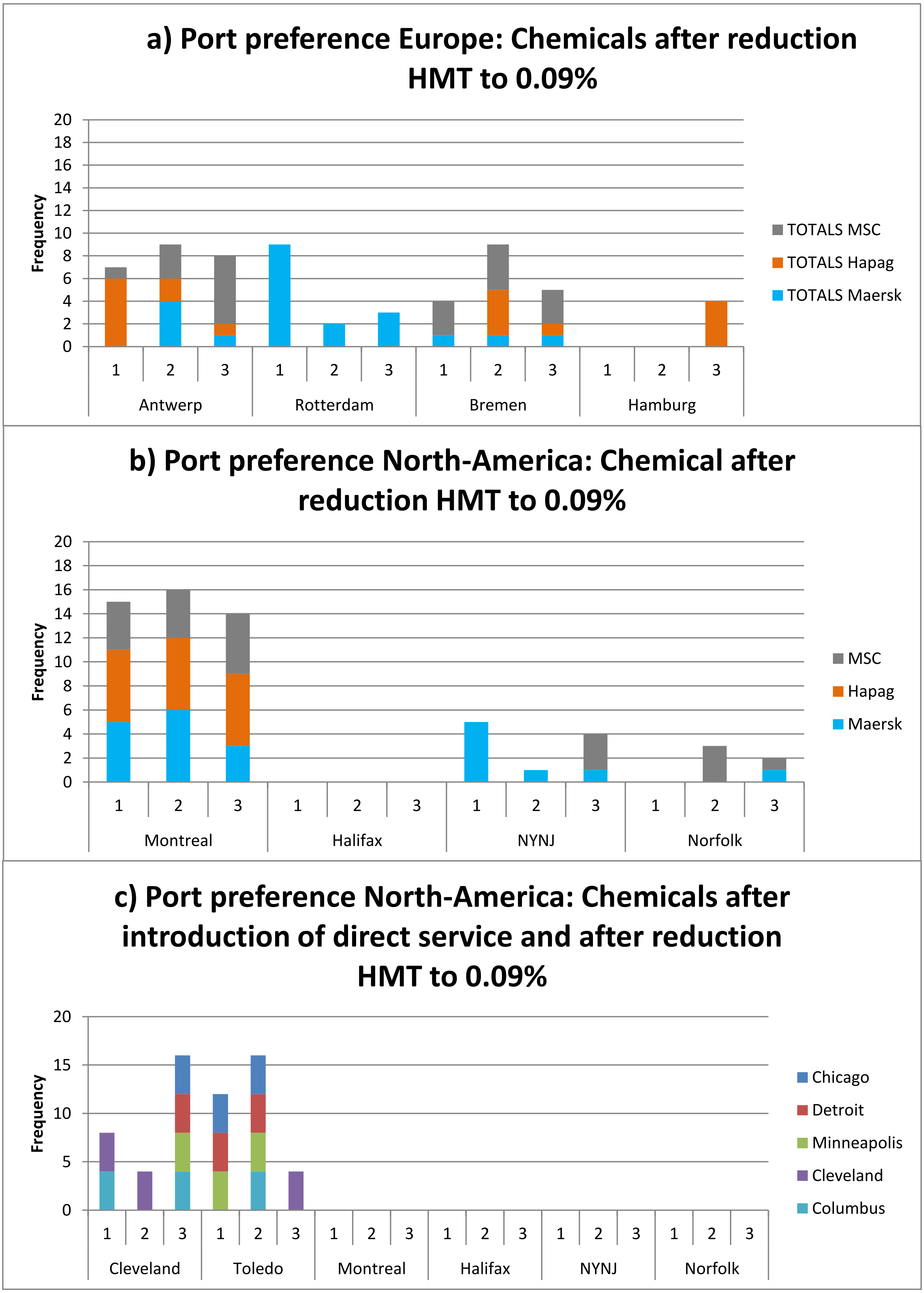

Figure 5.10: Port preference Europe (Baseline), North America (Baseline) and North America (Direct service) for the transportation for 20" ISO Tank chemical containers after reduction HMT to 0.09%

High Valued Goods

Changing the HMT percentage from 0.125% to 0.09% has compared to the transportation of chemicals a larger effect. By decreasing this percentage, a shipper is able to save $ 80.90 per 40"container with an average value of $ 231,140 leading to an amount of $ 208.03. Not only does this lower HMT could impact a potential direct service into the Great Lakes, also for existing services it could prove to be a decisive factor. When comparing the transportation rates from the existing services in Table 5.2 with the transportation rates in Table 5.14 below, there is only a slight difference noticeable, primarily on the routes to Columbus. On these routes, it is the port of Norfolk and New York/New Jersey that are gaining potential as transport node in their competition with the port of Montreal, although none of the existing routes are substituted. Another interesting aspect to notice is the stable situation on the carrier level, like the baseline of existing services discussed previously; Maersk and MSC are in a fierce competition based on the published transportation rates.

Next to the effect of the lower HMT on existing services, there is also a positive trend noticeable on the direct services into the Great Lakes. By reducing the HMT percentage, the direct services into the Great Lakes are also able to improve their competitive position for cargo destined for Chicago and Columbus as shown in Table 5.16 with $ 80.90.

Although the reduced HMT results in a 0.9 to 1.8 percentage point improvement in terms of benefits, the economic feasibility of the direct service does not change compared to the baseline situation. Like the normal situation with an HMT of 0.125% the difference on the trade routes to Chicago are not sufficient enough to cope with the additional switching costs during the seasonal closure of the St. Lawrence Seaway System. Also interesting to notice is the limited effect of HMT reduction on the trade routes to Columbus. As the ports of Norfolk and New York/New Jersey are strategically located to serve this market, a reduction of HMT also improves their position versus Montreal.

Although the reduction of the HMT percentage is an American factor in determination of the door-to-door transportation rate, it also has an effect on the European port selection. As a result of a lower HMT percentage, the port of Antwerp faces a slight change in their competitive role. While they lose a preferred 2nd choice, operated by Maersk to a service on MSC through Bremen, they are able to improve their position for 3rd option routes on Maersk and MSC routes. Also the port of Rotterdam is able to improve its position slightly, adding a 3rd choice option by Maersk, while the port of Bremen is considered to be the losing port, going from 15 to 14 choices overall.

As expected, the reduction of the HMT percentage has a slight impact on the port selection in North America. Compared to the baseline situation, the ports of New York/New Jersey, but especially the port of Norfolk is able to improve their competitive position versus Montreal. Another interesting fact is the competitive situation of New York/New Jersey versus Norfolk. While Maersk seems to prefer New York/New Jersey above Norfolk, it is vice versa for MSC. Another result on port level is the changed preference of MSC. While under normal circumstances, the port of Montreal is preferred as gateway to the U.S. Midwest for MSC, this shifts towards a preference for Norfolk. Clearly, a decrease of the HMT percentage results in a more geographical optimum, with East Coast ports serving Cleveland and Columbus, while the efficient rail network provides a competitive advantage for the port of Montreal as more optimal gateway for Detroit, Chicago and Minneapolis.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,526	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,502	$4,615	$4,655	$4,591	$4,841	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,785	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,839	$4,906	$5,037	$4,927	$5,125	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 5.14: Door-to-door transportation rates for 40" Containers with high valued goods for existing services after reduction of the HMT to 0.09% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,662	$3,787	$3,800	$3,750	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,529	$3,554	$3,654	$3,579	$4,591	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,999	$4,124	$4,137	$4,087	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,866	$3,891	$3,991	$3,916	$4,927	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.15: Door-to-door transportation rates for 40" Containers with high valued goods after the introduction of a direct service into the ports of Cleveland and Toledo after reduction of the HMT to 0.09% (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	**Chicago**	-$515	-$390	-$377	-$427	88.3%
Duisburg	**Columbus**	-$974	-$949	-$849	-$924	78.0%
Stuttgart	**Chicago**	-$600	-$475	-$462	-$512	88.0%
Stuttgart	**Columbus**	-$973	-$948	-$848	-$923	79.5%

Table 5.16: Difference in USD between the cheapest option for the transportation of 40" Containers with high valued goods after the introduction of a direct service into the ports of Cleveland and Toledo after HMT reduction to 0.09% (Based on own calculations)

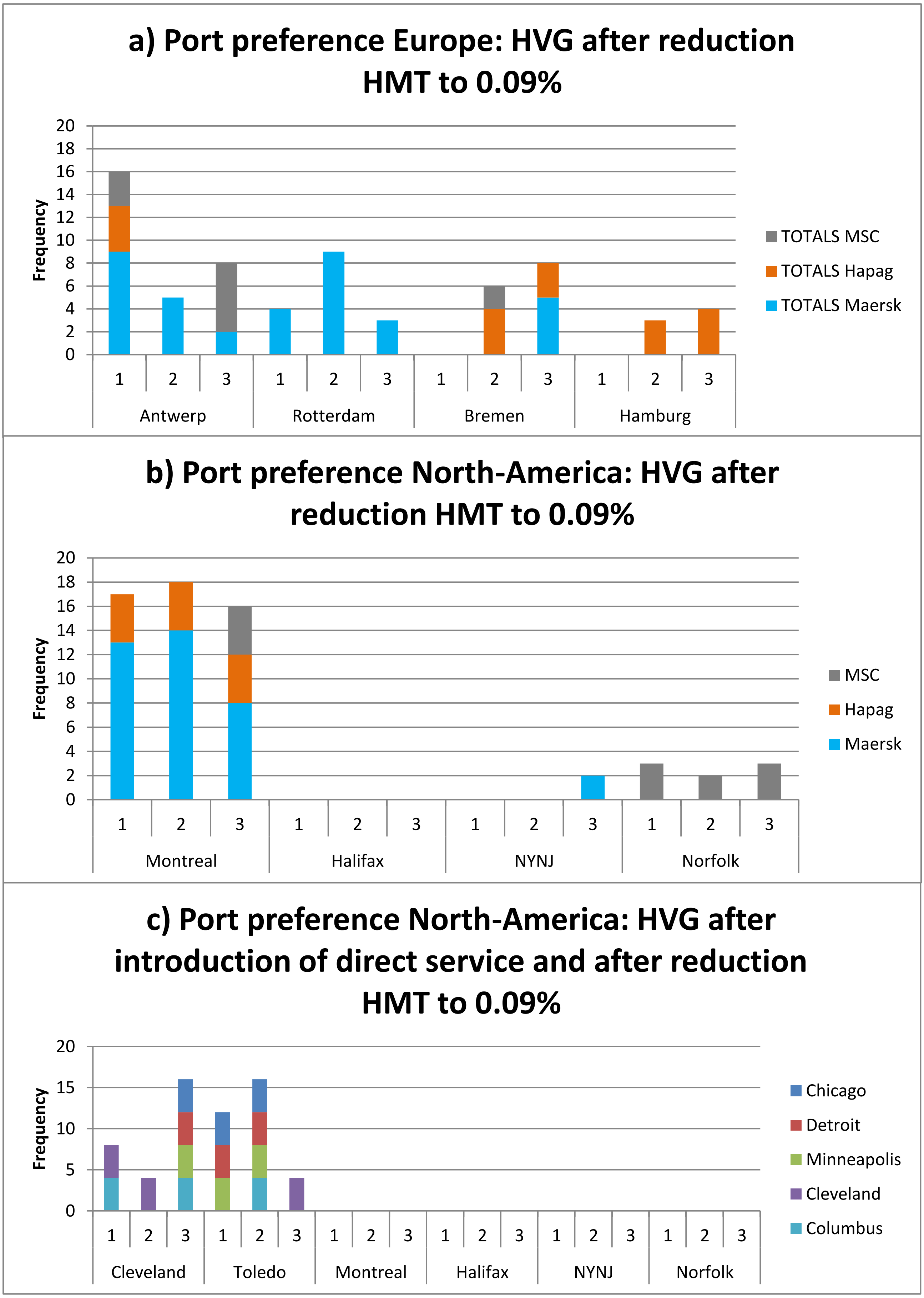

Figure 5.11: Port preference Europe (Baseline), North America (Baseline) and North America (Direct/feeder service) for the transportation for 40" containers with High Valued Goods after reduction HMT to 0.09%

Car Parts

Like the case of high valued goods, the value in a 40" container filled with car parts is also considered to be significantly higher than chemicals. Because of the value of a car parts container, lowering the HMT percentage from 0.125% to 0.09% results in saving $87.50 per 40"container with an average value of $ 250,000 worth of car parts per container to a level of $ 225.00 per container. Like previously discussed, this could not only have an impact on the potential direct service into the Great Lakes, also for existing services it could prove to be a decisive factor in terms of port selection. As a result of the reduction of the HMT percentage, the market for Cleveland bound cargo becomes very competitive with a minimal difference of $ 100 per container between the first 3 and first 9 choices. Also the competitive situation for Detroit bound cargo is slightly improved. Interestingly is the change on carrier level on the Stuttgart – Cleveland trade route. While Hapag-Lloyd has been able to compete through Montreal on this route in the baseline situation, its position is overtaken by MSC through Norfolk after reducing the HMT percentage.

As a result of a lower HMT percentage, also the services into the Great Lakes are able to improve their position versus the existing services, primarily through Montreal. As all other factors stay stable, there is no change in the competitive situation between the ports of Cleveland and Toledo as Table 5.18 shows. More interesting is the effect of the reduction on the feasibility of the direct service into the Great Lakes. Although the decrease of only 0.035 percentage point of the HMT percentage would be considered limited, the feasibility is increased by approximately 2.0 percentage point on the main trade routes to Detroit and Cleveland as shown in Table 5.19. Especially Detroit bound cargo show the largest improvement. This can be explained because of the position of Toledo/Cleveland versus Montreal in the case of car parts transportation. As a reduction of the HMT percentage leads to a lower door-to-door transportation rate, the direct service into the Great Lakes is able to improve its position versus Montreal, as the role of the HMT is reduced as well. Instead of having taxation as an important factor, location becomes more important.

Like the transportation of High Valued Goods, the port selection in Europe is slightly changed as a result of a lower HMT percentage. While Maersk is able to keep their competitive position through the port of Rotterdam stable, they face a slight reduction in Antwerp and Bremen, as a result of a stronger position of MSC. Also in North America, the same effect is noticeable as the case of high valued goods: the competitive position of Montreal is decreased in advantage of the largest ports on the U.S. East Coast: New York/ New Jersey and Norfolk.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,584	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,697	$4,737	$4,790	$4,741	$4,865	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,733	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,921	$4,961	$4,984	$4,955	$5,014	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.17: Door-to-door transportation rates for 40" Containers with car parts for existing services after reduction of the HMT to 0.09% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,481	$3,606	$3,786	$3,624	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,424	$3,549	$3,630	$3,534	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,643	$3,768	$3,949	$3,787	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,586	$3,711	$3,792	$3,697	$4,955	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
14 Knots Direct Cleveland		18 Knots Direct Cleveland			MAERSK	MSC	RAIL		ROAD		BARGE	
14 Knots Direct Toledo		18 Knots Direct Toledo			HAPAG-LLOYD							

Table 5.18: Door-to-door transportation rates for 40" Containers with car parts after the introduction of a direct service into the ports of Cleveland and Toledo after reduction of the HMT to 0.09% (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Detroit**	-$831	-$706	-$525	-$687	82.0%
Mannheim	**Cleveland**	-$1,249	-$1,124	-$1,044	-$1,139	73.6%
Stuttgart	**Detroit**	-$916	-$791	-$610	-$772	82.3%
Stuttgart	**Cleveland**	-$1,335	-$1,210	-$1,129	-$1,224	74.6%

Table 5.19: Difference in USD between the cheapest option for the transportation of 40" Containers with car parts after the introduction of a direct service into the ports of Cleveland and Toledo after HMT reduction to 0.09% (Based on own calculations)

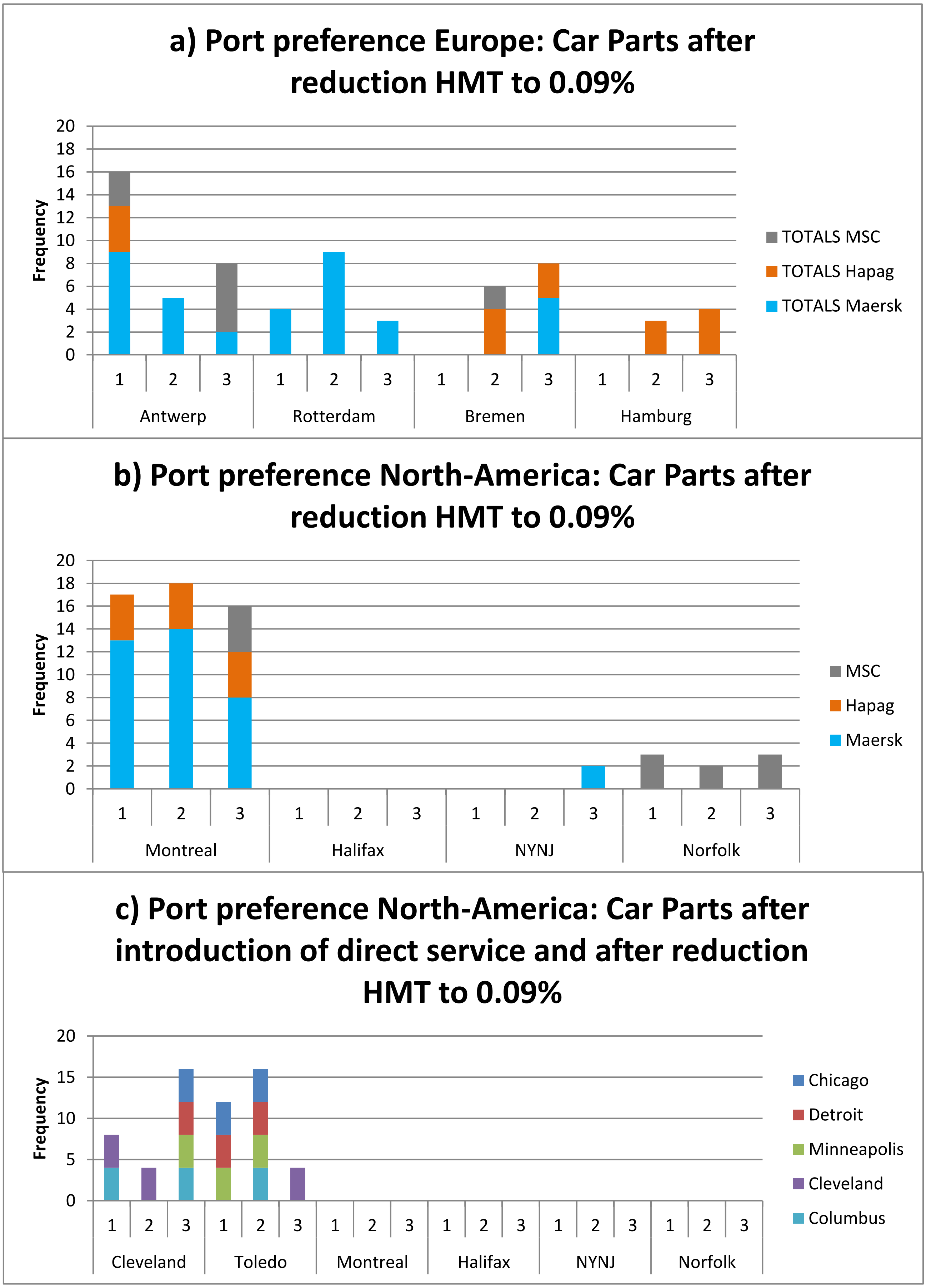

Figure 5.12: Port preference Europe (Baseline), North America (Baseline) and North America (Direct/feeder service) for the transportation for 40" containers with Car Parts after reduction HMT to 0.09%

0.00% Harbor Maintenance Tax scenario

Many of the interviewed parties have mentioned the HMT as one of the most important barriers for intensifying trade flows originating or destined for the Great Lakes. Although the impact of the HMT is considered quite low compared to the value of a good, it is being considered as a crucial element in terms of the image. For abolishment of the HMT, two levels have to be taken into account. First of all, the HMT has a negative effect on the US-Canadian maritime transportation system, as land based hinterland transportation modes are excluded from the HMT when crossing the border into the United States. Because of this regulation, US-Canadian trades through maritime transportation modes are taxed with the HMT, facing a negative effect on the potential of a feeder service into the Great Lakes. Secondly, there is the effect of the HMT on all cargo arriving in the United States, from all ports. As a result of this taxation ports in the United States face a significant competitive disadvantage when Canadian ports are considered as a reliable substitute.

Abolishment of the HMT could lead to a considerable difference in the profitability of an individual company as a result of its savings on the HMT. While for chemical containers this would only lead to an advantage of $33.48 USD on average, the High Valued Goods and Car Parts trade could save an amount of $228.93 or $312.50 per 40" container. Not only is this amount a considerable percentage of the rate of moving a container through the entire transportation chain, for shippers who transport a high volume of containers, it could lead to savings into millions of U.S. Dollars annually.

In order to analyze this problem, this scenario will further be split into two separate scenarios:

- A scenario in which a feeder service into the Great Lakes without HMT
- A scenario in which all HMT will be removed, both on the Great Lakes and other U.S. ports

The first part of this scenario is focused on the abolishment of the HMT on Canadian-US transportation, creating a level playing field between land based and water based hinterland transportation mode. This sub scenario specifically looks at the potential of a feeder service between the ports of Montreal and Cleveland/Toledo, connecting to existing services across the Atlantic.

The second scenario on the Harbor Maintenance Tax focuses on total removal of the taxation. Over the recent decades, discussion on the HMT has increased as a part of job loss and the budget of the national government. As mentioned before, the HMT funds have been stacking up over the last decades, while expenditures have been kept low. This low level of spending has lead to a balance of $ 5 billion U.S. Dollar (Haazen, 2012). Because only maritime services are required to pay HMT when calling at an U.S. port, rail and road haulage from Canada, these Canadian ports have a competitive advantage. As a result of this tax, the market becomes distorted, in the disadvantage of U.S. ports when there is a large contestable market where Canadian ports are considered an interesting substitute.

This second scenario will analyze the possibility that the HMT is being abolished entirely for the services into the Great Lakes as well as the existing services arriving in the Atlantic U.S. East Coast ports. Although this option has not been mentioned in the U.S. Congress as a proposed bill, it is interesting to learn whether or not this could strengthen the position of the Great Lakes ports in terms of container transportation, but also to what extent the HMT is responsible for distortion of the market.

No HMT on the feeder service between Montreal and Cleveland/Toledo

As mentioned before, the HMT is considered to be a large barrier for cargo arriving in the Great Lakes originating from Canadian ports. For years now, the HMT is considered to be one of the main barriers which prevent the introduction of a feeder service into the Great Lakes, destined for the ports of Cleveland and Toledo. This first scenario is based on propositions made in various bills proposed in the United States Congress to abolish HMT for US-Canadian cross border trade in order to put short sea shipping and feeder services on the same level in terms of taxation with land based hinterland transportation. Based on the results discussed in the paragraph 5.2.2, it is interesting to notice that direct service always has preferences compared to a feeder service between Montreal and Cleveland/Toledo. Therefore this scenario will exclude the possibility of a direct service into the Great Lakes to provide an in-depth overview on the potential of a feeder service to and from Montreal and the ports of Cleveland/Toledo compared to the land based hinterland modes.

As Table 5.20 shows, it is evident that a feeder service only has limited potential when looking at the transportation of chemicals with a feeder service to and from Montreal. Although the switching costs are considered to be at a low level, it is not sufficient enough to cope with these additional costs. Only on the trade route to Cleveland, the feeder service is able to compete as a seasonal mode. Another interesting result can be seen on the trade routes into Chicago. Unlike the other specific routes, a feeder service proves to be more expensive than the existing services. This outcome shows that on the Montreal – Chicago trade route, after abolishment of the HMT on Canadian-US maritime trade, rail is still able to be the most competitive hinterland transportation mode for 20" ISO tank containers. Although the impact of HMT abolishment on feeder services would be higher in the case of High Valued Goods and Car Parts, the contrary is visible in Tables 5.21 and 5.22. Especially for high valued goods, the Chicago trade routes prove to be 8.0 percentage points more expensive than existing modes of hinterland transportation. Also for Car Parts, the transportation of 40" containers through the Great Lakes is marginally more expensive for its main market, Detroit.

Although the benefits prove to be severe, the 7.5% advantage is not sufficient enough to cover the higher switching costs involved with semi-finished products like Car Parts. As Tables 5.21 and 5.22 shows, but also Table 5.20 shows, that the rail infrastructure between the port of Montreal and local U.S. Midwest markets, in particular Chicago and Detroit, are operating efficient enough and are able to provide a low enough hinterland transportation rate to compete with a, in theory, more efficient maritime mode of hinterland transportation. When looking at the markets that could be potentially interesting for a feeder service, it is only Cleveland which could benefit to a certain extent. As the feeder model is based on the assumption of an average weight of 20 metric tons per container, this weight is accepted by the rail carriers as normal. But, especially the containers that are exceeding a specific weight level of 28 metric tons, rail carriers are reluctant to transport these types of container and are charge with an additional amount of $ 300 per 40" container. Also for refrigerated, oversized and hazardous materials a charge of $ 300 is added, as published by CN and CP Rail. Interestingly enough, the addition of these charges could influence the potential of a feeder service positively. Based on this estimation, it is evident that a feeder service could offer potential for cargoes that are "not interesting enough" for the rail carriers because of its impact on the infrastructure and operational limits that these cargoes bear. Another aspect that has to be taken into account is the potential "revenge" on such a feeder by lowering rail transportation rates in order to compete. If the Canadian – U.S. maritime transportation would be excluded from the HMT, it requires the involvement of more stakeholders than just the ocean carriers, like CN and CP rail and the various levels of government, which could all benefit from a feeder service. Ocean carriers would be able to offer their customers an environmental solution for hinterland transportation for 10 months a year and a complementary choice to existing hinterland services, CN and CP rail are able to reduce the impact on their operations as a result of this niche containers and the various levels of government would be able to improve the position of the ports and create an additional effect on the local economy by the creation of additional jobs in transportation from the port to the final stop.

		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	$0	$72	$81	$51	105.3%
Mannheim	**Detroit**	-$68	-$36	-$34	-$46	98.7%
Mannheim	**Cleveland**	-$393	-$363	-$361	-$372	90.4%
Mannheim	**Columbus**	-$150	-$140	-$120	-$137	96.0%
Duisburg	**Chicago**	$0	$47	$78	$42	105.3%
Duisburg	**Detroit**	-$80	-$60	-$47	-$62	98.1%
Duisburg	**Cleveland**	-$405	-$385	-$375	-$389	89.4%
Duisburg	**Columbus**	-$163	-$153	-$142	-$153	95.7%
Basel	**Chicago**	$0	$88	$119	$69	106.0%
Basel	**Detroit**	-$19	$0	$14	-$2	99.8%
Basel	**Cleveland**	-$413	-$383	-$266	-$354	92.5%
Basel	**Columbus**	-$102	-$92	-$72	-$89	96.8%

Table 5.20: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container from the baseline vs. a direct service into the Great Lakes after HMT reduction to 0.00% for a feeder service through Montreal (Based on own calculations)

		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	$373	$423	$520	$439	108.6%
Duisburg	Columbus	-$157	-$142	-$112	-$137	96.3%
Stuttgart	Chicago	$373	$423	$461	$419	108.1%
Stuttgart	Columbus	-$72	-$57	-$27	-$52	97.7%

Table 5.21: Difference in USD between the cheapest option for the transportation of a 40” container with High Valued Goods from the baseline vs. a direct service into the Great Lakes after HMT reduction to 0.00% for a feeder service through Montreal (Based on own calculation)

		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Detroit	$40	$90	$190	$106	101.4%
Mannheim	Cleveland	-$369	-$324	-$219	-$304	92.7%
Stuttgart	Detroit	$40	$90	$128	$86	100.9%
Stuttgart	Cleveland	-$369	-$324	-$280	-$324	92.6%

Table 5.22: Difference in USD between the cheapest option for the transportation of a 40” container with Car Parts from the baseline vs. a direct service into the Great Lakes after HMT reduction to 0.00% for a feeder service through Montreal (Based on own calculation)

No HMT on all cargo arriving in the USA

Because of the high amount of funds in the Harbor Maintenance Trust Fund, ports are able to receive enough money for dredging if the federal government decides to abolish the HMT-concept for several years. Over the last decades, the influence of the HMT on the position of the maritime sector in the United States has been discussed multiple times. Although for companies the full abolishment of the HMT percentage would be ideal, it is not viable from a legislatorial view, as these government revenues will probably be substituted for governmental revenues from other forms of taxation.

First of all, the effect on the existing services. Based on Table 5.23 and Table 5.1 it is interesting to see that although the HMT have been removed entirely, it barely has an influence on the preferred routing when looking at chemical containers and the average transportation rates as the effect is only $ 33.48 per container. Clearly, the limited amount of HMT that is being paid when importing a container through an U.S. port only has marginal influence on the port selection process for existing services. Also overall, the position of European ports stays stable as figure 5.13a shows. Also on the North American side, the position of the port of Montreal shows that it is only the second and third choices that shift towards U.S. East Coast ports. Furthermore, the abolishment of the HMT does not change the preference from the direct service into the Great Lakes to other ports. As a result of the abolishment of the HMT on all imported cargo, the benefit of a direct service is increased with approximately 0.7 percentage points in favor of a direct service.

More interesting is the effect on the import of High Valued Goods to Chicago and Columbus. Clearly, the abolishment of the HMT has a severe effect on the transportation of these higher valued containers, in contrast to the chemical transportation. When looking at the existing services, an interesting effect takes places. First of all, on a carrier level, the abolishment of the HMT leads to a slightly stronger position for MSC on trade from Stuttgart to Columbus. But, with regards to port selection in Europe and North America a more severe change is evident. On the North American side, the abolishment of the HMT leads to a diminished market power for the port of Montreal. While in the baseline situation, only 3 out of 12 preferences contained a U.S. port, the removal of the HMT entirely shifts this balance with 8 out of 12 choices containing an U.S. port. Especially the port of Norfolk is able to improve its position as gateway for the transportation of High Valued Goods destined for Columbus. As a result of this shift, a significant change on the European side would be expected, but this does not occur as only the port of Rotterdam loses a 3rd position to Antwerp.

But, when looking at the results from the direct model in Tables 5.26, 5.27 and 5.28, the removal of the HMT on imported containers creates a significant effect on the feasibility of a direct service into the Great Lakes. Unlike the situation of a partial abolishment to 0.09%, the abolishment of the HMT for cargo into the Great Lakes leads to a sufficient enough benefit for a direct service, in order to cope with the additional switching costs in the winter period. Although sufficient, the trade routes to Chicago are still facing a heavy competition with existing services, primarily through Montreal. Columbus bounded cargo on the other hand is only able to improve their position by 2%. This limited effect can be explained due to the heavier competition with U.S. East Coast ports in conjunction with the good rail infrastructure from the coast into the U.S. Midwest.

The same effect is visible on the transportation chain of Car Parts. As a result of the abolishment of the HMT, the position of Maersk faces severe pressure from MSC on the trade routes to Detroit and Cleveland with respect to the transportation of Car Parts. Not only on a carrier level significant changes are visible, also on port level an interesting development is visible. As mentioned before, the market for cargo destined for Detroit is largely captured by the port of Montreal, as a result of its location and connectivity with Detroit. As a result of the abolishment of the HMT, this position proves to be stable, indicating that under normal circumstances, the port of Montreal is able to outperform U.S. East Coast ports by a large sum when looking at the door-to-door transportation routes involving the several ports. Significant change is also visible in the case of Cleveland destined cargo. The abolishment of the HMT shows that under a competitive situation, ports that are located close to the market are preferred. As a result of the change situation on the changed port selection in North America, the same result is visible in Europe, where the port of Rotterdam is facing more pressure from the port of Bremen, while the position of Antwerp stays rather stable.

As a result of more close-to-the-market port selection, it is evident that a direct service into the Great Lakes would be able to improve their position under these circumstances. Although the normal situation with an HMT percentage of 0.125% already proved to be sufficient to start a direct service, this position is improved by 5% in the case of Cleveland bound cargo and a 7% improvement in the case of Detroit bound cargo as Table 5.31 shows.

When looking overall on the port selection process for both types of cargo, High Valued Goods and Car Parts in figure 5.13ab, it is clear that the port of Rotterdam is facing the heaviest downturn when this American tax is abolished, due to the limited amount of services offered, for instance MSC does not transport cargo transatlantic through Rotterdam, but uses Antwerp for this trade lane, most likely as a result of the own terminal operations in Antwerp. Especially on the North American side, a significant effect is visible. As mentioned before, it is the port of Montreal which sees its power diminishing, in the advantage of especially Norfolk and to a lesser extent New York/New Jersey. It is also interesting to notice the preference for particular ports on a carrier level. While Maersk clearly prefers the port of New York/New Jersey, MSC prefers the port of Norfolk.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,031	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,920	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,140	$4,127	$4,169	Antwerp	Bremen	Rotterdam	Montreal	Montreal	NYNJ
Mannheim	Columbus	$4,125	$4,155	$4,181	$4,154	$4,246	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,890	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,834	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$3,979	$3,966	$4,039	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,964	$3,982	$4,008	$3,985	$4,090	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,654	$4,656	$4,626	$4,761	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	Montreal
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,656	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,818	$4,861	$4,874	$4,851	$4,900	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,803	$4,891	$4,914	$4,869	$4,983	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

Table 5.23:Door-to-door transportation rates for 20" ISO Tank Containers for existing services after reduction of the HMT to 0.00% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 Existing	EU			NA		
Duisburg	Chicago	$4,177	$4,217	$4,339	$4,245	$4,471	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,294	$4,487	$4,498	$4,426	$4,686	Antwerp	Antwerp	Antwerp	Norfolk	NYNJ	Norfolk
Stuttgart	Chicago	$4,599	$4,639	$4,676	$4,638	$4,758	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Columbus	$4,631	$4,698	$4,891	$4,740	$4,988	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	NYNJ

Table 5.24:Door-to-door transportation rates for 40" Containers containing high valued goods for existing services after reduction of the HMT to 0.00% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 Existing	EU			NA		
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,559	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,597	$4,675	$4,683	$4,652	$4,787	Antwerp	Antwerp	Bremen	Norfolk	NYNJ	Norfolk
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,708	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,759	$4,826	$4,892	$4,826	$4,934	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.25:Door-to-door transportation rates for 40" Containers containing car parts for existing services after reduction of the HMT to 0.00% (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$2,921	$3,005	$3,067	$2,998	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,548	$2,631	$2,862	$2,681	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,500	$2,583	$2,697	$2,593	$4,127	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,796	$2,813	$2,879	$2,829	$4,154	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,761	$2,844	$2,906	$2,837	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,387	$2,471	$2,701	$2,520	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,339	$2,422	$2,536	$2,433	$3,966	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,635	$2,652	$2,719	$2,669	$3,985	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,662	$3,745	$3,808	$3,738	$4,626	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,289	$3,372	$3,603	$3,421	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,240	$3,324	$3,437	$3,334	$4,851	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,537	$3,553	$3,620	$3,570	$4,869	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.26: Door-to-door transportation rates for 20" ISO Tank Containers after the introduction of a direct service into the ports of Cleveland and Toledo after abolishment of the HMT (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,454	$3,579	$3,592	$3,542	$4,245	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,321	$3,346	$3,446	$3,371	$4,426	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,791	$3,916	$3,929	$3,879	$4,638	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,658	$3,683	$3,783	$3,708	$4,740	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.27: Door-to-door transportation rates for 40" Containers containing High Valued Goods after the introduction of a direct service into the ports of Cleveland and Toledo after abolishment of the HMT (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct service	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,256	$3,381	$3,561	$3,399	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,199	$3,324	$3,405	$3,309	$4,652	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,418	$3,543	$3,724	$3,562	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,361	$3,486	$3,567	$3,472	$4,826	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.28: Door-to-door transportation rates for 40" Containers containing Car Parts after the introduction of a direct service into the ports of Cleveland and Toledo after abolishment of the HMT (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$969	-$885	-$823	-$892	76.1%
Mannheim	**Detroit**	-$1,273	-$1,190	-$959	-$1,140	70.1%
Mannheim	**Cleveland**	-$1,605	-$1,521	-$1,408	-$1,511	62.8%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.1%
Duisburg	**Chicago**	-$969	-$885	-$823	-$892	75.2%
Duisburg	**Detroit**	-$1,273	-$1,189	-$959	-$1,140	68.7%
Duisburg	**Cleveland**	-$1,605	-$1,522	-$1,408	-$1,511	61.3%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.0%
Basel	**Chicago**	-$906	-$823	-$761	-$830	80.8%
Basel	**Detroit**	-$1,211	-$1,127	-$896	-$1,078	75.2%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	68.7%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.3%

Table 5.29: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container from the baseline vs. a direct service into the Great Lakes after abolishment of the HMT (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	**Chicago**	-$723	-$598	-$585	-$635	83.4%
Duisburg	**Columbus**	-$974	-$949	-$849	-$924	76.2%
Stuttgart	**Chicago**	-$808	-$683	-$670	-$720	83.6%
Stuttgart	**Columbus**	-$973	-$948	-$848	-$923	78.2%

Table 5.30: Difference in USD between the cheapest option for the transportation of a 40" container with High Valued Goods from the baseline vs. a direct service into the Great Lakes after abolishment of the HMT (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Detroit**	-$1,079	-$954	-$774	-$936	77.6%
Mannheim	**Cleveland**	-$1,398	-$1,273	-$1,192	-$1,288	71.1%
Stuttgart	**Detroit**	-$1,141	-$1,016	-$835	-$997	77.4%
Stuttgart	**Cleveland**	-$1,398	-$1,273	-$1,192	-$1,288	71.9%

Table 5.31: Difference in USD between the cheapest option for the transportation of a 40" container with Car Parts from the baseline vs. a direct service into the Great Lakes after abolishment of the HMT (Based on own calculations)

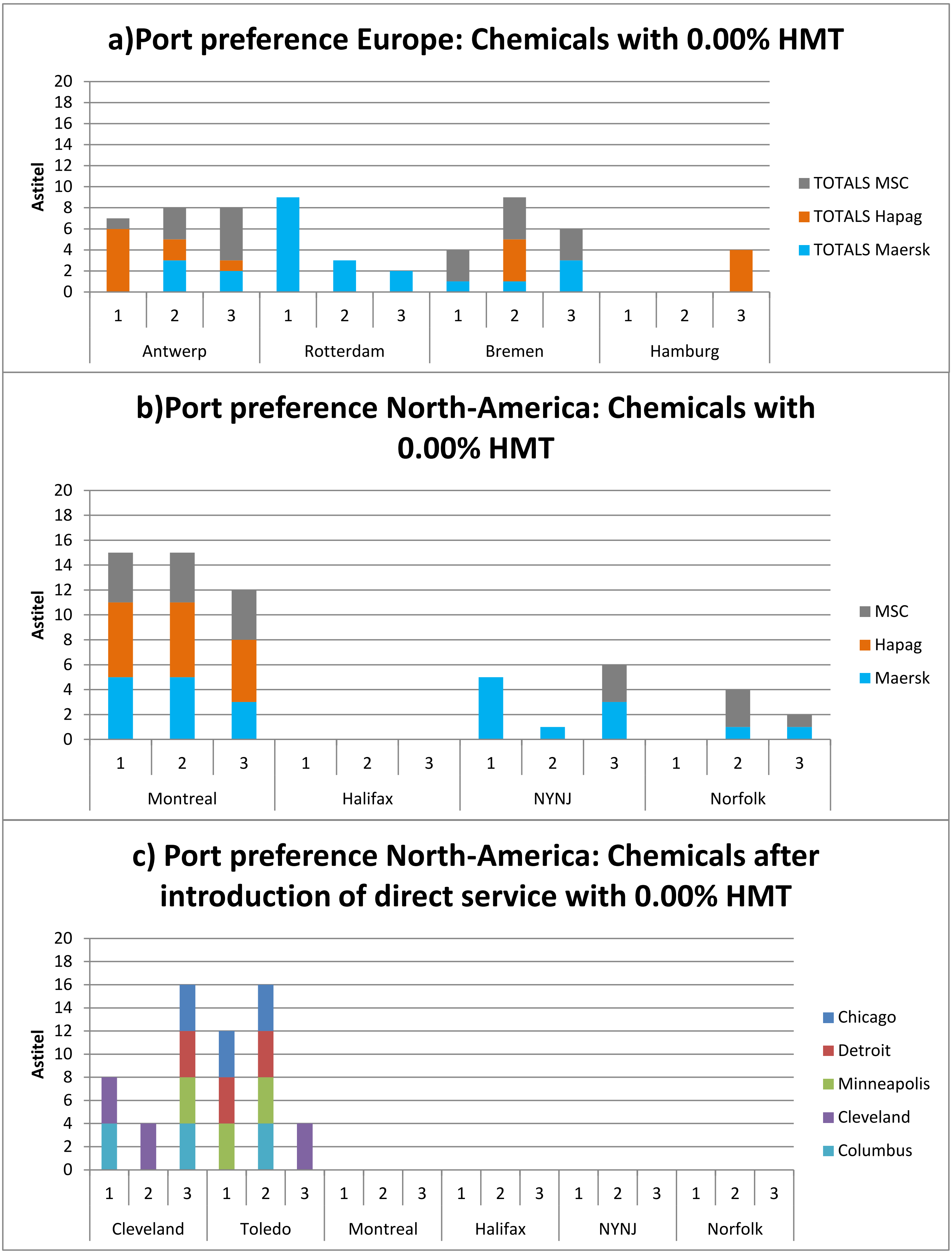

Figure 5.13: Port preference Europe (Baseline), North America (Baseline) and North America (Direct/feeder service) for the transportation for 20" ISO Tank containers after reduction HMT to 0.00%

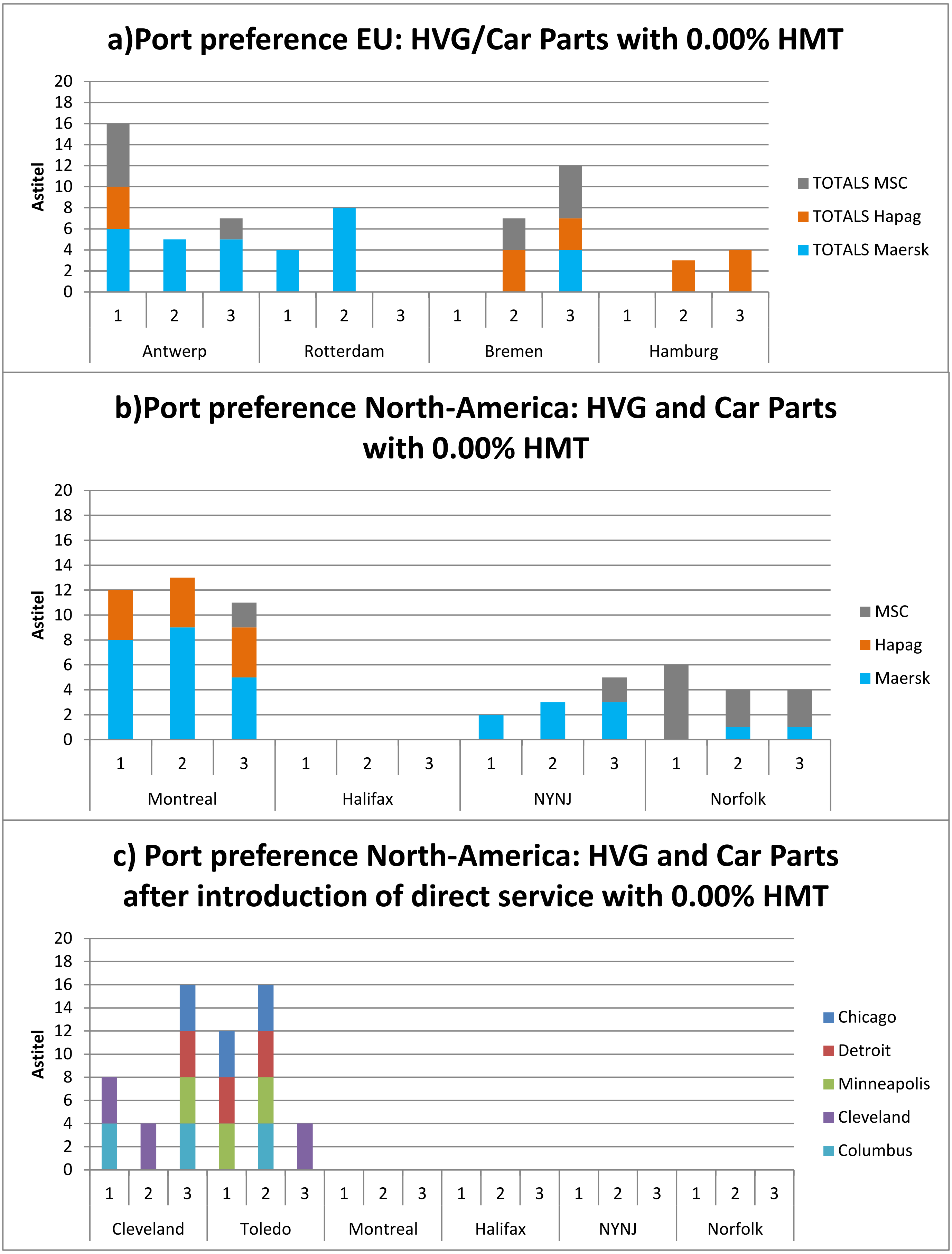

Figure 5.14: Port preference Europe (Baseline), North America (Baseline) and North America (Direct/feeder service) for the transportation for 40" containers containing High Valued Goods and Car Parts after reduction HMT to 0.00%

Conclusion Harbor Maintenance Tax Scenarios

For both the existing and new direct service, a development in the level of Harbor Maintenance Tax has proven to be very influential in terms of port selection and transportation rates. As the Harbor Maintenance Tax is levied on the value of the contents of the container, the major impact can be found in the case of transportation of the high valued goods and car parts in contrast to the less capital intensive chemical products. In the first scenario, a decrease from 0.125% to 0.09% is discussed. Although the lower Harbor Maintenance Tax is decreased with a slight 0.035 percentage point, the effect on the feasibility of a direct service into the Great Lakes can be considered severe. As the ad valorem tax is based on the value of a container, the transportation of chemical containers through a direct service would lead to a lower door-to-door transportation rate of 0.2 percentage point which is very limited, but for the more expensive containers with high valued goods and car parts, this would decrease the transportation rate with approximately 1.0 to 2.0 percentage point depending on the trade route. Also for the port preference, the lower Harbor Maintenance Tax leads to a (minimal) shift towards the U.S. East Coast ports when looking at the existing services for high valued goods, while for car parts, the port of Montreal is still able to effectively compete for cargo.

The abolishment of the Harbor Maintenance Tax however leads to an even larger effect on the feasibility of a direct service. As mentioned before, the Harbor Maintenance Tax does not prove to be a heavy burden for the transportation of chemical products because of its low value, but the abolishment would still result in an overall improvement of 0.5 to 1.0 percentage point for the select routes. For the high valued goods and car parts however, the abolishment of the Harbor Maintenance Tax would lead to an improvement by 3.0 to 7.0 percentage point in terms of the door-to-door transportation rate for the direct service. But as a result of this abolishment, another shift can be found in the port preference for the existing services. After abolishing the tax, the U.S. East Coast ports will be able to improve their position versus the port of Montreal, especially on the Columbus bound traffic. The abolishment of the tax would lead to a level playing field for the ports in both the U.S. and Canada, while also the position of the Great Lakes ports is improved. However, it is unlikely that under current budget restrictions of the national government abolishment of the Harbor Maintenance Tax will be on the political agenda. Additionally, it is likely that the abolishment of the Harbor Maintenance Tax would lead to another system to fund the dredging activities, either by higher charges from the coast guard, ports or another way of taxation on goods.

Although the abolishment of the Harbor Maintenance Tax proves to be advantageous for the direct service from Rotterdam into the Great Lakes and for the existing services, it does not create a competitive advantage for a feeder service between Montreal and Toledo/Cleveland. In fact, the feeder service would be even 10% more expensive than the existing service via rail after the abolishment of the Harbor Maintenance Tax for cargo bounded for Chicago and Detroit, because of their location along the rail hinterland connection between the port of Montreal and the U.S Midwest. Although the result also show in some cases that the feeder service would be cheaper, but only if switching costs are ignored. However, involvement of the Canadian rail carriers, bi-national government agencies and shippers could lead to the development of such a service, which would be most beneficial for the port of Cleveland because of its location versus the Montreal-Chicago rail tracks. CN rail and CP rail will be able to improve their competitive position versus NS and CSX and with their involvement, able to lower the switching costs as they can offer a viable alternative to reach Montreal during the seasonal closure of the St. Lawrence Seaway system.

5.2.3.2 Trucking premium

Over the last decade, the diesel price for trucks has been rising dramatically. Although the price of diesel fuel in the United States is lower than the European level, there are many initiatives to increase the tax on diesel fuel, in order to decrease the trips made by trucks and other commercial vehicles as part of several environmental initiatives. Not only is it expected that the tax on diesel fuel will rise, also the labor issues and diesel price itself are influencing the future of road haulage within the United States.

Like mentioned before, the diesel price has been rising dramatically over the last decade. Between 2003 and 2011, the price of diesel in the U.S. Midwest has exploded from $ 1.305 USD a gallon towards $ 3.802 USD a gallon,nearly tripled. Also the expectations for the diesel price are not indicating a positive trend. The U.S. Energy Information Administration projected a rise towards $ 6.20 USD a gallon in 2035, based on data in 2009, but in 2011 the expected value was already $ 0.80 USD a gallon lower than the actual price of a gallon of diesel (US Energy Information Administration, 2012).

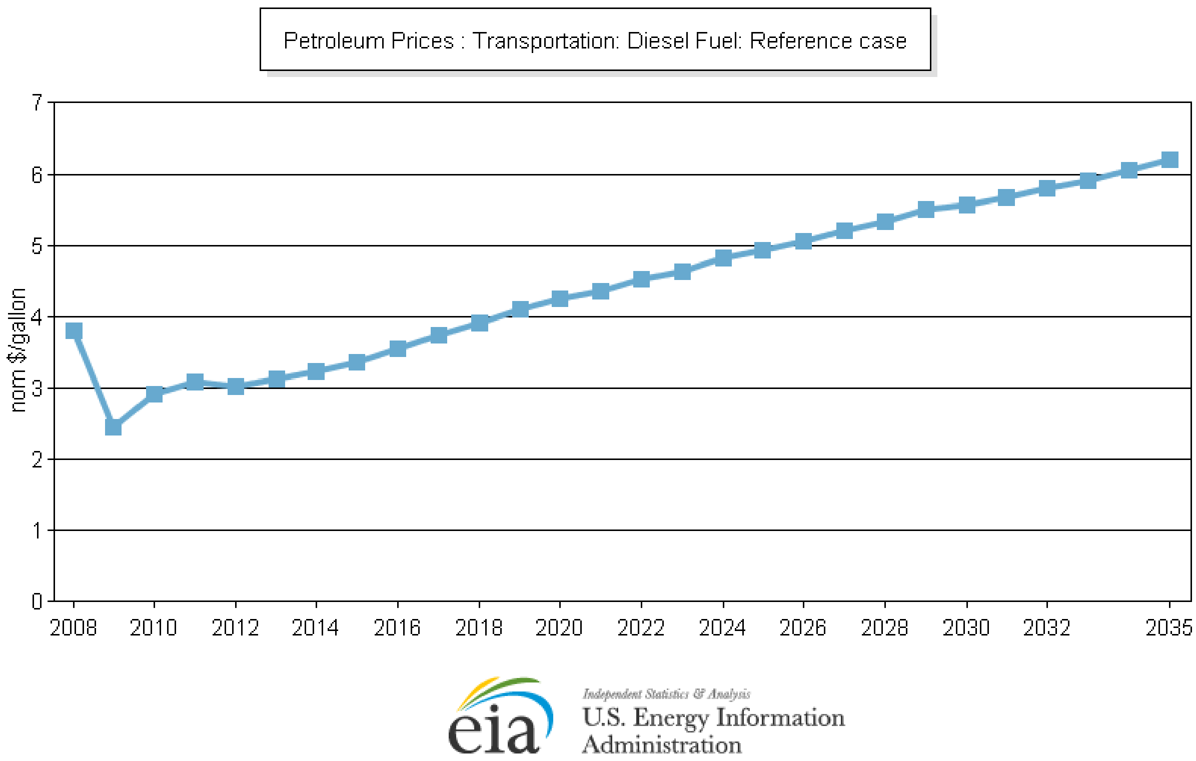

Figure 5.15: Predicted price in USD per gallon diesel fuel for the period 2008-2035 (EIA, 2012)

The next issue involved in trucking is the labor issue. Although the United States are facing a high unemployment, the trucking industry has not been able to attract young, capable personnel to operate trucks.

When looking at the U.S. Freight Transportation Forecast to 2022, it is expected that truck will increase its market share from 67.2% in 2010 towards 70% in 2022. In 2011, FTR associates have projected the driver shortage between 2011 and 2013 to be considerable. Their expectations are projecting an average shortage of 175,000 truck drivers within this period. Based on data from the U.S. Department of Labor, there is a clear reason why truck driving has lost interest as potential sector to work in. Between 1990 and 2000, the weekly earnings of the construction and trucking industry has been closely related to each other and exceeding the weekly earnings of the manufacturing industry by approximately $ 100 on average per week. After 2000 an interesting trend is visible, the weekly earnings in road industry collapse towards the level of the manufacturing, while the construction industry keeps its stable growth. In 2010, this resulted in a difference of approx. $ 100 of construction wage versus trucking and manufacturing. Also Bloomberg projected that truck driver rates have to be raised by 30% on average between 2011 and 2014. In order to attract truck drivers, while facing a driver shortage, companies will have to offer higher salaries for drivers in order to attract them. This salary will affect the profit margin of the road haulage unless the transportation rate will be increased in order to make it economically sustainable. Although this percentage sounds relatively high, the usage of road haulage in the U.S. Midwest is rather limited and focused on the short-distance market as a result of close competition with an efficient rail network.

Although some forwarders have had some concerns with the high percentage of this increase, they acknowledged the difficult position that the trucking industry will face in the upcoming years if the situation on the labor market and fuel market does not improve. One of the interviewed parties has shown strong objections to such an increase. In his opinion, the market will respond on this declining market condition by improving their efficiency and especially consolidate on a national level in order to reduce the freightless mileage by connecting the empty trucks to local demand and bigger consolidation within the industry.

Because of its unpredictability in terms of price trend, taxation and impact of the labor issues, this scenario has assumed 3 different percentages. These percentages represent the increased expenditure for trucking services, in 2011 $ U.S. Dollars, for future road haulage trips. First of all, a limited increase of 20% is economically analyzed as a limited growth of transportation rate sub scenario. This percentage reflect a below expected increase in trucking wages and a fairly stable increase of diesel prices as seen in figure 5.15.

Finally, a moderate sub scenario of 25% and a somewhat larger 30% increase will be analyzed. These scenarios reflects the projected increase in truck driver wages by Bloomberg and FTR associates, without taking an increase in diesel fuel price into account.

Although an increase of 25% and 30% in transportation rate would be exceeded if the fuel price change is also entirely included for the period 2020 to 2035, this sub scenario will only look at a moderate increase in the transportation rate, maximized at 30%. More information on the level of increased truck rates for these existing services, the corresponding door-to-door transportation rates and port preferences can be found in appendix E.

Chemicals

When looking at the development from the baseline and the 20% truck rate increase in Table 5.32, already a slight change is visible in terms of carrier preference. Especially Hapag-Lloyd is able to improve their position on the Detroit and Cleveland markets with 2 additional 3rd choice positions in the Mannheim-Detroit and Basel-Cleveland routes, while the position of Maersk and MSC stays quite equal to each other. But after increasing the truck rates with 25% and 30% in Tables 5.35 and 5.38, the position of Hapag-Lloyd is slightly decreased towards the 2nd or 3rd choice on 5 routes and losing their preferred 1st choice position on Cleveland bound cargo. As a result of this changed market position, also on a port level change is noticeable. Especially the port of Rotterdam is able to capture a lot of the market of containers with chemical products as a result of higher trucking rates in North America. While in the baseline, the port of Rotterdam was only mentioned 9 times out of 12, they are dominating the market with 11 times out of 12 after the trucking rates have increased.

Also on the North American port decision, the increased trucking rates have a significant influence. As a result of the position of Cleveland and Columbus and the structure of the Class I railway system in North America, the position of the port of Montreal is under severe pressure. In order to serve these markets, cargo is transported through the port of Montreal followed by rail transportation to Detroit, where it will be unloaded on a truck destined for Cleveland and Columbus. As the HMT is considered to be low in case of chemical containers, it is more economical to transport these containers through the U.S. East Coast ports, with a direct connection to Cleveland and Columbus in order to cope with the higher trucking rates.

Also for the transportation through a direct service into the Great Lakes, the increased trucking rates prove to be a slight burden. As a result of the close proximity of the ports of Toledo and Cleveland, the cargo destined for Detroit, Cleveland and Columbus are preferred to be hauled by truck as rail in not considered a viable option for short-haul transportation. But as a result of the higher trucking rates, the direct service into the Great Lakes loses a slight 1.0 – 2.0 percentage point in the case of a 20% increase (Table 5.34) to 1.5 – 2.5 percentage point in the case of 30% (Table 5.40), but as the baseline situation already proved, the margin created by the direct service because of its lower ocean rates prove to be enough to cover the switching costs in the winter period.

High Valued Goods

More interesting in the case of increased trucking rates are the High Valued Goods as this type is focused on a long-haul market (Chicago) and a short-haul market (Columbus) in combination with a severe burden in the form of the HMT on the U.S. East Coast. The first thing that is interesting to notice is the position of Montreal on Chicago bounded trade. As a result of the lack of HMT and the excellent rail connectivity to Chicago, this position stays stable throughout all levels of increase. Also on a carrier level the position stays stable, indicating that the port of Montreal stays a strong competitor for Chicago bounded cargo, even when the trucking rates are increase with 30% as Tables 5.41, 5.42 and 5.43 shows. Because of its distance to the ports, this limited effect can be explained due to the fact that the trucking premium will only impact the final part of delivery, between the rail terminal and final destination. As the usage of rail proves to be the best suitable option for long distance transportation, only markets close to the ports or with lacking rail services would face a large impact. More interesting in the effect of higher trucking rates on Columbus bound cargo. As mentioned before, the market for Columbus proves to be difficult to reach for the port of Montreal as a result of the rail network. Although they are not charging a $ 288.93 HMT charge it proves to be sufficient enough to compete up to a level of 25% increase in trucking rates. If the increase exceeds this percentage, Montreal loses its 3rd position on the Duisburg – Columbus trade route to Norfolk, which is able to serve this market more efficient. As a result of this, also the port of Rotterdam loses its 3rd position to Antwerp. This effect can be explained due to the fact that transportation from Montreal to Columbus requires road haulage from Detroit to serve this market, resulting in a longer trucking distance than regions that are directly served with a rail connection.

As for the direct service, the increased trucking rates are responsible for a slight increase in door-to-door transportation rates (Table 5.44, 5.45 and 5.46), but it proves that although the trucking rates are increased, it only has a marginal effect on the feasibility. Like the baseline, a direct service proves to be not sufficient enough for Chicago bounded trade, while on the Columbus bounded routes, an increase only has a very limited effect of up to 0.7 - 1.4 percentage point in the case of a 30% increase as Table 5.49 shows. As for the Chicago market, this can be explained due to the fact that rail is the preferred option. Only the final step, from the rail terminal in Chicago to the doorstep is faced with this increased trucking rate. Columbus on the other hand is served by truck, but the geographical position of the ports of Toledo and Cleveland result in a short trip, therefore limiting the effect of the trucking rate increase on the entire door-to-door transportation rate.

Car Parts

As mentioned in the case of High Valued Goods, it is the HMT in conjunction with location that is considered crucial for the port selection process when trucking rates are increased. Unlike in the case of High Valued Goods, the transportation of Car Parts containers is destined for 2 locations which are closely located to the shores of Lake Erie, Cleveland and Detroit. Interesting to notice is the strong position of the port of Montreal in this situation. Although the rail network is not optimal for transportation from Montreal to Cleveland, the burden of the HMT proves to be too high enough for shippers to prefer Montreal as gateway to the U.S. Midwest. As for Detroit, its geographical position, as well as its position on the major hinterland transportation lane between the port of Montreal and the U.S. Midwest results in a strong preference for the port of Montreal. As a result of this stable situation throughout the different levels of trucking rate increases, the port selection on both sides of the Atlantic stays stable.

When looking at the direct service into the Great Lakes and the mode of hinterland transportation an interesting trend is noticeable in Table 5.53, 5.54, 5.55. Although the door-to-door transportation rates increases for both destinations as a result of choosing road haulage as most optimal mode of hinterland transportation, the increased trucking rates have an opposite reaction. As the baseline already proved for the transportation of Car Parts to Detroit, the ports of Cleveland and Toledo faces fierce competition from the port of Montreal. As a result of this, in combination with the road haulage from the port of Toledo and Cleveland, the feasibility of a direct service declines slightly. When trucking rates increased by 20%, the benefit of a direct service is only 14.5%, just slightly above the switching costs of 14%. When these trucking rates are increased even further to 30%, this decreases to 14.1%. In contrary to cargo destined for Detroit, the feasibility for cargo destined for Cleveland improves when the trucking rates are increased. This can be explained due to the previously mentioned rail infrastructure.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,930	$4,002	$4,011	$3,981	$4,085	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,861	$3,864	$3,873	$3,866	$3,962	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,192	$4,195	$4,237	$4,208	$4,256	Antwerp	Rotterdam	Antwerp	Montreal	NYNJ	NYNJ
Mannheim	Columbus	$4,203	$4,231	$4,254	$4,229	$4,323	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,769	$3,816	$3,847	$3,811	$3,950	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,700	$3,700	$3,713	$3,704	$3,880	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,032	$4,034	$4,064	$4,043	$4,121	Antwerp	Rotterdam	Antwerp	Montreal	NYNJ	NYNJ
Duisburg	Columbus	$4,042	$4,057	$4,081	$4,060	$4,180	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,608	$4,696	$4,726	$4,677	$4,815	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,539	$4,600	$4,627	$4,589	$4,697	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,873	$4,962	$4,962	$4,932	$4,986	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,881	$4,970	$4,989	$4,947	$5,058	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.32: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$3,015	$3,098	$3,161	$3,091	$3,981	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,628	$2,711	$3,008	$2,782	$3,866	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,594	$2,677	$2,807	$2,692	$4,207	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,929	$2,945	$3,012	$2,962	$4,229	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,854	$2,938	$3,000	$2,931	$3,811	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,467	$2,550	$2,847	$2,622	$3,704	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,433	$2,516	$2,646	$2,532	$4,042	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,768	$2,785	$2,851	$2,801	$4,060	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,756	$3,839	$3,901	$3,832	$4,677	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,368	$3,452	$3,749	$3,523	$4,589	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,334	$3,418	$3,547	$3,433	$4,931	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,669	$3,686	$3,753	$3,703	$4,947	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.33: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$915	-$832	-$769	-$839	77.7%
Mannheim	Detroit	-$1,233	-$1,150	-$853	-$1,079	72.0%
Mannheim	Cleveland	-$1,599	-$1,515	-$1,386	-$1,500	64.0%
Mannheim	Columbus	-$1,274	-$1,258	-$1,191	-$1,241	70.0%
Duisburg	Chicago	-$915	-$832	-$769	-$839	76.9%
Duisburg	Detroit	-$1,233	-$1,150	-$853	-$1,078	70.8%
Duisburg	Cleveland	-$1,599	-$1,515	-$1,386	-$1,500	62.6%
Duisburg	Columbus	-$1,274	-$1,258	-$1,191	-$1,241	69.0%
Basel	Chicago	-$853	-$769	-$707	-$776	81.9%
Basel	Detroit	-$1,171	-$1,087	-$790	-$1,016	76.8%
Basel	Cleveland	-$1,539	-$1,456	-$1,326	-$1,440	69.6%
Basel	Columbus	-$1,212	-$1,195	-$1,129	-$1,179	74.9%

Table 5.34: Difference in USD between the cheapest option for the transportation of a 20" ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,940	$4,012	$4,021	$3,991	$4,097	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,871	$3,874	$3,882	$3,875	$3,972	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,201	$4,214	$4,244	$4,220	$4,274	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Mannheim	Columbus	$4,214	$4,241	$4,264	$4,240	$4,333	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,779	$3,826	$3,857	$3,821	$3,962	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,710	$3,710	$3,721	$3,714	$3,889	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,040	$4,054	$4,071	$4,055	$4,135	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Duisburg	Columbus	$4,054	$4,068	$4,091	$4,071	$4,196	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,618	$4,706	$4,736	$4,687	$4,827	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,549	$4,610	$4,637	$4,599	$4,707	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,879	$4,967	$4,984	$4,943	$5,004	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,893	$4,981	$4,999	$4,958	$5,068	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.35: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 direct	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$3,030	$3,114	$3,176	$3,107	$3,991	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,639	$2,723	$3,036	$2,800	$3,875	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,609	$2,692	$2,826	$2,709	$4,218	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,954	$2,970	$3,037	$2,987	$4,239	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,870	$2,953	$3,015	$2,946	$3,821	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,479	$2,562	$2,876	$2,639	$3,714	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,448	$2,531	$2,665	$2,548	$4,053	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,793	$2,809	$2,876	$2,826	$4,070	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,771	$3,854	$3,917	$3,847	$4,687	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,380	$3,463	$3,777	$3,540	$4,599	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,349	$3,433	$3,566	$3,449	$4,941	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,694	$3,711	$3,777	$3,727	$4,958	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.36: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$910	-$826	-$764	-$833	77.8%
Mannheim	**Detroit**	-$1,231	-$1,148	-$835	-$1,071	72.2%
Mannheim	**Cleveland**	-$1,592	-$1,509	-$1,375	-$1,492	64.2%
Mannheim	**Columbus**	-$1,261	-$1,244	-$1,178	-$1,228	70.4%
Duisburg	**Chicago**	-$910	-$826	-$764	-$833	77.1%
Duisburg	**Detroit**	-$1,231	-$1,148	-$835	-$1,071	71.1%
Duisburg	**Cleveland**	-$1,592	-$1,509	-$1,375	-$1,492	62.8%
Duisburg	**Columbus**	-$1,261	-$1,244	-$1,178	-$1,228	69.4%
Basel	**Chicago**	-$847	-$764	-$702	-$771	82.1%
Basel	**Detroit**	-$1,169	-$1,086	-$772	-$1,009	77.0%
Basel	**Cleveland**	-$1,530	-$1,446	-$1,313	-$1,430	69.8%
Basel	**Columbus**	-$1,199	-$1,182	-$1,115	-$1,165	75.2%

Table 5.37: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$3,950	$4,022	$4,031	$4,001	$4,108	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,881	$3,884	$3,890	$3,885	$3,981	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,206	$4,236	$4,252	$4,232	$4,293	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Mannheim	Columbus	$4,226	$4,251	$4,274	$4,250	$4,343	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,789	$3,836	$3,867	$3,831	$3,974	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,720	$3,720	$3,730	$3,723	$3,899	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,045	$4,076	$4,079	$4,067	$4,149	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Duisburg	Columbus	$4,065	$4,078	$4,101	$4,081	$4,210	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,628	$4,716	$4,746	$4,697	$4,839	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,559	$4,620	$4,647	$4,609	$4,716	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,884	$4,973	$5,006	$4,954	$5,023	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,904	$4,992	$5,010	$4,969	$5,078	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 5.38: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing		EU			NA	
Mannheim	Chicago	$3,045	$3,129	$3,191	$3,122	$4,001	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,651	$2,734	$3,064	$2,817	$3,885	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,624	$2,707	$2,845	$2,725	$4,229	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,978	$2,995	$3,062	$3,012	$4,250	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,885	$2,968	$3,030	$2,961	$3,831	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,490	$2,574	$2,904	$2,656	$3,723	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,463	$2,546	$2,684	$2,564	$4,064	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,818	$2,834	$2,901	$2,851	$4,081	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,786	$3,869	$3,932	$3,862	$4,697	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,392	$3,475	$3,805	$3,557	$4,609	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,364	$3,448	$3,585	$3,466	$4,952	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,719	$3,736	$3,802	$3,752	$4,969	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.39: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$905	-$821	-$759	-$828	78.0%
Mannheim	**Detroit**	-$1,230	-$1,147	-$817	-$1,064	72.5%
Mannheim	**Cleveland**	-$1,582	-$1,499	-$1,362	-$1,481	64.4%
Mannheim	**Columbus**	-$1,247	-$1,231	-$1,164	-$1,214	70.9%
Duisburg	**Chicago**	-$905	-$821	-$759	-$828	77.3%
Duisburg	**Detroit**	-$1,230	-$1,147	-$816	-$1,064	71.3%
Duisburg	**Cleveland**	-$1,582	-$1,499	-$1,362	-$1,481	63.1%
Duisburg	**Columbus**	-$1,247	-$1,231	-$1,164	-$1,214	69.9%
Basel	**Chicago**	-$842	-$759	-$696	-$766	82.2%
Basel	**Detroit**	-$1,168	-$1,084	-$754	-$1,002	77.2%
Basel	**Cleveland**	-$1,520	-$1,437	-$1,299	-$1,419	70.0%
Basel	**Columbus**	-$1,185	-$1,168	-$1,102	-$1,152	75.5%

Table 5.40: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,217	$4,257	$4,391	$4,288	$4,582	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,616	$4,751	$4,791	$4,719	$4,969	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,639	$4,679	$4,728	$4,682	$4,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,953	$5,019	$5,173	$5,048	$5,256	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal

Table 5.41: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,227	$4,267	$4,401	$4,298	$4,594	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,624	$4,785	$4,825	$4,745	$4,989	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,649	$4,689	$4,738	$4,692	$4,853	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,961	$5,027	$5,206	$5,065	$5,280	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal

Table 5.42: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,237	$4,277	$4,411	$4,308	$4,605	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,632	$4,818	$4,833	$4,761	$5,008	Antwerp	Antwerp	Antwerp	Norfolk	Montreal	Norfolk
Stuttgart	Chicago	$4,659	$4,699	$4,748	$4,702	$4,864	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,969	$5,036	$5,240	$5,082	$5,303	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.43: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,804	$3,929	$3,941	$3,891	$4,288	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,709	$3,734	$3,834	$3,759	$4,719	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,140	$4,265	$4,278	$4,228	$4,682	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$4,046	$4,071	$4,171	$4,096	$5,048	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

Table 5.44: Door-to-door transportation rates for a 40" Container with High Valued Goods for direct and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,819	$3,944	$3,956	$3,906	$4,298	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,734	$3,759	$3,859	$3,784	$4,745	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,156	$4,281	$4,293	$4,243	$4,692	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$4,071	$4,096	$4,196	$4,121	$5,065	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

Table 5.45: Door-to-door transportation rates for a 40" Container with High Valued Goods for direct and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,834	$3,959	$3,971	$3,921	$4,308	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,759	$3,784	$3,884	$3,809	$4,761	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,171	$4,296	$4,308	$4,258	$4,702	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$4,095	$4,120	$4,220	$4,145	$5,082	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.46: Door-to-door transportation rates for a 40" Container with High Valued Goods for direct and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$414	-$289	-$276	-$326	90.7%
Duisburg	Columbus	-$907	-$882	-$782	-$857	79.7%
Stuttgart	Chicago	-$499	-$374	-$361	-$411	90.3%
Stuttgart	Columbus	-$907	-$882	-$782	-$857	81.1%

Table 5.47: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$408	-$283	-$271	-$321	90.9%
Duisburg	Columbus	-$890	-$865	-$765	-$840	79.8%
Stuttgart	Chicago	-$493	-$368	-$356	-$406	90.4%
Stuttgart	Columbus	-$890	-$865	-$765	-$840	81.4%

Table 5.48: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$403	-$278	-$266	-$316	91.0%
Duisburg	Columbus	-$874	-$849	-$749	-$824	80.0%
Stuttgart	Chicago	-$488	-$363	-$351	-$401	90.6%
Stuttgart	Columbus	-$874	-$849	-$749	-$824	81.6%

Table 5.49: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,375	$4,415	$4,468	$4,419	$4,631	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,809	$4,850	$4,902	$4,854	$4,974	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,599	$4,639	$4,688	$4,642	$4,780	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,033	$5,074	$5,092	$5,066	$5,123	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal

Table 5.50: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,385	$4,425	$4,478	$4,429	$4,640	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,878	$4,930	$4,882	$4,996	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,609	$4,649	$4,698	$4,652	$4,790	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,102	$5,114	$5,092	$5,145	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal

Table 5.51: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,395	$4,435	$4,488	$4,439	$4,650	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,866	$4,906	$4,958	$4,910	$5,018	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,619	$4,659	$4,708	$4,662	$4,799	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,090	$5,130	$5,136	$5,119	$5,168	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.52: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,614	$3,739	$3,986	$3,780	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,572	$3,697	$3,793	$3,687	$4,854	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,777	$3,902	$4,149	$3,942	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,734	$3,859	$3,955	$3,850	$5,066	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

Table 5.53: Door-to-door transportation rates for a 40" Container with Car Parts for direct and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,626	$3,751	$4,015	$3,797	$4,429	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,587	$3,712	$3,812	$3,704	$4,882	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,788	$3,913	$4,177	$3,960	$4,652	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,749	$3,874	$3,974	$3,866	$5,092	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

Table 5.54: Door-to-door transportation rates for a 40" Container with Car Parts for direct and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,638	$3,763	$4,043	$3,814	$4,439	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,602	$3,727	$3,831	$3,720	$4,910	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,800	$3,925	$4,205	$3,977	$4,662	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,765	$3,890	$3,993	$3,882	$5,119	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.55: Door-to-door transportation rates for a 40" Container with Car Parts for direct and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Detroit**	-$760	-$635	-$389	-$595	85.5%
Mannheim	**Cleveland**	-$1,237	-$1,112	-$1,016	-$1,122	76.0%
Stuttgart	**Detroit**	-$822	-$697	-$450	-$656	84.9%
Stuttgart	**Cleveland**	-$1,299	-$1,174	-$1,078	-$1,184	76.0%

Table 5.56: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 20% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Detroit**	-$759	-$634	-$370	-$588	85.7%
Mannheim	**Cleveland**	-$1,250	-$1,125	-$1,025	-$1,134	75.9%
Stuttgart	**Detroit**	-$821	-$696	-$432	-$649	85.1%
Stuttgart	**Cleveland**	-$1,312	-$1,187	-$1,087	-$1,195	75.9%

Table 5.57: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 25% of the trucking rates in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Detroit**	-$757	-$632	-$352	-$581	85.9%
Mannheim	**Cleveland**	-$1,263	-$1,138	-$1,034	-$1,145	75.8%
Stuttgart	**Detroit**	-$819	-$694	-$414	-$642	85.3%
Stuttgart	**Cleveland**	-$1,325	-$1,200	-$1,096	-$1,207	75.9%

Table 5.58: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after an increase of 30% of the trucking rates in North America (Based on own calculations)

Conclusion trucking rates scenarios

As mentioned in the introduction of this scenario, the road transportation industry will be facing a severe challenge in the upcoming decades as a result of the higher diesel price and the shortage of qualified truck drivers. However, as the analysis of the various trucking rate scenarios show, the effect of higher trucking rates on the feasibility of a direct service is only minimal. Because of the efficient use of rail haulage from the East Coast ports and a strong covering network of intermodal facilities, the majority of cargo through existing services is being transported by rail instead of road haulage. However, when looking into detail at the port preference for the existing services it is interesting to notice that distance between the port and final destination becomes more important as trucking rates increase. For the transportation of chemicals, the lower Harbor Maintenance Tax per container leads to a stronger competition with the port of Montreal. Especially for chemicals bounded for Cleveland, the trend of higher trucking rates leads to a diminishing role for the port of Montreal while in particular the port of New York/New Jersey is able to improve its position together with Norfolk. The viable explanation for this trend is the lacking connection between the port of Montreal and the Cleveland area, as the rail haulage will go up to Detroit to be loaded on a truck. The longer trucking distance therefore results in a shift from Montreal to the U.S. East Coast ports.

For the transportation of high valued goods and car parts, shippers and consignees would still prefer the usage of Montreal as port of choice. Like previously mentioned, it is the cargo bounded for Columbus and Cleveland which would be facing the largest increments, but as this tax is a considerable amount, the effect of higher trucking rates is less of an impact. The port of Montreal will keep its competitive advantage in this situation, although it is slightly weakened. If the trucking rates would increase with extreme numbers, like 70% to 80% the port of Montreal will most likely lose its competitive advantage, but this is not considered as a realistic increase.

For the direct service into the Great Lakes, the higher trucking rates would lead to a minimal disadvantage of 0.3 to 1.1 percentage point for almost all routes in the case of a 30% increment. This effect can be explained due to the fact that the proximity of the final destinations from the ports of Cleveland and Toledo results in a preference for road haulage. When looking at the different types of cargo, the most limited effect can be found for the transportation of chemicals. The largest effect however can be found in the case of car parts transportation. As the baseline situation already showed, there is a strong competition for the transportation of car parts bounded for Detroit between the existing services through Montreal and the direct service to Toledo. As a result of the increased trucking rate the direct service will move towards an equally preferred situation between the existing and direct services.

In contrast to the majority of routes, an increase in trucking rates results in a stronger position for the direct service in the case of car parts transportation from Mannheim/Stuttgart to Cleveland. This effect can be explained due to the proximity of the final destination to the port. When looking at the existing services, these containers prefer to be transported through the port of Montreal, with rail to Detroit and being trucked onwards to Cleveland, because it lacks a reliable connection between the Canadian and American Class I rail operators. Because the distance between Detroit and Cleveland, higher trucking rates will penalize the existing services more than in the case of a direct service to Cleveland or Toledo, resulting in a stronger position for the direct service in this particular case.

5.2.3.3 Rail Rate

One of the important issues brought up during the interviews is the position of the Class I rail operators when commencing a direct or feeder service into the Great Lakes. Because of its strong position and efficient operations on hinterland transportation towards the U.S. Midwest, the Canadian Class I rail companies CN Rail and CP Rail have a large market power towards potential and existing customers. As a maritime service into the Great Lakes could cannibalize volume from rail haulage, the Class I rail companies could potentially retaliate by asking a premium during the closure of the St. Lawrence Seaway System during the winter period. Another potential retaliation could be the possibility that the Class I rail companies use their market power when renegotiating the contract with the ocean carrier and request a higher rate overall.

Another issue for rail haulage is, like in road haulage, the increasing price of fuel is impacting the profit margin of the Class I rail companies. In contrast to Europe, North American Class I rail companies are only operating locomotives that require diesel fuel to operate. Although the effects of an increasing fuel price are less noticeable on rail haulage (due to the higher volume of containers per trip compared to road haulage), it could influence the economics within the transportation chain. Within the economical analysis of these cases distinction will be made between the cases of a temporary winter premium, reflecting the extra costs involved during the Seaway closure, and the general increase in the transportation rate for rail haulage. Within this scenario, an increase of 10%, 15% and 20% in the rail transportation rate is being assumed for either a winter premium or higher transportation rates in general. In comparison, between 2004 and 2009, facing an increasing fuel price and an economic downturn as a result of the crisis in the late '00s, the average revenue per ton-mile has increased with 28% compared to an 11% decrease between 1990 and 2002. Clearly, there has been an upward trend which is unpredictable to make hard assumptions on the increase in the transportation rate. Therefore, it has been decided to use the previous mentioned percentages.

10%, 15% and 20% Rail premium winter

As interviews proved, there is a lot of uncertainty under shippers, forwarders and shipping lines to what extent the Class I rail companies are able to introduce a rail winter premium if a direct service or feeder service is introduced as a viable alternative for transportation through Montreal. Because of the uncertainty to what extent this rail premium will reach, this scenario will look at the effect of a 10%, 15% and 20% rail premium compared with the baseline scenario, in order to research the effect of a higher rail premium percentage. As a result of the seasonality issues in the St. Lawrence Seaway system, the Class I rail companies, CN, CP, CSX and NS, will charge a 10%, 15% and 20% premium on top of their regular cargo, as it is assumed to be a seasonal cargo, excluded from the normal contracts of the ocean shipping lines with the rail companies.

On top of the hinterland transportation rates published in Appendix A, the rail premium is applied. As the rates published only container rail+truck rates, an in-depth analysis has been done on the hinterland transportation rates in order to split it up in a rail and road part. The corresponding premiums on the existing services can be found in Appendix F, together with the entire collection of rates applicable to all 20 routes. As the tables in appendix F shows, it is interesting to notice that although the differences could lead to a change in preferred route, the difference ranges from $ 80 to $ 120 dollars between ports in terms of the 10% premium, which is less than the HMT in U.S. ports for 40" containers, while the premium for 20" Tank containers are exceeding the HMT. Another fact is that the rail winter premiums are not very differentiated, indicating a close relationship between the rail rates of the different carriers. But if the rail premium percentage increases, also the differences are increasing rapidly to a maximum difference of approximately $ 190 dollar in the case of Maersk to Detroit and Cleveland. Clearly, this indicates that Maersk pays significantly more on average for hinterland transportation from the ports of New York/New Jersey and Norfolk than their two other major competitors on the transatlantic market, Hapag-Lloyd and MSC.

Chemicals

As previously indicated, Maersk pays a higher rate for hinterland transportation in North America compared to its main competitors, MSC and Hapag-Lloyd. When looking at Table 5.59, comparing it with Table 5.1 from the baseline of existing services, the effect is noticeable particularly on the trade routes bound to Cleveland. First of all, on the Duisburg – Cleveland trade routes, the 3rd position for Maersk switches from a Rotterdam-New York/New Jersey Ocean routing towards a Rotterdam-Montreal routing. Also on the Basel-Cleveland the same effect of a rail premium in the winter period is visible. While this route was previously dominated by Maersk via the port of Rotterdam to New York/New Jersey and Montreal, the additional rail premium results in a weaker position leaving only the Montreal service in the top 3 choices. Another interesting effect on this route is the new presence of Hapag-Lloyd with a Montreal route, overtaking both Maersk (NYNJ-service) and MSC (Montreal-service). Also after increasing the rail winter premium to 15% and even 20% a slight change is visible in port and carrier selection of the shipper.

Another interesting effect takes place on the trade routes to Columbus. As the baseline indicates, this route is dominated by Maersk and MSC, through the ports of New York/New Jersey and Norfolk. But as a result of increasing rail premium in the winter period, the port of Montreal is able to increase its position slightly after introducing a 20% winter premium. Because nearly all port preferences in North America stay stable, it is an indication that although the rail rates increase, it is not high enough for shippers to route through another port on existing services. This can be explained due to the limited effect of the HMT on containers with chemical products, which is lower than the rail winter premium.

After introducing a direct service into the Great Lakes, it is necessary to have a viable alternative during the winter period when the St. Lawrence Seaway system is closed. As Table 5.62 shows, this direct service is feasible on all major trade routes, even after a rail premium of 20% is added during the winter period. Although the transportation rate for the direct services move towards the critical level of 95%, a 20% rail premium only has an effect of 2.0 to 4.0 percentage points as Table 5.62 indicates. This indicates that the rail premium is not considered to be a burden or a potential barrier for shippers and ocean carriers to start a direct service into the Great Lakes, while in the winter period, a more expensive than usual, rail hinterland transportation in used from Montreal, New York/New Jersey or Norfolk.

High Valued Goods

In contrast to the chemical containers, the HMT is more severe on the transportation of containers with high valued goods, resulting in a less optimal transportation chain, as this ad valorem tax in U.S. ports leads to a distortion of the port selection process. The importance that the HMT plays on the port selection process is evident in Tables 5.66, 5.67 and 5.68. Although the rail premium during the winter period is higher for these 40” containers, the port of Montreal proves to have the strongest position in this market. As the analysis of the baseline of existing services already showed, it is not the only location of the port that influences the port selection process in North America, but also the heavy taxation in the form of the HMT which disadvantages the port of New York/New Jersey and Norfolk.

When we look at the carrier preference and port preference in Europe, only a slight change is visible on the Duisburg-Columbus route where MSC loses its leading position to Maersk. Another interesting effect that is visible when analyzing the door-to-door transportation rates is on the Columbus trade routes. Under an increasing rail premium, the difference in rates between Norfolk and Montreal becomes closer. Especially on the Stuttgart-Columbus route, there is a close relationship between both rates. While in the baseline of the existing service the difference was $ 51 per container it is decreased to only $ 5 after applying a 20% rail premium during the winter period. Also the relationship between the 1st 3 and 1st 9 choices are becoming closer as a result of a higher rail premium. This indicates the stronger position of the port of Montreal within these first 3 choices, as the average of the first 9 choices increases linear.

But, as a result of this rail premium during the winter months, the feasibility of introducing a direct service into the Great Lakes is reduced. As Table 5.69 indicates, there is a stronger impact of this rail premium than for the transportation of chemical containers. As the initial analysis of the direct service already showed, it is not competitive on routes to Chicago. As a result of this initial position, the feasibility is even decreased further to a level of 93.4% and 94.1%, indicating that an existing service would only be 6% - 6.5% cheaper, without taking into account the high level of switching costs of 14%. Also on the trade routes towards Columbus, which are all considered to be feasible, a strong upward trend in noticeable towards the critical 86% rule. Clearly, the rail premium has a strong impact on the feasibility of a direct service in the case of the transportation of high valued goods, limiting its potential.

Car Parts

Unlike in the case of chemical containers or containers with high valued goods, the rail premium only has a very limited effect on the port selection process and the preferred choice of carriers for containers with Car Parts. As the majority of the market is located around Detroit and slightly less in Cleveland, the port of Montreal is able to keep its strong position for this market as a more optimal location and more importantly, without HMT charges. On a carrier level, no change is noticeable, but in terms of door-to-door transportation rate, an interesting effect is noticeable. Although both the averages of the 1st 3 and 1st 9 choices increase, the difference between the two numbers is showing an increasing trend. This indicates the strong position of the port of Montreal for these trade routes as this port has a lower assumed rail premium during the winter period.

As already mentioned, as a result of the stable carrier choice, the port selection also shows a stable position without changes in the top 3 choices of the 4 trade routes. As also the baseline of existing services shows the same port selection, it is evident that the rail premium during the winter closure does not have an effect on the port selection process up to a level of 20%. As higher rail premiums are not researched, it is not possible to indicate if this position stays stable if this premium increases to a higher level.

Although the rail premium does not have an effect on the carrier and port selection, it does have a significant effect on the feasibility of a direct service. As Table 5.70 indicates, a direct service into the Great Lakes is feasible on all 4 relevant trade routes under the baseline situation without a rail winter premium. But the introduction of a rail premium during the winter months influences the feasibility negatively when looking at cargo bounded for Detroit as it passes the 86% rule. On the routes to Cleveland on the other hand, the service remains feasible when looking at the situation up to 20% rail premium for the winter period.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice		EU			NA	
Mannheim	Chicago	$3,977	$4,049	$4,059	$4,029	$4,132	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,901	$3,903	$3,912	$3,906	$4,007	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,182	$4,217	$4,226	$4,209	$4,269	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,266	$4,295	$4,325	$4,296	$4,377	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,816	$3,863	$3,895	$3,858	$3,995	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,739	$3,741	$3,756	$3,745	$3,928	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,022	$4,053	$4,103	$4,059	$4,151	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,106	$4,122	$4,152	$4,126	$4,214	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,655	$4,744	$4,795	$4,731	$4,862	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,580	$4,639	$4,668	$4,629	$4,742	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,942	$4,952	$4,953	$4,949	$4,999	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$4,945	$5,033	$5,054	$5,010	$5,114	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

Table 5.59: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after adding a 10% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$4,021	$4,093	$4,103	$4,072	$4,178	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,942	$3,942	$3,952	$3,945	$4,048	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,221	$4,256	$4,266	$4,248	$4,313	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,321	$4,349	$4,380	$4,350	$4,426	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,860	$3,907	$3,939	$3,902	$4,042	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,779	$3,781	$3,795	$3,785	$3,972	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,061	$4,093	$4,143	$4,099	$4,197	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,160	$4,175	$4,207	$4,181	$4,262	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,699	$4,787	$4,839	$4,775	$4,909	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,620	$4,678	$4,708	$4,669	$4,783	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$4,982	$4,991	$4,992	$4,989	$5,043	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$4,999	$5,087	$5,098	$5,061	$5,163	Rotterdam	Antwerp	Rotterdam	NYNJ	NYNJ	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.60: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after adding a 15% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU			NA		
Mannheim	Chicago	$4,064	$4,137	$4,147	$4,116	$4,225	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,982	$3,982	$3,992	$3,985	$4,089	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,260	$4,296	$4,306	$4,287	$4,357	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,375	$4,402	$4,435	$4,404	$4,476	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,904	$3,951	$3,983	$3,946	$4,088	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,818	$3,821	$3,834	$3,824	$4,015	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,100	$4,132	$4,183	$4,138	$4,243	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,214	$4,229	$4,261	$4,235	$4,310	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,743	$4,831	$4,883	$4,819	$4,955	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,660	$4,718	$4,748	$4,709	$4,824	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Cleveland	$5,022	$5,030	$5,032	$5,028	$5,087	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Columbus	$5,053	$5,138	$5,141	$5,111	$5,213	Rotterdam	Antwerp	Rotterdam	NYNJ	NYNJ	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.61: Door-to-door transportation rates for a 20" ISO Chemical Container for existing services after adding a 20% Rail Premium for the winter period in North America (Based on own calculations)

		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Mannheim	**Chicago**	76.9%	78.6%	79.4%	80.2%
Mannheim	**Detroit**	70.9%	72.3%	73.0%	73.7%
Mannheim	**Cleveland**	63.6%	64.8%	65.4%	65.9%
Mannheim	**Columbus**	68.4%	70.2%	71.0%	71.8%
Duisburg	**Chicago**	76.1%	77.8%	78.6%	79.5%
Duisburg	**Detroit**	69.6%	71.0%	71.7%	72.4%
Duisburg	**Cleveland**	62.0%	63.2%	63.8%	64.4%
Duisburg	**Columbus**	67.2%	68.9%	69.8%	70.6%
Basel	**Chicago**	81.3%	82.9%	83.6%	84.3%
Basel	**Detroit**	75.9%	77.2%	77.8%	78.4%
Basel	**Cleveland**	69.3%	70.6%	71.1%	71.6%
Basel	**Columbus**	73.5%	75.1%	75.8%	76.5%

Table 5.62: Feasibility of a direct service into the Great Lakes, taking into account a Rail Premium during the winter closure, measured in percentage of the door-to-door transportation rate of a direct service divided by the cheapest option on existing services for 20"ISO Tank Containers(Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,274	$4,315	$4,448	$4,346	$4,637	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,699	$4,708	$4,749	$4,719	$4,980	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,696	$4,736	$4,785	$4,739	$4,893	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,036	$5,102	$5,130	$5,089	$5,248	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal

Table 5.63: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after adding a 10% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,323	$4,363	$4,497	$4,394	$4,688	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,755	$4,757	$4,795	$4,769	$5,033	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,745	$4,785	$4,834	$4,788	$4,943	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,094	$5,160	$5,177	$5,144	$5,298	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal

Table 5.64: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after adding a 15% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Duisburg	Chicago	$4,372	$4,412	$4,546	$4,443	$4,739	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,802	$4,815	$4,842	$4,819	$5,086	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,793	$4,834	$4,883	$4,837	$4,993	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,152	$5,218	$5,223	$5,198	$5,348	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.65: Door-to-door transportation rates for a 40" Container with High Valued Goods for existing services after adding a 20% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,428	$4,469	$4,521	$4,473	$4,692	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,790	$4,831	$4,883	$4,835	$4,978	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,652	$4,692	$4,742	$4,696	$4,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,014	$5,054	$5,100	$5,056	$5,127	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal

Table 5.66: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after adding a 10% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,475	$4,515	$4,568	$4,519	$4,741	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,877	$4,930	$4,881	$5,027	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,699	$4,739	$4,789	$4,742	$4,890	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,101	$5,148	$5,103	$5,176	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal

Table 5.67: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after adding a 15% Rail Premium for the winter period in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Existing	Average 1-9 choice	EU			NA		
Mannheim	Detroit	$4,521	$4,562	$4,614	$4,566	$4,791	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,883	$4,924	$4,976	$4,928	$5,075	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,745	$4,786	$4,837	$4,789	$4,940	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,107	$5,148	$5,196	$5,150	$5,225	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

Table 5.68: Door-to-door transportation rates for a 40" Container with Car Parts for existing services after adding a 20% Rail Premium for the winter period in North America (Based on own calculations)

		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Duisburg	Chicago	90.2%	92.2%	93.2%	94.1%
Duisburg	Columbus	79.3%	80.9%	81.8%	82.6%
Stuttgart	Chicago	89.8%	91.6%	92.5%	93.4%
Stuttgart	Columbus	80.2%	81.9%	82.8%	83.6%

Table 5.69: Feasibility of a direct service into the Great Lakes, taking into account a Rail Premium during the winter closure, measured in percentage of the door-to-door transportation rate of a direct service divided by the cheapest option on existing services for 40" Container with High Valued Goods (Based on own calculations)

		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Mannheim	Detroit	84.8%	87.1%	87.9%	88.7%
Mannheim	Cleveland	76.4%	78.3%	79.1%	79.8%
Stuttgart	Detroit	84.2%	86.4%	87.2%	88.0%
Stuttgart	Cleveland	76.3%	78.1%	78.8%	79.5%

Table 5.70: Feasibility of a direct service into the Great Lakes, taking into account a Rail Premium during the winter closure, measured in percentage of the door-to-door transportation rate of a direct service divided by the cheapest option on existing services for 40" Container with High Valued Goods (Based on own calculations)

10%, 15% and 20% Rail transportation rate general increase

Next to the potential rail premium during the winter months, several of the interviewed participants indicated that the increasing price of diesel fuel could impact the rail transportation rates as well. As the rail transportation rates for the direct service and feeder service into the Great Lakes is calculated based on the average ton-mile revenue, it is assumed that on top of these averages an increase of 10%, 15% and 20% is being applied. Although the effect of this increase is limited in terms of revenue per ton-mile, the transportation rate per container increases with $ 30 - $ 90 per container on specific routes. More information on these rates can be found in Appendix F.

	Original revenue ton-mile	**+ 10% rail rate increase**	**15% rail rate increase**	**20% rail rate increase**
Norfolk Southern	$ 0.0619	$ 0.06809	$ 0.071185	$ 0.07428
CSX	$ 0.0657	$ 0.07227	$ 0.075555	$ 0.07884
CP Rail	$ 0.0545	$ 0.05995	$ 0.062675	$ 0.0654

Table 5.71: Rail revenues per ton-mile after applying rail rate increase

But because of the close distances between Cleveland/Toledo and Detroit/Cleveland/Columbus, rail is only preferred as hinterland transportation mode on routes towards Chicago and Minneapolis. Although these are the only two destinations that are directly impacted by an increasing rail transportation rate, the position of a potential direct service or feeder service is also influenced indirectly as a result of higher hinterland transportation rates for existing services into the U.S. Midwest.

Chemicals

When looking at Tables 5.72, 5.74 and 5.76 it is interesting to notice the limited effect of a rail rate increase on the direct service. As previously mentioned, it is only the Chicago and Minneapolis market that is being served by rail through the Great Lakes ports. As a result of the close distance, the Detroit, Cleveland and Columbus markets are directly served by road haulage as it is the most optimal mode of transportation for these short distances. As a result of the lower transportation rates for a direct service, the existing services are not able to compete for this cargo, resulting in a larger difference in the two types of averages. When analyzing the averages for the Chicago trade routes, it is interesting to notice the role of location on the impact of the increased rail rates. While the average of a direct service only increase by $ 23 per 5% rail rate increase, the existing services from the U.S. East Coast and Montreal face a $ 49 increase per 5% rail rate increase on Chicago bounded trade routes.

As a result of the larger difference between the direct service and the existing services, the direct service into the Great Lakes is able to improve the feasibility with approximately 0.3% to 0.7% per 5% increase in rail rates. Although this is considered relatively low, it could be sufficient to overcome the step from not-feasible to feasible for trade routes that are closely matched with the existing services. But for the transportation of chemical containers, the advantage of using the direct service into the Great Lakes is feasible for all routes by far and under an increasing rail rate, this feasibility will grow even further.

High Valued Goods

More interesting is the effect of the increasing rail rate for the transportation of high valued goods. When looking at the different trade routes, the first thing that differs between chemical containers and high valued containers is the specific distinction between a rail haulage route (Chicago) and a road haulage route (Columbus). Next to this is the higher HMT charge that is subjected to these containers. As a result of this, there is expected to be a strong competition with the port of Montreal. When looking further into detail on the two types of averages, it is evident that just like in the case of chemical container transportation, the direct service is also able to increase the difference between the two averages from \$ 417 per 40" container in the baseline situation to \$ 520 per 40" container after applying a 20% rail rate increase on all routes as Table 5.69 and 5.80 shows.

Needless to say, the effect of a larger difference in the both averages also has an interesting effect on the feasibility of a direct service into the Great Lakes. Although the cargo bound for Chicago, through the Great Lakes also faces an increase in rail rate, the direct service is able to improve its feasibility with approximately 0.5% per 5% increase. When looking at Tables 5.81, 5.82 and 5.83 it shows that for cargo bounded for Chicago it doesn't change the feasibility, but moves toward the 86%, which is required in order to cope for switching costs during the winter closure.

Car Parts

In the case of Car Parts transportation, no significant results are noticeable. As previously noticed, cargo bounded for Detroit and Cleveland are considered road haulage markets, which are not subjected to an increase in rail haulage rates. Like the transportation of high valued goods, the direct service into the Great Lakes is able to increase the difference in average between existing and direct services as tables 5.84, 5.85 and 5.86 proves. Although subject to HMT, it proves to be more efficient to transport containers through the Great Lakes to Detroit and Cleveland, in comparison to existing services through the HMT-free port of Montreal.

Interestingly, the increase in rail rates for all routes has the largest effect on the transportation of containers with Car Parts. When looking at the development of the feasibility percentage in tables 5.87, 5.88 and 5.89 and Table 5.9 from the baseline for the direct service an increase of 5% in rail rates results in an improvement by approximately 0.9 percentage point on Detroit bounded trade routes, while on Cleveland bounded trade routes, the feasibility improves by 0.7 percentage point. But as the baseline already showed, under normal circumstances the direct service is already able to compete with existing service as the benefit is large enough to cope with the 14% switching costs during the winter closure.

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$2,995	$3,079	$3,157	$3,077	$4,038	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,920	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,225	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,304	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,834	$2,918	$2,997	$2,916	$3,868	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,761	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,075	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,134	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,736	$3,819	$3,898	$3,818	$4,741	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,964	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,019	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.72: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$982	-$899	-$820	-$900	76.4%
Mannheim	Detroit	-$1,320	-$1,236	-$1,006	-$1,187	69.5%
Mannheim	Cleveland	-$1,649	-$1,566	-$1,452	-$1,556	62.4%
Mannheim	Columbus	-$1,437	-$1,420	-$1,354	-$1,404	66.6%
Duisburg	Chicago	-$982	-$899	-$820	-$900	75.6%
Duisburg	Detroit	-$1,318	-$1,235	-$1,004	-$1,186	68.2%
Duisburg	Cleveland	-$1,649	-$1,566	-$1,452	-$1,556	60.8%
Duisburg	Columbus	-$1,437	-$1,420	-$1,354	-$1,404	65.5%
Basel	Chicago	-$920	-$836	-$758	-$838	80.7%
Basel	Detroit	-$1,257	-$1,174	-$943	-$1,125	74.6%
Basel	Cleveland	-$1,668	-$1,584	-$1,471	-$1,574	68.0%
Basel	Columbus	-$1,375	-$1,358	-$1,291	-$1,341	71.9%

Table 5.73: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$3,016	$3,099	$3,186	$3,100	$4,087	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,967	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,272	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,362	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,855	$2,938	$3,025	$2,939	$3,917	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,808	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,122	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,193	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,756	$3,839	$3,926	$3,841	$4,790	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,689	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$5,012	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,076	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.74: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$1,005	-$922	-$835	-$921	76.1%
Mannheim	Detroit	-$1,360	-$1,277	-$1,046	-$1,227	68.8%
Mannheim	Cleveland	-$1,688	-$1,605	-$1,491	-$1,594	61.8%
Mannheim	Columbus	-$1,491	-$1,474	-$1,408	-$1,458	65.8%
Duisburg	Chicago	-$1,005	-$922	-$835	-$921	75.3%
Duisburg	Detroit	-$1,358	-$1,275	-$1,044	-$1,225	67.5%
Duisburg	Cleveland	-$1,688	-$1,605	-$1,491	-$1,595	60.2%
Duisburg	Columbus	-$1,491	-$1,474	-$1,408	-$1,458	64.6%
Basel	Chicago	-$943	-$860	-$773	-$859	80.4%
Basel	Detroit	-$1,298	-$1,214	-$984	-$1,165	74.0%
Basel	Cleveland	-$1,708	-$1,625	-$1,511	-$1,614	67.5%
Basel	Columbus	-$1,429	-$1,412	-$1,345	-$1,395	71.2%

Table 5.75: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Chicago	$3,036	$3,119	$3,214	$3,123	$4,136	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$4,014	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,320	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,420	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,875	$2,958	$3,053	$2,962	$3,965	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,855	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,169	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,251	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,776	$3,860	$3,955	$3,863	$4,838	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,736	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$5,059	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,130	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
14 Knots Direct Cleveland		18 Knots Direct Cleveland			MAERSK	MSC	RAIL		ROAD		BARGE	
14 Knots Direct Toledo		18 Knots Direct Toledo			HAPAG-LLOYD							

Table 5.76: Door-to-door transportation rates for a 20" ISO Chemical Container for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$1,029	-$945	-$850	-$942	75.9%
Mannheim	Detroit	-$1,400	-$1,317	-$1,086	-$1,268	68.1%
Mannheim	Cleveland	-$1,727	-$1,643	-$1,530	-$1,633	61.3%
Mannheim	Columbus	-$1,545	-$1,529	-$1,462	-$1,512	65.0%
Duisburg	Chicago	-$1,029	-$945	-$850	-$942	75.1%
Duisburg	Detroit	-$1,398	-$1,314	-$1,083	-$1,265	66.8%
Duisburg	Cleveland	-$1,727	-$1,644	-$1,530	-$1,634	59.6%
Duisburg	Columbus	-$1,545	-$1,529	-$1,462	-$1,512	63.8%
Basel	Chicago	-$966	-$883	-$788	-$879	80.2%
Basel	Detroit	-$1,338	-$1,255	-$1,024	-$1,205	73.4%
Basel	Cleveland	-$1,748	-$1,665	-$1,551	-$1,655	67.0%
Basel	Columbus	-$1,483	-$1,466	-$1,400	-$1,450	70.5%

Table 5.77: Difference in USD between the cheapest option for the transportation of a 20” ISO Chemical container for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,784	$3,909	$3,938	$3,877	$4,346	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,719	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,121	$4,246	$4,274	$4,213	$4,739	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,089	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

Table 5.78: Door-to-door transportation rates for a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,804	$3,929	$3,966	$3,900	$4,394	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,769	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,141	$4,266	$4,303	$4,236	$4,788	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,144	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

Table 5.79: Door-to-door transportation rates for a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Duisburg	Chicago	$3,824	$3,949	$3,994	$3,923	$4,443	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,819	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,161	$4,286	$4,331	$4,259	$4,837	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,198	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.80: Door-to-door transportation rates for a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$490	-$365	-$337	-$398	89.2%
Duisburg	Columbus	-$1,089	-$1,064	-$964	-$1,039	77.6%
Stuttgart	Chicago	-$576	-$451	-$422	-$483	88.9%
Stuttgart	Columbus	-$1,089	-$1,064	-$964	-$1,039	78.5%

Table 5.81: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$519	-$394	-$357	-$423	88.7%
Duisburg	Columbus	-$1,145	-$1,120	-$1,020	-$1,095	76.7%
Stuttgart	Chicago	-$604	-$479	-$442	-$508	88.5%
Stuttgart	Columbus	-$1,147	-$1,122	-$1,022	-$1,097	77.7%

Table 5.82: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Duisburg	Chicago	-$547	-$422	-$377	-$449	88.3%
Duisburg	Columbus	-$1,192	-$1,167	-$1,067	-$1,142	75.9%
Stuttgart	Chicago	-$632	-$507	-$462	-$534	88.1%
Stuttgart	Columbus	-$1,205	-$1,180	-$1,080	-$1,155	76.9%

Table 5.83: Difference in USD between the cheapest option for the transportation of a 40" Container with High Valued Goods for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North- America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,473	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,835	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,696	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,056	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

Table 5.84: Door-to-door transportation rates for a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,519	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,881	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,742	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,103	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

Table 5.85: Door-to-door transportation rates for a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North America (Based on own calculations)

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 Direct	Average 1-3 Existing	EU			NA		
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,566	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,928	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,789	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,150	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

Table 5.86: Door-to-door transportation rates for a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Detroit	-$860	-$735	-$554	-$716	83.0%
Mannheim	Cleveland	-$1,279	-$1,154	-$1,073	-$1,168	74.9%
Stuttgart	Detroit	-$922	-$797	-$616	-$778	82.5%
Stuttgart	Cleveland	-$1,340	-$1,215	-$1,135	-$1,230	74.8%

Table 5.87: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 10% rail rates increase in North- America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Detroit	-$907	-$782	-$601	-$763	82.1%
Mannheim	Cleveland	-$1,325	-$1,200	-$1,120	-$1,215	74.2%
Stuttgart	Detroit	-$968	-$843	-$663	-$825	81.7%
Stuttgart	Cleveland	-$1,387	-$1,262	-$1,181	-$1,277	74.1%

Table 5.88: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 15% rail rates increase in North- America (Based on own calculations)

		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Detroit	-$953	-$828	-$648	-$810	81.3%
Mannheim	Cleveland	-$1,372	-$1,247	-$1,166	-$1,262	73.5%
Stuttgart	Detroit	-$1,015	-$890	-$709	-$871	80.9%
Stuttgart	Cleveland	-$1,434	-$1,309	-$1,228	-$1,323	73.5%

Table 5.89: Difference in USD between the cheapest option for the transportation of a 40" Container with Car Parts for a direct service into the ports of Cleveland and Toledo and existing services after 20% rail rates increase in North- America (Based on own calculations)

Conclusion rail rate scenarios

This scenario has looked at two separate types of increments in rail rate: a winter premium and a general increase. Although it is uncertain to what extent a winter premium as a result of seasonality would be charged by the rail carriers, it is clear that such a premium would create a considerable effect on the feasibility of a direct service into the Great Lakes. After applying the premium during the winter months, the direct service would lose 1.3 to 2.3 percentage point versus the existing service when facing a 10% premium. When looking at the more extreme 20% premium, this would even increase further towards a 2.5 to 4.0 percentage point impact. Because of its low switching costs, the transportation rates of chemical products prove to be able to withstand such a premium, while the largest impact can be found in the case of high valued goods and car parts. It is further interesting to notice that if such premium would apply, the transportation of car parts to Detroit would not be feasible anymore. As a result of the increase rail rates during the winter period, shippers on this specific route to Detroit would rather prefer using existing services for the entire year instead of the direct service. Also for the transportation of high valued goods the rail premium shows a disadvantageous position for the direct service, however, this is not the result of the rail premium as the baseline situation already proves the disadvantageous position.

With regards to the port preference for the winter period, but also after the general increase of rail transportation rates, no significantly large changes can be found in the case of high valued goods and car parts, however, in the case of chemicals some interesting changes can be found. Especially for cargo bounded for Cleveland a shift can be found from the port of New York/New Jersey to Montreal. As mentioned before, this effect could be explained due to the modal change of cargo destined for Cleveland when coming from Montreal. As the cargo is routed through Detroit, a low rail transportation rate can be offered, hence a low premium, while being transported further by truck between Detroit and Cleveland. From the port of New York/New Jersey however, a direct route to a rail intermodal facility in Cleveland is used.

A general rail rate increase however has a vice versa effect to the feasibility of a direct service. Because the direct service prefers to use road haulage as hinterland mode between the port and final destination, an increase in the rail rate does not affect the door-to-door transportation rate for the direct service. The only exception to this is cargo bounded for Chicago, but as Cleveland and Toledo is located closer to Chicago than the U.S. East Coast and Canadian ports, the impact of the increased rail rate will be lesser. This overall increase however, improves the economic feasibility of a direct service by 0.5 to 1.8 percentage point if the rates increase by 10%, while the feasibility improves by up to 3.5 percentage point if the rates increase by 20%.

5.2.3.4 Terminal Handling Charges in Europe

This scenario looks at the effect of a scenario where the terminal handling charges (THC) of existing services between the Rotterdam-Antwerp and Bremerhaven-Hamburg dual-port-system are set at an equal level. As a result of close competition between the ports in the Hamburg – Le Havre range for cargo, port and terminal handling charges have become interesting factors that can be influenced by the port authorities and terminal operators in order to attract additional services.

Especially between the ports of Rotterdam and Antwerp, competition for cargo is highly competitive as a result of the proximity between both ports. Also between the German ports of Bremen (Bremerhaven) and Hamburg a fierce competition for the same hinterland is visible, but unlike the ports of Antwerp and Rotterdam, the terminal handling charges for these ports are equal. In order to research to what extent the contestable hinterland in Europe relates to the position of the 4 ports for the existing services; this scenario uses an assumption on the terminal handling charges. When looking specifically on a hinterland transportation level for carriers like Maersk and Hapag-Lloyd in Table A.18 in Appendix A, the transportation rates for cargo to the port of Rotterdam and Antwerp match closely, while also the rates to Bremerhaven and Hamburg match, although limited exceptions exist.

As this scenario is focused on existing services originating from Europe, the main focus will be on the competitive position of the ports in the Hamburg – Le Havre range. Therefore, as the economical effect in terms of transportation rate will be limited and irrelevant for this analysis, the corresponding door-to-door transportation rates can be found in Appendix G. As the baseline information in table 5.90, there is a clear relationship between the THC for the German ports, which could be explained by a fixed THC of $ 273 per container implied by the German government or between the both ports as there is also no difference found on a carrier-level. Within the Hamburg-Le Havre range, a strong competition in noticeable between Antwerp and Rotterdam and therefore, this scenario will look at the effect of having an equal terminal handling charge of $ 234, in order to analyze the market potential for the port of Rotterdam based on transportation rates.

	Baseline THC	**THC: RTM=ANT, BRE=HAM**
Rotterdam	$ 260.00	$ 234.00
Antwerp	$ 208.00	$ 234.00
Bremerhaven	$ 273.00	$ 273.00
Hamburg	$ 273.00	$ 273.00

Table 5.90: THC used in both THC scenarios (Based on information from Maersk, MSC and Hapag-Lloyd)

Terminal handling charge RTM=ANT, BRE=HAM

This sub scenario looks at the competition between the ports of Rotterdam and Antwerp, and the ports of Bremerhaven and Hamburg. Over the last decades, these ports have developed themselves into competitors of each other within the Hamburg – Le Havre range, but also within this range competition exists in terms of a competitive port delta, consisting of multiple ports. Many researchers mentioned the potential for ports in the Flemish-Dutch Delta to further cooperate with each other in order to effectively compete with other port deltas, like Hamburg-Bremerhaven and Calais-Le Havre-Portsmouth. Recent research on the Flemish-Dutch port delta by Kuipers et al. (2012) on the Flemish-Dutch ports in 2040, already indicates the high volume of containers between the ports of Rotterdam, Antwerp and Zeebrugge in the current situation and is expected to grow as a result of the rationalization of the shipping liner networks to call in only one of these three ports. By jointly investing in the hinterland network, these ports are able to attract cargo from other port delta's within the range, but as a result of this joint approach, competition between the ports in this delta will increase as it will be easier for a shipper to change its preferred port.

The heavier competition is also the result of a port regionalization trend, as explained in the literature review. As a result of more efficient hinterland transportation and the removal of internal borders within the EU, the contestable market for the ports within a delta, but also within the entire Hamburg – Le Havre range has grown. As a result of this, port authorities and terminal operators are actively partnering in improving the competitive situation of their ports and terminals. For both the Antwerp/Rotterdam and Bremerhaven/Hamburg delta's, it is clear that they are in a stage of port regionalization as there hinterland networks continue to grow into each other with connecting short sea and feeder service and land based hinterland transportation. Also the development of inland terminals, like TCT Venlo and Duisburg are becoming increasingly more important.

Because of a close proximity between these ports and the interrelationship between both hinterland networks, the mobility of cargo increases from a shipper's perspective. As the ports of Rotterdam, Antwerp, Bremerhaven and Hamburg are high-quality stable ports, competition on price is evident. In order to increase its competitiveness with the port of Antwerp, it is interesting to research the effect on the terminal handling charges, which are charged through the shipping line, on the competitive position of the ports on a delta-level by setting the level of terminal handling charges on a equal level between the port of Rotterdam and Antwerp, and the port of Bremerhaven equal to Hamburg.

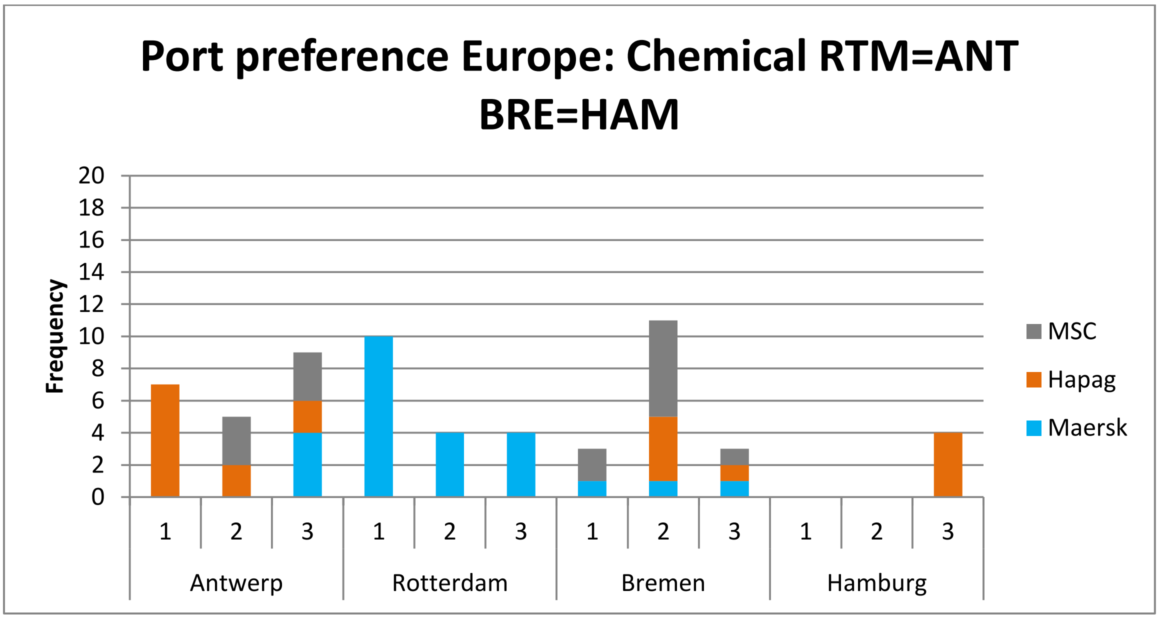

Figure 5.16: Port preference Europe for chemical containers when THC is equal between Rotterdam/Antwerp and Bremerhaven/Hamburg (Based on own calculations)

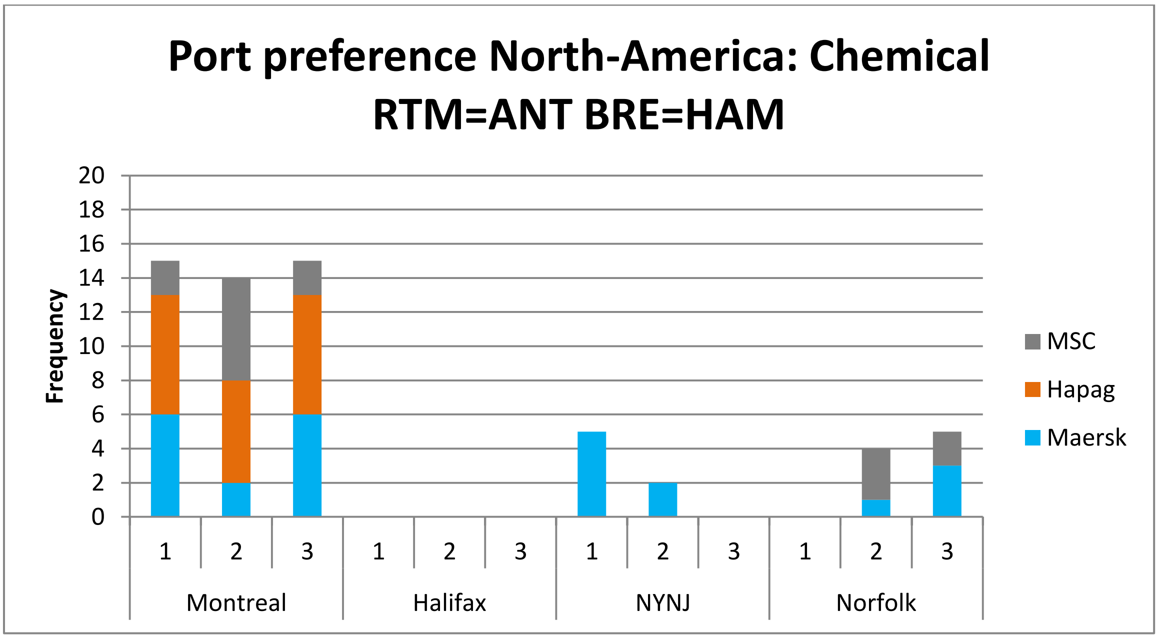

Figure 5.17: Port preference North America for chemical containers when THC is equal between Rotterdam/Antwerp and Bremerhaven/Hamburg (Based on own calculations)

After setting the terminal handling charges equal within the Antwerp/Rotterdam and Bremerhaven/Hamburg delta's, the port of Rotterdam is able to slightly improve its competitive position on the transportation market for chemical containers. When comparing figure 5.1 in paragraph 5.2.1 with figure 5.16, it is evident that an increased terminal handling charged would lead to a tougher competition with Rotterdam and Bremen. Another interesting effect takes place in Bremen. Although the Terminal Handling Charge stays stable compared to the baseline, it loses a few 1st and 3rd choices, while improving their position as 2nd choice. On a carrier level a change can be found on carrier level with regards to port choice. As a result of an equal terminal handling charge between Rotterdam and Antwerp, Maersk shifts its preference more towards Rotterdam, while MSC keeps its position rather stable between Antwerp and Bremen. Not only does it influence the European port selection process. As containers with chemicals are only charged with a low amount of HMT per container, cargo is flexible in the port of choice. Interestingly, it is the position of the port of Montreal which faces the heaviest downturn as a result of a change in terminal handling charges in Europe. While the port of Montreal faces a downturn, it leads to an increase for the ports of New York/New Jersey and especially Norfolk. The reason for the sudden growth of Norfolk for Maersk could be explained because of the route structure of this carrier. As New York/New Jersey and Norfolk are both considered to be important ports on the U.S. East Coast, nearly all services will call at both ports. As a result of their location, only a slight difference will occur on hinterland transportation resulting in this outcome.

While the effect on the chemical transportation is only limited, a significant large effect is visible for the transportation of High Valued Goods and Car Parts. As a result of an equal terminal handling charge in Antwerp and Rotterdam, the position of the port of Antwerp drastically declines. Especially as 1st choice, where it declines from 16 out of 20 services to 6 out of 20, the port of Antwerp loses to the port of Rotterdam. But on the position of 2nd choice port, the port of Rotterdam loses a significant share to the port of Antwerp. On a carrier level, leveling the terminal handling charge has a significant effect. While for Maersk, this leveling result in a number 1 preference for Rotterdam and a number 2 preference for Antwerp, other carriers stay rather stable and are not shifting cargo from one port to another. This can be explained due to the terminal ownership situation in both ports. While Maersk operates their own terminals in Rotterdam and Bremen, MSC operates an own terminal in Antwerp.

Unlike the transportation options for the chemical containers, the port selection as a result of equal terminal handling charges in Rotterdam/Antwerp stays rather stable in North America. This can be explained due to the high amount of HMT, which limits the port preference in favor of U.S. East Coast ports as figures 5.19a and 5.19b show in comparison to figure 5.3 and 5.4 in paragraph 5.2.1.

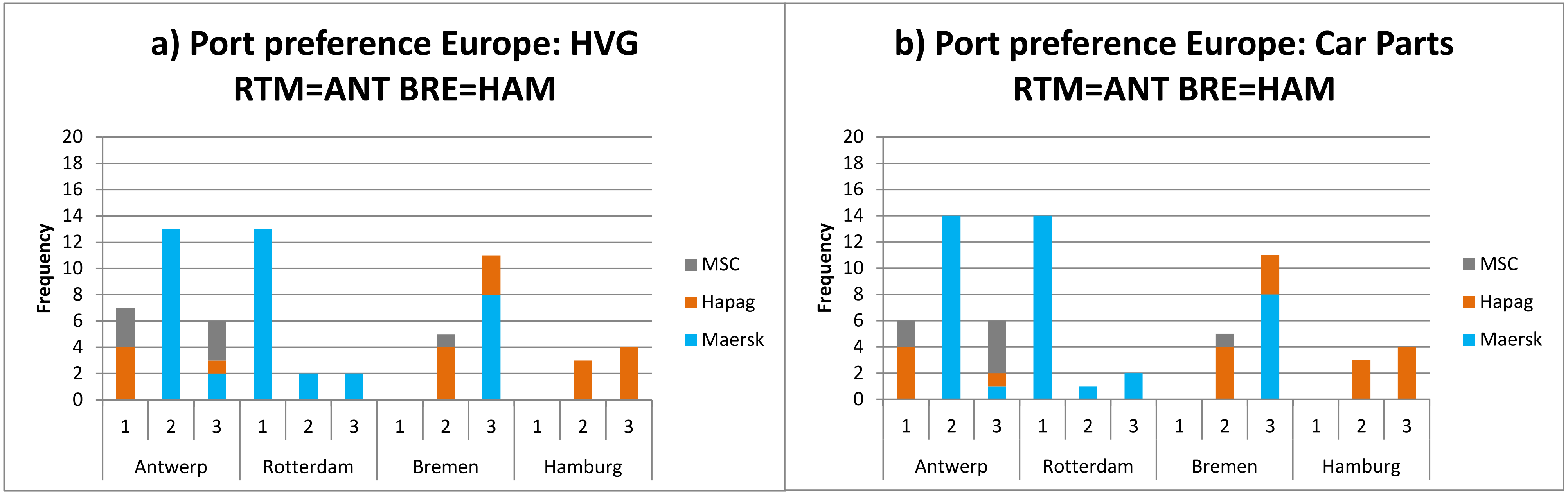

Figure 5.19: Port preference Europe for High Valued Goods containers when THC is equal between Rotterdam/Antwerp and Bremerhaven/Hamburg (Based on own calculations)

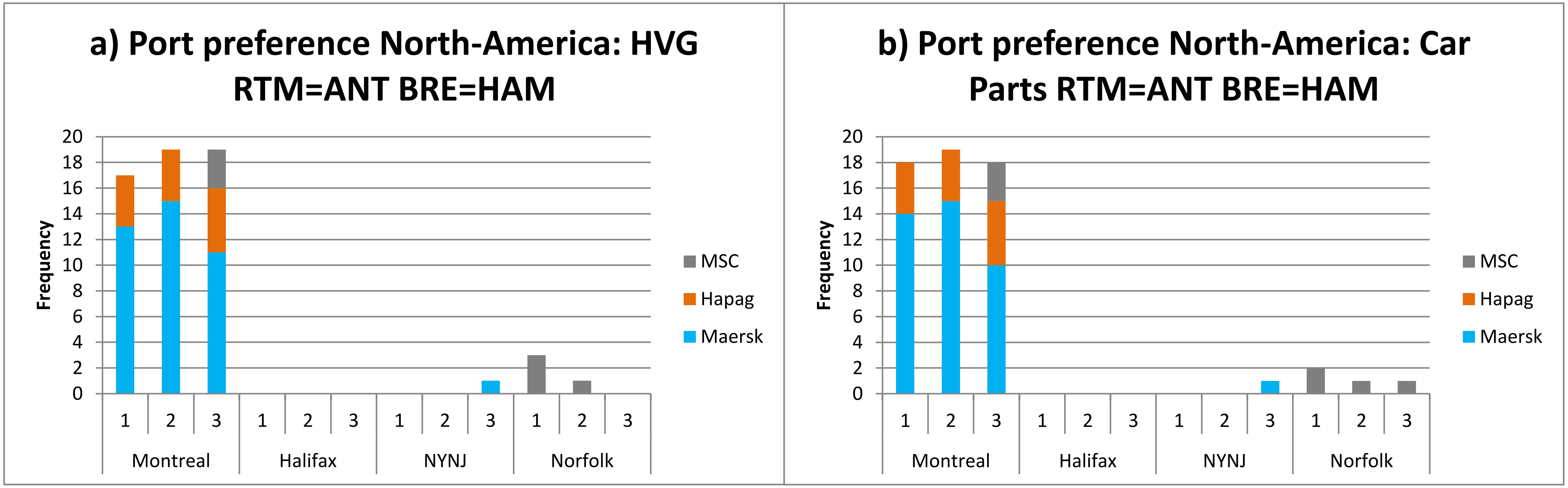

Figure 5.18: Port preference Europe for High Valued Goods containers when THC is equal between Rotterdam/Antwerp and Bremerhaven/Hamburg (Based on own calculations)

5.2.4 Conclusion transportation rate scenarios

This paragraph has provided an overview on the transportation rates for existing services on Maersk, MSC and Hapag-Lloyd, a new direct service from Rotterdam into the Great Lakes and a potential feeder service between Montreal under various scenarios with regards to Harbor Maintenance Tax, Trucking Rates, Rail Rates and Terminal Handling Charges.

Based on the different scenarios and various assumptions made, it proves the potential of a direct service between Rotterdam and the Great Lakes. Although on some routes heavy competition with existing services is noticeable, the direct service is overall positive under the various scenarios indicating a high potential for a direct service which is able to provide a benefit under positive (lower HMT rates) and negative (higher trucking and rail rates) external factors while the ocean carrier is able to make an 10% profit. When looking on a specific cargo level, the potential for chemical containers proves to be the highest, with nearly all +++ scores, while the potential for High Valued Goods proves to be less on a +- overall level as a result of strong competition from existing services and the high impact of switching costs on this type of cargo as can be seen in Appendix H. Also for the transportation of Car Parts, the direct service proves to be sufficient on nearly all trade routes involved with only scenario of a rail winter premium in a doubtful category because of the strong position of Montreal on Detroit bounded containers with Car Parts.

Also after combining the scenarios, the results show a strong position for a direct service into the Great Lakes. For the transportation of chemical products, combining the scenarios would not lead to any changes in the results because of their strong preference for the direct service. Also for the transportation of high valued goods from Duisburg/Stuttgart to Columbus and car parts between Mannheim/Stuttgart and Cleveland, combining the scenarios would not lead to significant changes in the viability of the direct service.

However, for the transportation of high valued goods from Duisburg/Stuttgart to Chicago, the abolishment of the HMT is the only opportunity in order to compete with the existing services. After combining the scenarios of a trucking rate increase and the rail carrier winter premium, it is preferred to use existing services over the direct service. For the transportation of car parts from Mannheim to Detroit the direct service can stay feasible when the rail carriers will charge a 20% winter premium, if the HMT will be reduced to 0.09%. Also in the case that the trucking rates will go up by 30% and HMT decreased to 0.09%, the direct service is able to keep its economic feasibility within the limits (door-to-door transportation rate < 86% of the existing service). But, in the event that the trucking rates increase by 30%, while additionally the rail carriers ask a 15% or 20% winter premium and the HMT is lowered to 0.09%, the direct service will lose its advantageous position to the existing service on the Mannheim-Detroit trade route. For the Stuttgart-Detroit route however, the winter premium of 20%, in conjunction with a 0.09% HMT would lead to a stronger position for the existing service, though this is only minimal at 0.1 percentage point. If however also the trucking rates will increase, it will result in a stronger preference for the existing services.

Another interesting conclusion that this analysis has shown is the weak position for a feeder service between Montreal and Cleveland/Toledo. As all scenarios have shown, the feeder service is not able to compete with existing services or direct services into the Great Lakes. Not only is this caused by the HMT charge on imported containers, the feeder service is not able to compete as a result of fierce competition with the efficient railway system in North America as the 0.00% HMT for feeder service scenario showed. Additionally, this can be caused as a result of facing an additional terminal handling between the port of Montreal and the final destination in the U.S. Midwest, contributing to additional costs for this rather short route. But there could also be a possibility under which this feeder service could prove to be feasible. As the Class I rail companies rather not prefer to move hazardous cargo, reefer containers and the overweight and odd-sized containers, an extra charge is added of approximately $ 300 per container. If these Class I rail companies are able to shift these containers onto a maritime mode of transportation, it gives them the opportunity to carry more standardized containers from the port of Montreal into the hinterland. But in order to introduce such a feeder service, close cooperation with ocean carriers and the various levels of government are required in order to improve the feasibility of a feeder service, which could also benefit the utilization rate of these vessels to a 95% - 100% utilization rate, ultimately leading to lower transportation prices.

5.3 Transit Time

This paragraph will discuss the different scenarios based on the transit time throughout the door-to-door chain between previously mentioned locations in Northwest-Europe and the U.S. Midwest, only excluding Minneapolis as a result of lacking data. This paragraph will first start of with introducing the baseline specific inputs for existing services and a direct or feeder service into the Great Lakes, like hinterland transportation rates and provides an overview of the current situation in terms on the transportation rate and Harbor Maintenance Tax on existing services for several categories of goods.

5.3.1 Baseline transit time for existing services

The baseline of transit time for existing services are determined by combining the hinterland transit time for multiple modalities (Rail, road and barge transportation) between the European origins towards one of the four ports in the model. As a next step, the modality-specific port dwell times are incorporated for the 4 ports after which the ocean transit times on all various routes by Maersk, Hapag-Lloyd and MSC are added, published in appendix A. Upon arrival at a North American port, a dwell time based on information provided by the ocean carriers is added after which a transit time for hinterland transportation services by rail is added. As data shows by the Bureau of Transportation Statistics in their commodity flow survey in 2007, only 7.5% and 5.1% are transported by truck over 500 miles. Together with the very high rates for road haulage as published in Appendix B, which even exceeds the tariff for ocean haulage, road haulage is not considered a viable option from the ports of Montreal, Halifax, New York/New Jersey and Norfolk to the U.S. Midwest and therefore only rail haulage is considered on the North American continent. In contrast to North America, road haulage is considered a viable option for the European hinterland transportation as both the difference in tariff are acceptable (approx. $ 600 maximum) and distances are within a 750 kilometer radius from the European ports.

When looking at the transit times for these routes in table 5.91, it is interesting to notice the diversity on a carrier level throughout all routes in transit time. While Maersk and Hapag-Lloyd are competing with each other on transit time, MSC is considered the least interesting option for all routes. This result can be explained by looking at the operating model of Maersk/Hapag-Lloyd versus MSC and the typical customer preferences in both operating models.

As table 4.1 shows, the operating model of Maersk and Hapag-Lloyd is focused on a limited amount of port calls per route and offering multiple sails each week between both continents through the various ports. As a result of this operating model, Maersk and Hapag-Lloyd services are more dependent on the economic condition in Europe and North America with regards to the volume. In order to fill these vessels, there is also a clear trend of cooperation visible between carriers, in a vessel sharing agreement. When looking in-depth at the services offered by Hapag-Lloyd, it shows a high level of cooperation with various ocean carriers in order to fill the vessels dedicated to the ocean services. Because of the high number of transatlantic services, a sustainable and sufficient volume is required to fill the various vessels. As a result of this time sensitive orientation, the operating model requires a high reliability of the terminals of call and a frequent hinterland connection through various modalities.

When looking at the type of customers for this operating model, it is clear that this type of services is preferred by customers with a time-sensitive supply chain, with a strict focus on the reliability of the service and the flexibility to transport their container from one service to another. Although this reliability and flexibility comes at a price, they accept higher transportation rates as quality is considered to be a leading factor.

In contrast to the operating model of Maersk and Hapag-Lloyd, the operating model of MSC is more focused on a single ocean service between both continents. As a result of this structure, the ocean services of MSC are calling at more ports on both continents, compared to their competitors. Although this results in a higher overall utilization rate, the limited amount of options leads to a lower flexibility and reliability of the service, because missing the last port of call on these weekly services means an additional 7 days of transit time.

As a result of the limited frequency and higher utilization rate, MSC is less dependent on the economic situation on both continents and the cooperation with other carriers. When looking at Table 4.1, only cooperation on the Montreal trade route is required. Next to the different operating model, the characteristics of MSC customers differ from Maersk and Hapag-Lloyd. While flexibility and reliability was considered to be leading for a time-sensitive supply chain, the customers of MSC are more focused on the cost of moving containers from door to door, measured in the published rate.

When looking at the specific preferences on the trade routes, it is interesting to notice a distinction in terms of port choice. While Hapag-Lloyd prefers a connection through the port of Hamburg and Antwerp, MSC shows a preference for Antwerp and Bremen, while Maersk proves to have a strong preference for the port of Rotterdam and to a lesser extent Antwerp. Although this relationship seems logical, based on distance to the market and the ocean services offered for the respective ocean carriers, it is interesting to notice the strong preference for terminals that are operated by the carriers. Especially the choice of MSC for Antwerp and Bremen seems logical as they operate their own terminals in both Antwerp (MSC Home Terminal) and Bremen (MSC Gate Terminal). By operating their own terminal as well as operating as an ocean carrier, MSC is able to create a more efficient connection between the arriving containers from the hinterland to the ocean part of their transit, while they are also able to internalize a profit margin destined for the terminal operator on their own services, giving them the possibility to offer a more competitive rate in contrast to non-terminal operating carriers.

Also for Maersk, a strong preference for using terminals operated by sister company APM Terminals can also be found on both sides of the Atlantic. While in Europe, Maersk shows a strong preference for the port of Rotterdam where they operate their own terminal next to ECT on the Maasvlakte I. Interestingly enough, the port of Antwerp proves to be a viable option on the Montreal bounded ocean service for Maersk when looking at transit time. This result can be explained when looking at the history of the terminal Maersk uses in Antwerp, the Antwerp gateway. Historically, the Antwerp Gateway terminal on the Deurganckdock was owned by P&O ports consortium, which was a joint venture containing P&O ports (67.5%), P&O Nedlloyd (25%) and Duisport (7.5%). After the purchase of P&O Nedlloyd by the A.P. Møller group, parent company of Maersk, and the purchase of P&O Ports by global terminal operator DP World, Maersk was still holding a 20% stake in the Antwerp Gateway joint venture. Although this stake has been sold to the Israeli ocean carrier ZIM for $ 18 million in 2007, it is interesting to notice that this historical relationship is still influencing the current port preference for Maersk. On the North American side of the Atlantic Ocean, Maersk prefers the ports of New York/New Jersey and Norfolk which both have terminals operated by sister company APM Terminals. But although the transportation rate analysis showed a close relationship between the transportation rates through both ports, in preference for Norfolk, the transit time model shows that Norfolk is considered to be more optimally located for U.S. Midwest. This indicates that the network of Maersk uses New York/New Jersey more as a destination port, for local traffic, as the New York/Boston/Washington corridor is considered a very populous corridor, while cargo destined deeper into the US, towards the U.S. Midwest prefers to be transported through Norfolk.

Also in the case of Hapag-Lloyd, although less strong, there is a preference for calling at ports where they have influence on the terminal operator by having a stake in the terminal operating company. In Hamburg, Hapag-Lloyd has a 25.1% stake in the HHLA Altenwelter Container Terminal, together with the Hamburg Hafen und Logistic AG company, which is majority owned by the state of Hamburg. Also in Montreal, Hapag-Lloyd has a participating interest in the terminal operator as a result of taking over CP Ships, which had previously been owned by CP Rail, explaining its strong preference for the Hamburg-Montreal ocean connections.

When looking on a specific trade route level it is interesting that it is not proximity that determines the port of choice in the case of Maersk and Hapag-Lloyd with their multiple services between all ports, but that the influence the carriers can force on terminal operations and the hinterland connectivity is more important when deciding the most optimal port choice under normal conditions.

Another interesting result from this baseline analysis on existing services is the preference on hinterland modality in Europe. Because of the rather short distances between the locations and the port, there is a significant preference for road haulage within Europe. While this leads to a longer dwell time at the port of call for the container, it is offset by the quicker and more flexible hinterland transportation connectivity. But although barge hinterland transportation is considered to be the least optimal mode of hinterland transportation from a time-perspective, it is able to compete for cargo on several trade routes operated by Maersk and MSC on shorter haul routes to Duisburg and Mannheim, which are both served frequently. On longer routes to Stuttgart and Basel, rail is preferred after road haulage, indicating that the hinterland transportation by barge diminishes in power when distance increases. Although time is less an issue for MSC customers, they still prefer rail haulage over barge haulage for cargo from Mannheim, Stuttgart and Basel.

When looking at the position of the port of Antwerp one of the interesting results from this analysis can be found in the limited position for rail and barge haulage. In order to prevent congestion in the port of Antwerp by additional trucks as a result of a higher volume, especially the rail connectivity should be invested in. As barge hinterland transportation is more dependent on natural characteristics, the port of Antwerp faces competition from the port of Rotterdam which is more strategically located for barge shipping.

Another interesting result from this analysis on the baseline for existing services is the weak position of the port of Halifax. Although the port of Halifax is strategically located along the routes between Europe and North America the hinterland connectivity and distance to the market limits the potential usage of Halifax for container imports to the U.S. Midwest. But as capacity in Montreal is reaching its maximum, the port of Halifax could be considered an interesting location for U.S. exports, potentially by adding a feeder service between the ports of Boston/New York/Montreal to Halifax to top-off vessels as they make the trip back to Europe.

	Maersk			Hapag-Lloyd			MSC		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Mannheim - Chicago	482.4 RTM-NOR	514.1 ANT-MTR	517.2 RTM-NOR	454.1 HAM-MTR	486.5 HAM-MTR	509.1 ANT-MTR	544.1 BRE-MTR	580.1 ANT-MTR	591 BRE-MTR
Mannheim - Detroit	502.4 RTM-NOR	507.5 ANT-MTR	537.2 RTM-NOR	447.5 HAM-MTR	479.9 HAM-MTR	502.5 ANT-MTR	537.5 BRE-MTR	573.5 ANT-MTR	584.4 BRE-MTR
Mannheim - Cleveland	500.4 RTM-NOR	507.5 ANT-MTR	528.4 RTM-NYNJ	447.5 HAM-MTR	479.9 HAM-MTR	502.5 ANT-MTR	537.5 BRE-MTR	573.5 ANT-MTR	584.4 BRE-MTR
Mannheim-Columbus	474.4 RTM-NOR	507.5 ANT-MTR	509.2 RTM-NOR	447.5 HAM-MTR	479.9 HAM-MTR	502.5 ANT-MTR	537.5 BRE-MTR	573.5 ANT-MTR	584.4 BRE-MTR
Duisburg - Chicago	479.4 RTM-NOR	493.2 RTM-NOR	510.8 RTM-NOR	452.1 HAM-MTR	482.3 HAM-MTR	506.6 ANT-MTR	541.85 BRE-MTR	577.6 ANT-MTR	591.9 ANT-MTR
Duisburg - Detroit	499.4 RTM-NOR	505 ANT-MTR	513.2 RTM-NOR	445.5 HAM-MTR	475.7 HAM-MTR	500 ANT-MTR	535.25 BRE-MTR	571 ANT-MTR	585.3 ANT-MTR
Duisburg - Cleveland	497.4 RTM-NOR	505 ANT-MTR	511.2 RTM-NOR	445.5 HAM-MTR	475.7 HAM-MTR	500 ANT-MTR	535.25 BRE-MTR	571 ANT-MTR	585.3 ANT-MTR
Duisburg - Columbus	471.4 RTM-NOR	485.2 RTM-NOR	502.6 RTM-NOR	445.5 HAM-MTR	475.7 HAM-MTR	500 ANT-MTR	535.25 BRE-MTR	571 ANT-MTR	585.3 ANT-MTR
Stuttgart - Chicago	483.65 RTM-NOR	515.1 ANT-MTR	425.9 BRE-NOR	455.6 HAM-MTR	497 HAM-MTR	510.1 ANT-MTR	545.6 BRE-MTR	581.1 ANT-MTR	592.25 BRE-MTR
Stuttgart - Detroit	503.65 RTM-NOR	508.5 ANT-MTR	544.9 BRE-NOR	449 HAM-MTR	490.4 HAM-MTR	503.5 ANT-MTR	539 BRE-MTR	574.5 ANT-MTR	585.65 BRE-MTR
Stuttgart - Cleveland	501.65 RTM-NOR	508.5 ANT-MTR	529.65 BRE-NYNJ	449 HAM-MTR	490.4 HAM-MTR	503.5 ANT-MTR	539 BRE-MTR	574.5 ANT-MTR	585.65 BRE-MTR
Stuttgart- Columbus	475.65 RTM-NOR	508.5 ANT-MTR	516.9 BRE-NOR	449 HAM-MTR	490.4 HAM-MTR	503.5 ANT-MTR	539 BRE-MTR	574.5 ANT-MTR	585.65 BRE-MTR
Basel - Chicago	485.4 RTM-NOR	516.6 ANT-MTR	521.3 RTM-NOR	457.1 HAM-MTR	488.75 HAM-MTR	511.6 ANT-MTR	547.1 BRE-MTR	582.6 ANT-MTR	593.5 BRE-MTR
Basel - Detroit	505.4 RTM-NOR	510 ANT-MTR	541.3 RTM-NOR	450.5 HAM-MTR	482.15 HAM-MTR	505 ANT-MTR	540.5 BRE-MTR	576 ANT-MTR	586.9 BRE-MTR
Basel - Cleveland	503.4 RTM-NOR	510 ANT-MTR	531.4 RTM-NYNJ	450.5 HAM-MTR	482.15 HAM-MTR	505 ANT-MTR	540.5 BRE-MTR	576 ANT-MTR	586.9 BRE-MTR
Basel - Columbus	477.4 RTM-NOR	510 ANT-MTR	513.3 RTM-NOR	450.5 HAM-MTR	482.15 HAM-MTR	505 ANT-MTR	540.5 BRE-MTR	576 ANT-MTR	586.9 BRE-MTR

	RAIL	ROAD	BARGE
RTM=Rotterdam	ANT=Antwerp	HAM=Hamburg	BRE=Bremen
MTR=Montreal	NOR=Norfolk	NYNJ=New York/New Jersey	HAL=Halifax

Table 5.91: Baseline existing services door-to-door transit times, including modality for hinterland transportation and the ports of choice. (Based on own calculations)

5.3.2 Baseline for a direct and feeder service

Next to the transit times for existing services, the first part of this subparagraph focuses on the potential of a direct service between the port of Rotterdam and the port of either Cleveland or Toledo. After analyzing the potential of a direct service in a baseline situation, the potential of a feeder connection between Montreal and Cleveland or Toledo is being analyzed. The detailed inputs for this direct and feeder model is based on several factors, mentioned in Appendix A.

As mentioned before in the transportation rate analysis, the direct service and feeder service model focuses on providing a container connection for the ports of Cleveland and Toledo. As an analysis on the sailing speed has shown, the common speed for the Hapag-Lloyd, MSC and Maersk services to Montreal varies between 12.22 knots (Maersk Ta4) to 17.07 knots (Hapag-Lloyd SLCS 2) for the various carriers. Therefore, the analysis for this baseline situation the two models have been further distinguished into a 14 knots service and an 18 knots direct service and feeder service.

Also for the direct service model, hinterland times and dwell times in Europe have been based on multiple modalities as rail, road and barge haulage, identical to the values used in the baseline for existing services. For the ports of Cleveland and Toledo however, a significant difference with regards to dwell time can be found. As a result of limited space in the port, terminal dwell times will be expected to be shorter compared to the major seaports along the Atlantic coast. But unlike the case of existing services, the position of these ports in the intermodal container rail network is minimal. Therefore, rail haulage transit times has been determined by using the average intermodal rail speed for CSX and NS Rail, published by the American Association of Railroads for the period of 11/14/11 – 11/20/11 and additionally the rail terminal dwell time has been added. For road haulage, Google Maps has been consulted to provide estimation on transit times. Appendix A provides an overview of the values used for transit time.

When looking at a direct service into the Great Lakes originating from the port of Rotterdam in Tables 5.92 and 5.93, the transit time for the 18 knots service is able to compete with existing services by far. On average, the 18 knots service is able to improve door-to-door transit time by approximately 4 days when using truck haulage in both Europe and North America, while even with slower, but cheaper transportation modes like rail and barge haulage in Europe this direct service is able to improve the transit times by 1 to 2 days compared to existing services. Unlike the transportation rate analysis, the position of the port of Toledo leads to a longer transit time compared to Cleveland, but still the 18 knots service proves to be several days faster than the existing services through Montreal and other East Coast ports. Another interesting result based on the comparison of existing services to a direct service to these ports is the fact that the direct service not only outperforms Montreal destined ocean routes in terms of transit time, but also the ocean routes destined for New York/New Jersey and Norfolk which sail at a higher speed. When comparing Cleveland and Toledo with each other, it shows that Cleveland is preferred when looking strictly at the transit time, although the difference is only limited as a result of a longer maritime transit time of 4 hours.

As the comparison of a direct service to either Cleveland or Toledo also proved, Cleveland has a slight advantage as a result of the geographical location, being one of the first major cities with a port in Lake Erie. This relationship is also visible when looking in depth to the 14 knots services. As a result of the longer sailing distance to Toledo, an additional 6 hours are required compared to Cleveland, but again, this is only very marginal and less than 1.5% of the total transit time. While an 18 knots direct service proves to outperform the existing services, the 14 knots service is facing a closer competition with existing services. For both direct services, the competition with Hapag-Lloyds Hamburg – Montreal service is fierce, with only an advantage of 12 hours on the entire door-to-door chain, when road haulage is chosen for European hinterland transportation. When changing the modality for the European hinterland transportation of the direct service, this advantage is even diminished resulting in a preference for existing services over a direct service into the Great Lakes. But, when comparing the direct service with the existing service of Maersk, the direct service is also able to compete with rail haulage, while facing a small disadvantage when choosing for the cheaper barge transportation hinterland mode in Europe. Unlike the preference for Hapag-Lloyds Montreal service, the Maersk ocean parts are dominated by Norfolk and Montreal in a smaller role; it proves that a direct 14 knots service into the Great Lakes is able to compete with an existing service to Norfolk at a speed of 18 knots.

When comparing the existing services of MSC with the direct service into the Great Lakes it shows a clear potential for MSC to add this trade route. For the 14 knots service, an advantage of approximately 4 days can be achieved, while for an 18 knots service it could even lead to a 7 day advantage on several trade routes when choosing for road haulage on both sides on the ocean. Also for slower hinterland modalities like rail haulage and barge transportation, a considerable advantage in terms of transit time can be achieved. But as MSC customers are less time-sensitive than Maersk/Hapag-Lloyd customers, it is more like that a 14 knots service will be preferred by MSC. But, as this direct service only looks at a Rotterdam – Great Lakes direct route without extra calls in Europe and North America, MSC should be able to gain enough cargo in order to make this route feasible. As a result of this preference for a 14 knots direct Rotterdam –Great Lakes service, MSC would able to compete with Maersk and Hapag-Lloyd on their existing services towards the U.S. Midwest.

But, in order for these carriers to successfully implement a direct service into the Great Lakes, also on a terminal operations level consideration has to be made. As explained in the analysis of the baseline for existing services, a clear trend is visible for calling at ports/terminals which have a terminal operated by the carrier itself or with a minority stake in the terminal operator. As none of the three largest container carriers are actively involved with terminal operations in the Great Lakes, it would be an important aspect to take into account when comparing the existing services with a potential direct service into the Great Lakes. As a result of this effect of terminal operations on the network of the ocean carriers, also the viability of this service with Rotterdam as starting point has to be considered. As the analysis of existing services has shown, only Maersk favors Rotterdam above the other three options. But, as a result of capacity-limitations in the port of Antwerp, MSC has recently invested in the ECT Delta Dedicated North Terminal to cope with expansion in the port of Rotterdam. As a result of the investment of MSC in ECT and the expansion of APM Terminals in the port of Rotterdam, Hapag-Lloyd has a weaker position as they have not been able to vertically integrate by investing in terminal operations in the port of Rotterdam.

	14 knots direct service Cleveland			18 knots direct service Cleveland		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim - Chicago	439.90 RTM-CLE	474.70 RTM-CLE	476.30 RTM-CLE	380.40 RTM-CLE	415.20 RTM-CLE	416.80 RTM-CLE
Mannheim - Detroit	435.90 RTM-CLE	470.70 RTM-CLE	472.30 RTM-CLE	376.40 RTM-CLE	411.20 RTM-CLE	412.80 RTM-CLE
Mannheim - Cleveland	435.90 RTM-CLE	470.70 RTM-CLE	472.30 RTM-CLE	376.40 RTM-CLE	411.20 RTM-CLE	412.80 RTM-CLE
Mannheim - Columbus	435.90 RTM-CLE	470.70 RTM-CLE	472.30 RTM-CLE	376.40 RTM-CLE	411.20 RTM-CLE	412.80 RTM-CLE
Duisburg - Chicago	436.90 RTM-CLE	450.70 RTM-CLE	468.30 RTM-CLE	377.40 RTM-CLE	391.20 RTM-CLE	408.80 RTM-CLE
Duisburg - Detroit	432.90 RTM-CLE	446.70 RTM-CLE	464.30 RTM-CLE	373.40 RTM-CLE	387.20 RTM-CLE	404.80 RTM-CLE
Duisburg - Cleveland	432.90 RTM-CLE	446.70 RTM-CLE	464.30 RTM-CLE	373.40 RTM-CLE	387.20 RTM-CLE	404.80 RTM-CLE
Duisburg - Columbus	432.90 RTM-CLE	446.70 RTM-CLE	464.30 RTM-CLE	373.40 RTM-CLE	387.20 RTM-CLE	404.80 RTM-CLE
Stuttgart - Chicago	441.15 RTM-CLE	484.30 RTM-CLE	495.44 RTM-CLE	381.65 RTM-CLE	424.80 RTM-CLE	435.94 RTM-CLE
Stuttgart - Detroit	437.15 RTM-CLE	480.30 RTM-CLE	504.30 RTM-CLE	377.65 RTM-CLE	420.80 RTM-CLE	435.20 RTM-CLE
Stuttgart - Cleveland	437.15 RTM-CLE	480.30 RTM-CLE	494.70 RTM-CLE	377.65 RTM-CLE	420.80 RTM-CLE	435.20 RTM-CLE
Stuttgart - Columbus	437.15 RTM-CLE	480.30 RTM-CLE	494.70 RTM-CLE	377.65 RTM-CLE	420.80 RTM-CLE	435.20 RTM-CLE
Basel - Chicago	442.90 RTM-CLE	478.80 RTM-CLE	497.19 RTM-CLE	383.40 RTM-CLE	419.30 RTM-CLE	437.69 RTM-CLE
Basel - Detroit	438.90 RTM-CLE	474.80 RTM-CLE	494.70 RTM-CLE	379.40 RTM-CLE	415.30 RTM-CLE	435.20 RTM-CLE
Basel - Cleveland	438.90 RTM-CLE	474.80 RTM-CLE	494.70 RTM-CLE	379.40 RTM-CLE	415.30 RTM-CLE	435.20 RTM-CLE
Basel - Columbus	438.90 RTM-CLE	474.80 RTM-CLE	494.70 RTM-CLE	379.40 RTM-CLE	415.30 RTM-CLE	435.20 RTM-CLE
RTM=Rotterdam	RAIL		ROAD		BARGE	

Table 5.92: Baseline door-to-door transit times, including modality for hinterland transportation between the port of Rotterdam and Cleveland. (Based on own calculations)

	14 knots direct service Toledo			18 knots direct service Toledo		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim - Chicago	443.40 RTM-TOL	478.20 RTM-TOL	479.80 RTM-TOL	382.73 RTM-TOL	417.53 RTM-TOL	419.13 RTM-TOL
Mannheim - Detroit	441.40 RTM-TOL	476.20 RTM-TOL	477.80 RTM-TOL	380.73 RTM-TOL	415.53 RTM-TOL	417.13 RTM-TOL
Mannheim - Cleveland	441.40 RTM-TOL	476.20 RTM-TOL	477.80 RTM-TOL	380.73 RTM-TOL	415.53 RTM-TOL	417.13 RTM-TOL
Mannheim - Columbus	441.40 RTM-TOL	476.20 RTM-TOL	477.80 RTM-TOL	380.73 RTM-TOL	415.53 RTM-TOL	417.13 RTM-TOL
Duisburg - Chicago	440.40 RTM-TOL	454.20 RTM-TOL	471.80 RTM-TOL	379.73 RTM-TOL	393.53 RTM-TOL	411.13 RTM-TOL
Duisburg - Detroit	438.40 RTM-TOL	452.20 RTM-TOL	469.80 RTM-TOL	377.73 RTM-TOL	391.53 RTM-TOL	409.13 RTM-TOL
Duisburg - Cleveland	438.40 RTM-TOL	452.20 RTM-TOL	469.80 RTM-TOL	377.73 RTM-TOL	391.53 RTM-TOL	409.13 RTM-TOL
Duisburg - Columbus	438.40 RTM-TOL	452.20 RTM-TOL	469.80 RTM-TOL	377.73 RTM-TOL	391.53 RTM-TOL	409.13 RTM-TOL
Stuttgart - Chicago	444.65 RTM-TOL	487.80 RTM-TOL	502.20 RTM-TOL	383.98 RTM-TOL	427.13 RTM-TOL	441.53 RTM-TOL
Stuttgart - Detroit	442.65 RTM-TOL	485.80 RTM-TOL	500.20 RTM-TOL	381.98 RTM-TOL	425.13 RTM-TOL	439.53 RTM-TOL
Stuttgart - Cleveland	442.65 RTM-TOL	485.80 RTM-TOL	500.20 RTM-TOL	381.98 RTM-TOL	425.13 RTM-TOL	439.53 RTM-TOL
Stuttgart - Columbus	442.65 RTM-TOL	485.80 RTM-TOL	500.20 RTM-TOL	381.98 RTM-TOL	425.13 RTM-TOL	439.53 RTM-TOL
Basel - Chicago	446.40 RTM-TOL	482.30 RTM-TOL	502.20 RTM-TOL	385.73 RTM-TOL	421.63 RTM-TOL	441.53 RTM-TOL
Basel - Detroit	444.40 RTM-TOL	480.30 RTM-TOL	500.20 RTM-TOL	383.73 RTM-TOL	419.63 RTM-TOL	439.53 RTM-TOL
Basel - Cleveland	444.40 RTM-TOL	480.30 RTM-TOL	500.20 RTM-TOL	383.73 RTM-TOL	419.63 RTM-TOL	439.53 RTM-TOL
Basel - Columbus	444.40 RTM-TOL	480.30 RTM-TOL	500.20 RTM-TOL	383.73 RTM-TOL	419.63 RTM-TOL	439.53 RTM-TOL
RTM=Rotterdam	RAIL		ROAD		BARGE	

Table 5.93: Baseline door-to-door transit times, including modality for hinterland transportation for a direct service between the port of Rotterdam and Toledo. (Based on own calculations)

Next to the potential introduction, a feeder service from Montreal into the Great Lakes has been mentioned by some of the interviewed parties as an alternative for the current hinterland transportation preference for rail. When looking at the competition with existing services, its situation differs from the direct service as the transit times provided by the Class I rail companies CN Rail and CP are creating the competitive market for hinterland services. Another significant difference is the geographical focus of the feeder service. As it directly competes with existing rail connections from the port of Montreal, it does not take into account the rail hinterland transportation services provided by CSX Rail and NS from the ports of New York/New Jersey and Norfolk.

As the analysis of existing services showed, customers are defined in two groups: time-sensitive and price-sensitive (in the form of transportation rates). As Table 5.94 shows, a feeder service into the Great Lakes is not feasible from a transit time perspective as it leads to an additional 2 days in the transportation chain when assuming that time is a critical factor. But also for price sensitive customers, the transportation rate analysis showed that a feeder service between Montreal and Cleveland/Toledo is not feasible from that perspective, even after abolishing the HMT for Canada-US cross border maritime trade. As a result of this longer transit time and the higher door-to-door transportation rates, a feeder service between the previously mentioned ports is not considered feasible and will therefore be excluded from further analysis in the transit time analysis as this would only focus on a very marginal volume of overweight, hazardous and odd-sized containers.

	Cleveland feeder		Toledo feeder		Montreal
	14 kts	18 kts	14 kts	18 kts	Rail
Montreal - Chicago	197.00	188.50	196.75	187.00	142.70
Montreal - Detroit	193.00	184.50	194.75	185.00	136.10
Montreal - Cleveland	193.00	184.50	194.75	185.00	136.10
Montreal - Columbus	193.00	184.50	194.75	185.00	136.10

Table 5.94: Transit times for a feeder service between the port of Montreal and Cleveland/Toledo versus existing rail services. (Based on own calculations)

5.3.3 Scenario analysis transit time scenarios

This paragraph will discuss three various scenarios and their result on the baseline model of existing services and the direct services. First of all, 5.3.3.1 discusses the effect of a longer dwell time in the ports of Cleveland and Toledo during the months that commercial shipping on the Great Lakes is possible. Secondly, in 5.3.3.2 the effect of a longer dwell time on 2 occasions are analyzed. First of all, this scenario will look at a longer container dwell time as a result of more cargo in the major East Coast ports after the opening of the expanded Panama Canal. Secondly, this scenario will also look at the seasonal aspect of using the Great Lakes by implementing a longer container dwell time during the winter months as this cargo only result in a seasonal effect. After this scenario, 5.3.3.3 discusses the effect of slow steaming on the existing services on the competitiveness of a direct service into the Great Lakes.

5.3.3.1 Longer dwell time for the ports of Cleveland and Toledo

As mentioned before, container shipping on the Great Lakes is close to non-existent. Although recent investments have been done in terms of movable container handling cranes, more investments in equipment are required in order to operate as a container port. As a result of lacking infrastructure information as well as hinterland infrastructure capabilities of handling containers on a frequent basis, container dwell times have been difficult to predict as no data on dwell time is available yet. But, as explained in Appendix A, the average dwell time per container has been set at 48 hours on average in the baseline situation as an assumption for these smaller container terminals. But for this scenario, an additional 24 hours has been used in order to analyze the effect of a longer dwell time on two levels: higher dwell times as a result of terminal inefficiencies and on the level of longer dwell times as a result of incapable hinterland transportation modes. Because the ports of Cleveland and Toledo have a daily connection with the network of CSX rail and NS rail, 24 hours is assumed to be sufficient enough as assumed extra dwell time.

Although one of the major factors contributing to the container dwell time from a terminal operator or port authority's perspective are a set of strict rules on container dwell time at the terminal, combined with setting additional fees after a certain amount of dwell days have been reached, terminal inefficiency could also contribute severely. Another important factor which could contribute to longer dwell time, especially for Cleveland, is the shifting on rail hubs further towards the West with the investment of rail hubs particularly in North-Baltimore and Columbus by CSX Rail and NS.

As shown already in the analysis in the baseline situation, the 14 knots direct service into the Great Lakes faces strong competition with the existing services on nearly all routes and even less preferred when compared to the existing routes offered by Hapag-Lloyd. But, after facing an additional 24 hours in container dwell time, the competitive position of the 14 knots direct service is also facing heavy competition by Maersk in terms of transit time, through the port of Norfolk in particular, limiting the benefit of using the direct service to only 15 hours with the fastest option and 30 hours overall, while requiring an alternative mode during the winter period.

As indicated before in the analysis of the baseline situation, also the direct service to the port of Toledo is facing stronger competition from the existing services on the 14 knots service, limiting the advantage is transit time to a slight 9 hours on the majority of services. For both the direct routes into Cleveland and Toledo, the effect of choosing a slower hinterland transportation mode in Europe even results in a more negative situation with very though competition with Maersk and Hapag-Lloyd for time-sensitive cargo.

But when looking at the 18 knots services to Cleveland and Toledo in Tables 5.95 and 5.96, the advantage of using a direct service is also decreasing, but still the direct service is able to improve door-to-door transit times by 2 days on average for Toledo bounded vessels and approximately 2.25 days on Cleveland bounded vessels. But as a result of a longer container dwell time in these Great Lakes ports, the direct service faces a less preferred position when barge hinterland transportation has been used for cargo originating in Stuttgart and Basel. Also for Mannheim and Duisburg originating cargo, the longer container dwell time results in closer competition with the existing services from Hapag-Lloyd as the difference is reduced to only 12 hours.

Based on this scenario, it is clear that although a direct container service into the Great Lakes proves to be competitive compared to existing services in the baseline, an additional container dwell time of 24 hours results in more competition with the existing services. While the 14 knots service proves to be facing heavy competition with and outperformed by the existing services, it is still able to reduce the transit times by 1 day, but requires a high level of reliability and limited delays. Also the modal choice in Europe proves to be an important factor for the competitive situation. While it is more environmental friendly to use rail of barge hinterland transportation in Europe, it results a weaker position for the direct service into the Great Lakes if existing services are using road haulage.

For the 18 knots service, the additional advantage as a result of this higher sailing speed leads to a more flexible position to choose hinterland transportation mode which keeps its strength after adding an additional 24 hours to the dwell time in the ports of Cleveland and Toledo. But as sailing at 18 knots proves to be less environmental friendly due to higher consumption of IFO 380, it is illogical to think that customers on the 18 knots service would switch to more environmental friendly modes of hinterland transportation, indicating that it is more likely a choice based on transit time than environmental friendliness.

	14 knots direct service Cleveland			18 knots direct service Cleveland		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim - Chicago	463.90	498.70	500.30	404.40	439.20	440.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Mannheim - Detroit	453.90	494.70	496.30	400.40	435.20	436.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Mannheim - Cleveland	459.90	494.70	496.30	400.40	435.20	436.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Mannheim - Columbus	459.90	494.70	496.30	400.40	435.20	436.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Duisburg - Chicago	460.90	474.70	492.30	401.40	415.20	432.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Duisburg - Detroit	456.90	470.70	488.30	397.40	411.20	428.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Duisburg - Cleveland	456.90	470.70	488.30	397.40	411.20	428.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Duisburg - Columbus	456.90	470.70	488.30	397.40	411.20	428.80
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Stuttgart - Chicago	465.15	508.30	519.44	405.65	448.80	459.94
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Stuttgart - Detroit	461.15	504.30	528.30	401.65	444.80	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Stuttgart - Cleveland	461.15	504.30	518.70	401.65	444.80	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Stuttgart - Columbus	461.15	504.30	518.70	401.65	444.80	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Basel - Chicago	466.90	502.80	521.19	407.40	443.30	461.69
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Basel - Detroit	462.90	498.80	518.70	403.40	439.30	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Basel - Cleveland	462.90	498.80	518.70	403.40	439.30	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
Basel - Columbus	462.90	498.80	518.70	403.40	439.30	459.20
	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE	RTM-CLE
RTM=Rotterdam	RAIL		ROAD		BARGE	

Table 5.95: Door-to-door transit times, including modality for hinterland transportation between the port of Rotterdam and Cleveland after increasing the container dwell time for the port of Cleveland. (Based on own calculations)

	14 knots direct service Toledo			18 knots direct service Toledo		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim - Chicago	467.40 RTM-TOL	502.20 RTM-TOL	503.80 RTM-TOL	406.73 RTM-TOL	441.53 RTM-TOL	443.13 RTM-TOL
Mannheim - Detroit	465.40 RTM-TOL	500.20 RTM-TOL	501.80 RTM-TOL	404.73 RTM-TOL	439.53 RTM-TOL	441.13 RTM-TOL
Mannheim - Cleveland	465.40 RTM-TOL	500.20 RTM-TOL	501.80 RTM-TOL	404.73 RTM-TOL	439.53 RTM-TOL	441.13 RTM-TOL
Mannheim - Columbus	465.40 RTM-TOL	500.20 RTM-TOL	501.80 RTM-TOL	404.73 RTM-TOL	439.53 RTM-TOL	441.13 RTM-TOL
Duisburg - Chicago	464.40 RTM-TOL	478.20 RTM-TOL	495.80 RTM-TOL	403.73 RTM-TOL	417.53 RTM-TOL	435.13 RTM-TOL
Duisburg - Detroit	462.40 RTM-TOL	476.20 RTM-TOL	493.80 RTM-TOL	401.73 RTM-TOL	415.53 RTM-TOL	433.13 RTM-TOL
Duisburg - Cleveland	462.40 RTM-TOL	476.20 RTM-TOL	493.80 RTM-TOL	401.73 RTM-TOL	415.53 RTM-TOL	433.13 RTM-TOL
Duisburg - Columbus	462.40 RTM-TOL	476.20 RTM-TOL	493.80 RTM-TOL	401.73 RTM-TOL	415.53 RTM-TOL	433.13 RTM-TOL
Stuttgart - Chicago	468.65 RTM-TOL	511.80 RTM-TOL	526.20 RTM-TOL	407.98 RTM-TOL	451.13 RTM-TOL	465.53 RTM-TOL
Stuttgart - Detroit	466.65 RTM-TOL	509.80 RTM-TOL	524.20 RTM-TOL	405.98 RTM-TOL	449.13 RTM-TOL	463.53 RTM-TOL
Stuttgart - Cleveland	466.65 RTM-TOL	509.80 RTM-TOL	524.20 RTM-TOL	405.98 RTM-TOL	449.13 RTM-TOL	463.53 RTM-TOL
Stuttgart - Columbus	466.65 RTM-TOL	509.80 RTM-TOL	524.20 RTM-TOL	405.98 RTM-TOL	449.13 RTM-TOL	463.53 RTM-TOL
Basel - Chicago	470.40 RTM-TOL	506.30 RTM-TOL	526.20 RTM-TOL	409.73 RTM-TOL	445.63 RTM-TOL	465.53 RTM-TOL
Basel - Detroit	468.40 RTM-TOL	504.30 RTM-TOL	524.20 RTM-TOL	407.73 RTM-TOL	443.63 RTM-TOL	463.53 RTM-TOL
Basel - Cleveland	468.40 RTM-TOL	504.30 RTM-TOL	524.20 RTM-TOL	407.73 RTM-TOL	443.63 RTM-TOL	463.53 RTM-TOL
Basel - Columbus	468.40 RTM-TOL	504.30 RTM-TOL	524.20 RTM-TOL	407.73 RTM-TOL	443.63 RTM-TOL	463.53 RTM-TOL
RTM=Rotterdam	RAIL		ROAD		BARGE	

Table 5.96: Door-to-door transit times, including modality for hinterland transportation between the port of Rotterdam and Toledo after increasing the container dwell time for the port of Toledo. (Based on own calculations)

5.3.3.2 Longer dwell times for Canadian and U.S. East Coast ports

Next to the previously discussed scenario, dwell times in the Canadian and U.S. East Coast ports are facing significant changes in the upcoming decade as a result of growing global trade and the enlarged Panama Canal, giving ocean carriers the opportunity to deliver its cargo closer to the market. Although significant infrastructure investments have been done by the terminal operators, port authorities and hinterland transportation providers like CSX Rail and NS, a large amount of cargo is being expected as a result of an improved competitive position versus West Coast ports for Asian originated cargo volumes. This scenario can be further split into two sub scenarios: first of all, this scenario looks at the impact of an additional 24 hours dwell time in the ports as a result of more cargo arriving and departing due to a shift in the network of ocean carriers after the expansion of the Panama Canal. Secondly, this scenario looks at the effect of an additional 24 hours of container dwell time as a result of the seasonality in order to cope with either longer hinterland transportation times due to bad weather or the effect of being a seasonal volume, exceeding the capacity of rail infrastructure.

Cargo related longer dwell times

With the expansion of the Panama Canal, significant changes in the shipping networks by ocean carriers are expected from the perspective of several terminal operators located on the U.S. East Coast. As a result of these expectations, the ports of Miami, New York/New Jersey and Norfolk have actively invested in their ports in order to cope with additional cargo flows, both on the ocean side and the land side. After the expansion project, the capacity of container vessels increase from 5,000 TEU to approximately 13,000 TEU indicating an increase of 160%, which has a significant impact on the economies of scale that can be achieved. Currently, these large vessels are only able to call at the ports of Seattle, Los Angeles/Long Beach and Oakland after which the containers are transported by rail cross-continent to the major markets, most of them located on the East Coast of the United States. Expectations by both academic and business experts state that the expansion of the Panama Canal would lead to a significant shift of containers from the West Coast to the East Coast in order to reduce to door-to-door transportation rates, also mentioned by Haazen (2012). Although this additional amount of containers do not directly influence the dwell times of the ports of Montreal and Halifax, it is expected that also these ports will face a higher volume of European containers as a result of a shift towards Canadian ports as a result of longer dwell times in New York/New Jersey and Norfolk. For the port of Montreal one of the main reasons for a longer dwell time is the very limited amount of capacity still available. Although the port of Montreal has been planning to increase the capacity of the port, it is a long-term project, expected to finish in 2020. For the port of Halifax, this additional 24 hours is related to the limited rail hinterland connectivity with only a daily service.

The additional dwell time in the major ports on the U.S. and Canadian East Coast proves to have a significant effect on the choice of ocean service when looking at the door-to-door transit times, without having a specific choice for the carrier of the existing service. As a result of this longer transit time on existing services, the 14 knots direct service is improve its competitive position with the existing services, while offering a broader choice of modality for European hinterland transportation. Especially on the trade routes originating in Mannheim and Duisburg, the 14 knots direct service to Cleveland and Toledo are able to compete with the existing services on a time-orientated basis, while giving the customer the opportunity to choose for a more economical and environmental friendly mode of hinterland transportation from their European originating region.

Also on Stuttgart and Basel originating trade routes, the extra dwell time on existing services (table 90) result in a stronger position for the 14 knots service as previously discussed in table 5.92 and 5.93. Although rail and barge hinterland transportation in Europe prove to be longer than by truck on the existing services, it is only limited at 7 to 24 hours extra depending on the hinterland modality chosen in Europe compared to Hapag-Lloyd ocean routes. When looking at the Maersk ocean routes, it is evident that the longer dwell times in North America result in a stronger competitive position for a direct service into the Great Lakes. For the less time-sensitive customers of MSC, this direct service would result in a 4 to 5 day advantage for a 14 knots direct service under the various modes of hinterland transportation. Although these customers are less time-sensitive, a 4 to 5 day advantage over the existing services could be considered significant, especially in combination with the lower transportation rates that a direct service could provide as shown in the transportation rate analysis.

Because of this slight difference on Maersk and Hapag-Lloyd, customers who are transportation cargo that is time-sensitive are able to improve their environmental awareness image while they are also able to reduce the transportation rate as a result of more economically efficient operating hinterland transportation modes without facing significantly additional time compared to existing services. As the baseline information of the transportation rate analysis showed, using truck haulage as European hinterland mode results in an additional $ 600 dollars on average compared to rail and barge haulage. As this sub scenario shows, the longer dwell time is able to improve the competitive situation of the 14 knots direct service itself, but also provides the shipper an opportunity for the customer to choose a slower hinterland transportation mode in Europe in order to decrease the door-to-door transportation rate, without facing a significantly longer transit time, which could be considered a win-win situation. Although time is less relevant for the customers on these 14 knots services, it is considered an advantage if transit times can be improved.

As the 14 knots service already showed, the longer dwell time in North America leads to a longer transit time on existing services, but also the effect on the 18 knots is noticeable. When looking at the Mannheim and Duisburg trade routes with Hapag-Lloyd and Maersk versus the 18 knots service, the direct service into the Great Lakes is able to improve its competitive position and difference with an additional day to 4 days overall when looking at the fastest mode of European hinterland transportation. But also for slower modes of hinterland transportation in Europe, the competitive improvement of the direct service could be considered significant as its increases from 1.5 to 2.5 days for cargo originating in Mannheim and Duisburg. But also on cargo originating from Stuttgart and Basel, the direct service is able to improve the transit time by a day to 4 days overall after using road haulage. As a result of a longer distance and a slower mode of hinterland transportation, the impact and competitiveness for slower hinterland transportation modes stays limited at approximately 2 days as the ports of Antwerp and Hamburg are more strategically located to serve these destinations versus the port of Rotterdam.

Although overall the transit time with the various modalities for an 18 knots direct service prove to be less than on existing services, the effect of a longer dwell time could be considered irrelevant as the shippers of time-sensitive cargo see flexibility and reliability of the existing services as an important asset in their supply chain. As the direct ocean route into the Great Lakes would most likely be operating on a weekly basis, shippers will prefer using existing services as it gives them more opportunities on a weekly basis to make sure their cargo is transported instead of the risk of missing the call at the port of Rotterdam for the direct service. Therefore, it is important that the operating carrier of this direct service is able to provide the customer with a strong “Plan B” to gain their confidence in the initial stage of operations for the direct service.

Longer seasonal dwell/hinterland transit times in North America

Also seasonality proves to influence the transit time of ocean originating containers on two different levels. First of all, the seasonality on the Great Lakes results in the deferral of containers to the Canadian and U.S. East Coast ports as an alternative for a direct service, resulting in overall longer transit times. Although the transition of the flow of goods is only limited to a maximum of approximately 800 TEU on a weekly basis for three months, which accounts for approximately 10,000 TEU, it is possible that the terminal infrastructure is not able to cope with this additional level of containers or as a result of the lack of space of an additional vessel at the dock at the East Coast ports. Not only could the limitations at the side of the terminal operator contribute to a longer dwell time during the seasonal closure of the St. Lawrence Seaway, also the influence of the rail hinterland infrastructure has to be taken into account. As these containers will use rail hinterland transportation from the port towards the U.S. Midwest, it is highly debatable if the Class I rail carriers are able to cope with additional cargo during these months. As cargo volumes on long-term contracts are more preferred over a short-term contract on a seasonal basis, it is possible that these seasonal containers face a longer dwell time at the port terminal before being moved inland to the U.S. Midwest. Especially CN and CP rail would have a strong incentive to leave these containers longer at the terminal, as a direct service into the Great Lakes could be considered a direct attack on the volumes of these Canadian Class I rail carriers.

When comparing the transit time of the 14 knots direct service to the winter transit time on existing services, the seasonal closure would lead to a longer transit time from approximately 18 days to 23 to 24 days on MSC services, while the effect only stays limited to 1 or 2 days extra for Hapag-Lloyd and Maersk services. Although the difference could be overcome for Hapag-Lloyd and Maersk customers, the impact of switching during the winter period from a 14 knots direct service to an existing MSC services would have a severe impact of nearly a week. Although the direct service proves to offer a lower door-to-door transportation rate on many routes, it is questionable to what extent the customers would be able to cope with the additional sailing time during the winter. Although this impact is more important for time-sensitive customers of Maersk and Hapag-Lloyd, an extra sailing time of 5 to 6 days could also be considered a significant impact on the supply chain of less time-sensitive customers of MSC. For Maersk and Hapag-Lloyd customers the additional transit time after transferring the cargo on an existing route during the winter period does not result in a very significant change in the supply chain operations, while the longer transit time on MSC services would require a drastic change to its supply chain as a result of nearly 40% additional transit time.

For time-sensitive customers, it is more important to take into account the effect on the 18 knots service and their supply chain. Unlike in the case of a 14 knots service, the switch from an 18 knots service to an existing service results in larger impact on the supply chain for time-sensitive supply-chain-orientated shippers. When switching from the 18 knots direct service into the Great Lakes to an existing service to Canadian and U.S. East Coast ports an additional 4 days is required, 25% of the transit time of the 18 knots service. As a result of this longer transit time, adjustments will have to be made in the operations and supply chain of the customer of the ocean service. Especially for just-in-time supply-chains like the car manufacturing industry, where an additional 4 days during the winter period could lead to a severe impact on the production of their vehicles, while also for high valued goods like electronics; time is a rather critical element for manufacturers. Although 4 days does not seem long, the stock holding in the period just before the closure of the Seaway must be sufficient in order to cope with this switching time of 4 additional days resulting in higher costs on warehousing, stock holding, depreciation and would require a large sum for the investment of products that are being stocked. While the 14 knots direct service would be able to switch during the winter period to a fast existing service by Hapag-Lloyd or Maersk to cover the additional transit time, the 18 knots service is not able to do so as a result of the economic efficiency of sailing speed. In order to cope with this additional transit time when going from the 18 knots direct service to an existing service, it would require speeds up to 21 to 22 knots, which are economically not feasible with the current level of oil prices. Even though oil prices would drop, ocean carriers have indicated that slow steaming will be the way to go in container transportation. As a result of this, it is expected that the difference between the 18 knots direct service and the existing services will only grow further as a result of this focus on slow steaming.

One of the solutions mentioned during the interviews to cope with the seasonality was the potential warehousing facilities at the ports of Cleveland and Toledo. Although this seems a viable solution to store containers that are not yet required by the recipient, warehousing is not considered economically viable due to various reasons. First of all, storage of full containers during these three months leads to a higher capital investment by the receiving companies as they already have invested in the products inside the container, which are not yet required for operations or sales. Also the scarcity of land near the ports of Cleveland and Toledo is very important to take into account when offering warehousing as it is more interesting to house offices or operations that are not limited to the Seaway season, like inter-lake transportation of grain and other bulk materials. By offering warehousing or a place to stack these containers during the winter months, high opportunity costs are faced which would be covered by the income earned in the operational 9 months, leading to higher port dues and charges.

.	Maersk			Hapag-Lloyd			MSC		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim-Chicago	506.40	538.10	541.20	478.10	510.50	533.10	568.10	604.10	615.00
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Mannheim-Detroit	526.4	531.5	561.2	471.5	503.9	526.5	561.5	597.5	608.4
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Mannheim-Cleveland	524.4	531.5	552.4	471.5	503.9	526.5	561.5	597.5	608.4
	RTM-NOR	ANT-MON	RTM-NYNJ	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Mannheim-Columbus	498.4	531.5	533.2	471.5	503.9	526.5	561.5	597.5	608.4
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Duisburg - Chicago	503.4	517.2	534.8	476.1	506.3	530.6	565.85	601.6	615.9
	RTM-NOR	RTM-NOR	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	ANT-MON
Duisburg - Detroit	523.4	529	537.2	469.5	499.7	524	559.25	595	609.3
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	ANT-MON
Duisburg-Cleveland	521.4	529	535.2	469.5	499.7	524	559.25	595	609.3
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	ANT-MON
Duisburg-Columbus	495.4	509.2	526.6	469.5	499.7	524	559.25	595	609.3
	RTM-NOR	RTM-NOR	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	ANT-MON
Stuttgart - Chicago	507.65	539.1	449.9	479.6	521	534.1	569.6	605.1	616.25
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Stuttgart - Detroit	527.65	532.5	568.9	473	514.4	527.5	563	598.5	609.65
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Stuttgart - Cleveland	525.65	532.5	553.65	473	514.4	527.5	563	598.5	609.65
	RTM-NOR	ANT-MON	RTM-NYNJ	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Stuttgart - Columbus	499.65	532.5	540.9	473	514.4	527.5	563	598.5	609.65
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Basel - Chicago	509.4	540.6	545.3	481.1	512.75	535.6	571.1	606.6	617.5
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Basel - Detroit	529.4	534	565.3	474.5	506.15	529	564.5	600	610.9
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Basel - Cleveland	527.4	534	555.4	474.5	506.15	529	564.5	600	610.9
	RTM-NOR	ANT-MON	RTM-NYNJ	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON
Basel - Columbus	501.4	534	537.3	474.5	506.15	529	564.5	600	610.9
	RTM-NOR	ANT-MON	RTM-NOR	HAM-MON	HAM-MON	ANT-MON	BRE-MON	ANT-MON	BRE-MON

	RAIL	ROAD	BARGE
RTM=Rotterdam	ANT=Antwerp	HAM=Hamburg	BRE=Bremen
MTR=Montreal	NOR=Norfolk	NYNJ=New York/New Jersey	HAL=Halifax

Table 5.97: Door-to-door transit times for direct services, including modality for hinterland transportation between the port of Rotterdam and Canadian/US East Coast after adding an extra container dwell time of 24 hours at the 4 North American ports (HAL, MON, NYNJ and NOR). (Based on own calculations)

5.3.3.3 Slow Steaming

In this final scenario, the effect of slow steaming on all transatlantic ocean services is taken into account. As a result of the increasing price of IFO 380, ocean carriers face a two-sided decision: either raising the Bunker Adjustment Factor to cover this higher expenditure or use slow steaming on these ocean services. Although over the recent years the price of IFO 380 have multiplied to a high level per ton, the ocean carriers have shown a limited response by adding the Bunker Adjustment Factor in order to cover their higher costs. But when the economy proves to be lagging behind and customers are not willing to pay a higher transportation rate the only response the ocean carrier can make, is sailing at a lower speed, saving exponentially amounts of IFO 380. When looking at the current economic situation, in conjunction with the sailing speed of the various container routes, it is clear that for North American imports, there is still a willingness to pay on routes bounded for New York/New Jersey and Norfolk, while Montreal characterizes itself with slow steaming routes.

On a customer level, the effect of slow steaming on the supply chain can be considerable for time-sensitive customers of Maersk and Hapag-Lloyd in terms of additional transit time required for the door-to-door transportation. For these customers, only 2 alternatives are available if they are not able to change their production and distribution process to the longer sailing times. First of all, the usage of an alternative mode is considered irrelevant due to higher costs as air transportation will be enormous in terms of transportation rate, although it is assumed to be a faster mode of transportation. Secondly, the consignee is able to choose for another supplier from a different continent which is able to provide the products at a comparable cost and transit time.

As literature already mentioned, sailing speed is considered an important factor contributing to the network of the ocean carrier in combination with the amount of calls on both sides of the service. As the data on existing services showed, there is a clear distinction in the sailing speed of the ocean service in conjunction with the specific carrier and called ports. For time-sensitive carriers like Maersk and Hapag-Lloyd, the additional IFO 380 consumption as a result of a higher sailing speed is offset by a higher transportation, although those carriers prove that they are still competitive enough in comparison to MSC as the transportation rate analysis has shown. When looking into detail at the various ocean routes, Maersk distinguishes itself by offering a fast 18.2 knots Ta1 service and a 16.7 knots Ta2 service between the Hamburg - Le Havre range and the U.S. East Coast, both are considered to be fast services. On the other hand, the Maersk service to Montreal is considered a slow steaming service already with an average speed of 12.9 knots on the ocean voyage in its current state.

What characterizes the Hapag-Lloyd services from Maersk is not speed, but frequency. Hapag-Lloyd is able to offer 5 US-Transatlantic services and 2 Canadian-Transatlantic services, although several services are operated by another, smaller carrier under a vessel sharing agreement. Although the speed of these Hapag-Lloyd services is slower than Maersk, the broad combination of port calls in the Hamburg – Le Havre range results in competitive transit times for time-sensitive customers. Also on the Canadian Transatlantic routes to Montreal, Hapag-Lloyd differentiates itself from Maersk in terms of sailing speed by offering a 17.5 knots and 16.3 knots service between both continents.

MSC on the other hand characterizes itself by offering slow steaming services as a standard, in order to compete on transportation rate instead of transit time. Especially on the US-Transatlantic service, MSC is able to offer only a slow service at 13.6 knots, while on the Canadian-Transatlantic they are sailing at a speed of 16.3 knots as a result of vessel sharing with OOCL and Hapag-Lloyd on the SLCS 1 service.

Although various speeds are considered as slow steaming, this scenario will only assume a 14 knots sailing speed as slow steaming in order to compare the impact of slow steaming on the door-to-door transit time. Additionally, the sailing speed of ocean services which are currently sailing slower than 14 knots (Maersk Ta4 and MSC NA) will not sail faster than in the current situation.

When comparing the transit times in Table 5.91 on the existing services with their scheduled speed to Table 5.98 after implementation of slow steaming at 14 knots, there are various effects noticeable on multiple levels of the transportation chain. Not only does slow steaming influence the door-to-door transit times in itself, there is also a considerably significant impact on a carrier/port level for several routes in the analysis, but also on the modality choice involved with this route preference. As a result of their central location within the contestable hinterland of the Hamburg – Le Havre range, the effects of slow steaming on cargo originating from Duisburg and Mannheim are showing a significant slide from Rotterdam to Antwerp in terms of port of origin for Maersk, while for Hapag-Lloyd a slight change from Antwerp to Rotterdam is noticeable.

First of all, the change of Maersk can be explained as a result of its network structure. In the analysis of the existing services, Maersk clearly preferred its Ta1 US-Transatlantic service above the Ta4 Canadian Transatlantic service, but as a result of slow steaming, the Ta1 service faces an additional 51 hours, making the service not competitive for cargo bounded for the U.S. Midwest. Because of the impact of the additional sailing time, it proves to be more efficient in terms of transit time to use the Ta4 (Montreal) service to transport cargo destined for the U.S. Midwest. As a result of the structure of this route, shippers can save 3.5 days on the door-to-door transit time when choosing the port of Antwerp as this is the last European port of call compared to Rotterdam. As Table 5.98 shows, the stronger preference for the port of Antwerp also results in a more competitive situation for other hinterland modalities like barge and rail transportation in Europe, as the ports of Rotterdam and Antwerp are located close to each other.

When looking at cargo originating from Stuttgart and Basel, the same trend is noticeable but to a lesser extent. Although the Rotterdam – Norfolk route faces a longer ocean transit time as a result of slow steaming, it is still able to compete with the Montreal bounded service from the port of Antwerp, due to the advantage of lower dwell times in the port of Norfolk. Also the longer distance from the European production site to the port contributes to a stronger position for the Rotterdam originating ocean route as the extra distance results in longer hinterland transit times for rail and barge modalities.

Also for Hapag-Lloyd, slow steaming has a severe impact on the preferred routings and hinterland modalities for the Europe – U.S. Midwest cargo markets. Unlike in the case of Maersk with its shift from Rotterdam to Antwerp, a shift from Antwerp to Rotterdam is noticeable for Hapag-Lloyd, though in a lesser extent. When comparing the transit times itself in Tables 5.91 and 5.98, it is interesting to notice that the impact of slow steaming is much severe on Hapag-Lloyd service then it is on Maersk services. For the majority of routes, slow steaming leads to an additional 40 to 48 hours while this number for Maersk services varies between 10 to 30 hours. Although Hapag-Lloyd offers the most transatlantic services, these services are not competitive with each other as a result of several time-consuming calls in the UK after leaving the European continent.

For cargo originating from Mannheim and Duisburg, the proximity of the ports within the Hamburg – Le Havre range results in a stronger competitive market for the ports served by Hapag-Lloyd. Especially for the 3rd choice position, slow steaming results in a more competitive situation between the ports of Antwerp and Rotterdam for these cargoes. But also on the cargo bounded from Stuttgart and Basel, slow steaming leads to a stronger position for the port of Rotterdam in the network of Hapag-Lloyd. Especially for Stuttgart originating cargo, the port of Rotterdam is able to improve its position versus Antwerp, but is also able to compete with cargo that is transported through Hamburg by rail modality. Another interesting results, although focused on a rather nice market, is on the Stuttgart – Chicago trade route where the port of Halifax is able to attract cargo.

Although the customers of MSC are less time-sensitive than Maersk and Hapag-Lloyd, the slow steaming also impacts their door-to-door transit time. After the introduction of slow steaming on the vessel-shared Canadian service by MSC, door-to-door transit times are increased by approximately 2 days. Although time is less an issue for MSC customers, the difference between the time-orientated services by Maersk/Hapag-Lloyd and MSC becomes closer. This trend can be explained due to the structure of the port calls. While the Ta4 service from Maersk and the SLCS 2 service from Hapag-Lloyd sail directly from the ports in the Hamburg – Le Havre range, the MSC service (in conjunction with Hapag-Lloyd (SLCS 1) and OOCL) additionally calls in Liverpool resulting in additional transit time for sailing into the St. George's Channel and the Irish Sea. Another interesting result is the absence of the MSC North America service route, which sails at a 13.6 knots sailing speed as scheduled in the existing situation. Clearly, for U.S. Midwest destined cargo, the MSC North America service route to several U.S. ports is not able to compete with a Montreal bounded service, even after introducing a slow steaming scenario. Though this service provides a competitive ocean rate as seen in the transportation rate analysis, it proves not to be competitive enough in terms of transit time.

As a result of slow steaming on the existing services, distance between the port of departure in Europe and the port of arrival in North America is an important influencing factor contributing to the competitiveness of a service. Although the distance from the port of Rotterdam to Cleveland/Toledo is only approximately 200 miles less than through the port of New York/New Jersey, the closer proximity to the market results in a competitive door-to-door transit time for a direct service into the Great Lakes. When looking at the situation in Table 5.98, with slow steaming on the existing services, compared to a direct service to Cleveland and Toledo in Table 5.92 and 5.93, the 14 knots direct service is very competitive in terms of transit time for all destinations. While the 14 knots service results in a 2.5 day advantage on average when choosing for road haulage in Europe, also the slower rail and barge modalities are able to reduce the transit time by a day on average for rail, while barge transportation proves to be equal to the fastest routes between both regions.

Clearly, the competiveness of a 14 knots direct service improves after the existing services choose to slow steam. This advantage can be explained due to two reasons, first of all the closer proximity to the market for the ports of Cleveland and Toledo result in a quicker hinterland transportation possibility as all destinations are in trucking distance. Secondly, the direct service characterizes itself due to the 1 port to 1 port principle with only a single call on both sides on the Atlantic. As the analysis on the existing services also showed in Appendix A, the Montreal services characterize themselves as being a niche service, with only a very limited amount of calls on especially the North-Atlantic side of the route.

Although considered irrelevant, the 18 knots service is also able to improve its competitive position versus the existing service, but it is unlikely that in the situation that all ocean carriers decide to slow steam, an 18 knots direct service into the Great Lakes would prevail. As a result of the additional space in terms of transit time, it would also become possible to use rail hinterland transportation on the American side of the chain.

	Maersk			Hapag-Lloyd			MSC		
	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim - Chicago	514.10	533.54	549.90	508.81	535.21	538.19	571.96	607.96	618.86
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	BRE-MTR
Mannheim - Detroit	507.5	543.3	543.4	496.21	528.61	551.21	565.36	601.36	612.26
	ANT-MTR	ANT-MTR	ANT-MTR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Mannheim - Cleveland	507.5	543.3	543.4	496.21	528.61	551.21	565.36	601.36	612.26
	ANT-MTR	ANT-MTR	ANT-MTR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Mannheim - Columbus	507.5	525.54	543.3	496.21	528.61	530.19	565.36	601.36	612.26
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	BRE-MTR
Duisburg - Chicago	511.6	525.9	530.54	500.81	531.01	535.19	569.71	605.46	619.76
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	ANT-MTR
Duisburg - Detroit	505	519.3	548.4	494.21	524.41	548.71	563.11	598.86	613.16
	ANT-MTR	ANT-MTR	ANT-MTR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	ANT-MTR
Duisburg - Cleveland	505	519.3	548.4	494.21	524.41	548.71	563.11	598.86	613.16
	ANT-MTR	ANT-MTR	ANT-MTR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	ANT-MTR
Duisburg - Columbus	505	519.3	522.54	494.21	524.41	527.19	563.11	598.86	613.16
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	ANT-MTR
Stuttgart - Chicago	515.1	534.79	554	504.31	539.44	541.04	573.46	608.96	620.11
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	RTM-NOR	RTM-HAL	BRE-MTR	ANT-MTR	BRE-MTR
Stuttgart - Detroit	508.5	547.4	554.79	497.71	539.11	552.21	566.86	602.36	613.51
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Stuttgart - Cleveland	508.5	547.4	552.79	497.71	539.11	552.21	566.86	602.36	613.51
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Stuttgart - Columbus	508.5	526.79	547.4	497.71	531.44	539.11	566.86	602.36	613.51
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	RTM-NOR	HAM-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Basel - Chicago	516.6	536.54	552.75	505.81	537.46	541.19	574.96	610.46	621.36
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	BRE-MTR
Basel - Detroit	510	546.15	556.54	499.21	530.86	533.71	568.36	603.86	614.76
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Basel - Cleveland	510	546.15	554.54	499.21	530.86	533.71	568.36	603.86	614.76
	ANT-MTR	ANT-MTR	RTM-NOR	HAM-MTR	HAM-MTR	ANT-MTR	BRE-MTR	ANT-MTR	BRE-MTR
Basel - Columbus	510	528.54	546.15	499.21	530.86	533.19	568.36	603.86	614.76
	ANT-MTR	RTM-NOR	ANT-MTR	HAM-MTR	HAM-MTR	RTM-NOR	BRE-MTR	ANT-MTR	BRE-MTR

	RAIL	ROAD	BARGE
RTM=Rotterdam	ANT=Antwerp	HAM=Hamburg	BRE=Bremen
MTR=Montreal	NOR=Norfolk	NYNJ=New York/New Jersey	HAL=Halifax

Table 5.98: Door-to-door transit times for direct services, including modality for hinterland transportation between the port of Rotterdam and Canadian/US East Coast after applying slow sailing speeds on existing services. (Based on own calculations)

5.3.4 Conclusion transit time scenarios

This paragraph has provided an overview on the transit time for existing services on Maersk, MSC and Hapag-Lloyd, a new direct service from Rotterdam into the Great Lakes and a potential feeder service between Montreal under various scenarios with regards to slow steaming and longer dwell times as a result of seasonality and overutilization.

Based on the different scenarios and various assumptions made, it proves that a direct service between the port of Rotterdam and the Great Lakes would benefit in terms of door-to-door transit time, but only for the less environmental friendly 18 knots service. The 14 knots service on the other hand, proves to have a competitive transit time which is comparable to existing services in its baseline situation on all routes. Although this 14 knots service proves to be competitive enough versus the existing services in terms of transit time, it diminishes the possibility of using a more environmental and cheaper hinterland transportation modality in Europe without losing several days. With the current trend of environmental friendliness and the focus of companies to reduce their transport expenditures, the value of time needs to be determined on a company basis to defy their willingness to pay to switch from the existing service to a new connection into the Great Lakes. But, longer dwell times in the ports of Cleveland or Toledo limit the competitiveness of an 14 knots direct service versus the existing services for time-sensitive customers of Maersk and Hapag-Lloyd to less than a day in the advantage of the existing services, while the competition with the existing services offered by MSC is reduced to 3 to 4 days overall.

But also the impact on a national level proves to be of significant interest for the direct service into the ports of Cleveland and Toledo. Although based on uncertainty of future supply chains, the direct service would be able to provide shippers with a viable alternative for the existing service if the major ports are not able to cope with the additional traffic flows as a result of the expansion of the Panama Canal. Interestingly enough, the seasonal closure would not have a large impact for time-sensitive customers of Hapag-Lloyd and Maersk when using the 14 knots direct service during the sailing season. Although these 1 or 2 extra days is less than 10% of the total door-to-door transit time, the shippers are able to improve their transit time during the 9 month sailing season. Next to this, the period from January to March (depending on sector) is considered low production months resulting in less demand for transportation services. If it is known on forehand when the Seaway system will close for the winter, producers and shippers are able to adjust their supply chain in time to reduce the impact of switching to another service.

When looking at the 18 knots service in the baseline situation, it is able to improve the transit time by several days on average for all routes and gives the shipper the opportunity to switch modality, but during the winter closure of the St. Lawrence Seaway system a considerable longer transit time will be faced. But a longer dwell time in the ports of Cleveland/Toledo then assumed, also severely impacts the competitiveness of this 18 knots service to only 2 days. But switching during the seasonal closure from this 18 knots direct service to the existing services result in a larger switching impact on the supply chain of 4 days for regular speed services of Hapag-Lloyd and Maersk and 7.5 days for a slower service by MSC. Especially for time sensitive goods like car parts, this switch from a direct to existing would lead a huge impact on the supply and production chain.

The biggest impact on the competitiveness of the 14 knots service is introducing slow steaming on all existing ocean services on the transatlantic. If this trend will continue over the upcoming years, the potential of a 14 knots direct service will grow tremendously as a result of being the most optimal connection in terms of distance from the port of Rotterdam to the U.S. Midwest. This slow steaming also gives shippers the opportunity to choose a more environmental modality on the European hinterland connection resulting in a lower door-to-door transportation rate while they are not giving in on transit time.

Not only does the transportation rate analysis show hard evidence that a feeder service between the port of Montreal and Cleveland/Toledo is not feasible, also on transit time the feeder service faces heavy competition from the existing rail service by taking an additional 2 to 2.5 days to deliver the containers at their final destination. Although the feeder service is able to offer a more direct route to the lower U.S. Midwest markets and a quicker port-hinterland land based transportation, the additional dwell times at the both ports of call and less frequent services versus rail hinterland service providers, reduces the potential time savings from a feeder services into a negative situation, with longer transit times when a shipper wants to use the feeder service. Unlike the transportation rate analysis mentioned, the Class I rail companies from the port of Montreal, CP rail and CN rail, would have no incentive to participate in this feeder service as there is only limited benefits for them to achieve. Also on a governmental level, the introduction of a feeder service into the Great Lakes would not benefit the situation as the preferred modality from the ports of Cleveland/Toledo towards the U.S. Midwest would be road haulage, resulting in more trucks on their highways and a large impact on the quality of the infrastructure next to the decreased attractiveness for these states as a location for distribution centers.

Chapter 6 – Conclusion

In this final chapter, the conclusions and recommendations of this thesis on the potential of a maritime connection between North West Europe and the U.S. Midwest through the port of Rotterdam and the Great Lakes are given. First of all, this chapter will start off with answering the main research question based on the analysis on transportation rates and transit time from chapter 5. Based on these conclusions, the following paragraph 6.2 will recommend measures for various stakeholders, followed by paragraph 6.3 which discusses the critic on this thesis and followed by recommendations for further research to provide a more in-depth overview of un-covered areas in the researched literature on container transportation between both regions.

6.1 Main Conclusion

This thesis has been based on a joint project by the Erasmus School of Economics in conjunction with the Ministry of Foreign Affairs of the Kingdom of The Netherlands, embodied by its Consulate-General based in Chicago. Because of its strong position on maritime trade of bulk and container products, the port of Rotterdam has been a strong mainport for The Netherlands. Although over the recent years competition from other ports in the so-called Hamburg – Le Havre range have been growing, the port of Rotterdam is still considered to be the Nr. 1 port in Europe for bulk and container cargoes. Via this exploratory study on the potential of a 14 and 18 knots direct service between the port of Rotterdam and the ports of Cleveland and Toledo, more insight is given in the transport economical background of maritime transportation and the competitiveness of this direct service versus existing services through the major ports along the U.S. East Coast and Canada. Additionally, also the potential of a feeder service between the ports of Montreal and Cleveland/Toledo have been researched to broaden the scope of this research into a global perspective. In order to cover all ground, both institutional and economical, this thesis will focus only on the economic side of analysis. For more information on the institutional barriers of shipping on the Great Lakes, the first part of this research project by Haazen (2012) will provide a thorough overview and analysis on the impact of these barriers.

During the course of this thesis, several sub questions are answered in order to answer the main research question. This paragraph will provide an overview of the most important and significant conclusions of this research project, based on a transport economical point-of-view. In the joint report consisting of this thesis and the research done by Haazen (2012) a final conclusion is given on all sub-questions and the main research question.

The goal of this thesis was to provide an overview of the economic opportunities of container shipping in the Great Lakes basin, with the aim to intensify trade between key markets in North West Europe and the U.S. Midwest. In order to answer this question, the main question and several sub research questions has been created. The main research question of this paper is, in line with the objective, as follows:

"Does the Great Lakes/St. Lawrence Seaway maritime transportation system hold the potential to better accommodate the needs of stakeholders on both ends of the Northwest Europe – U.S. Midwest container transport corridor and if so, what measures can be suggested to enable the implementation of a regular scheduled container transport services between U.S. Midwest ports along the Great Lakes coasts and the port of Rotterdam?"

In order to effectively analyze the major cargo flow an analysis on the main trade patterns and key opportunities for future cargoes have been researched in Haazen (2012) together with the institutional barriers. Based on the research by Haazen (2012), three distinct types of cargo on the transatlantic route have been identified: Chemicals, High Valued Goods and Car parts. As the analysis in chapter 5 has shown, these cargoes have been linked to specific trade routes based on European origin and U.S. destination markets based on their value and geographical concentration. Secondly, the key barriers that have been identified in Haazen (2012) are of major importance in the analysis of the feasibility of a direct service between both regions. Not only does a direct service face a barrier as a result of the seasonal closure, also the Harbor Maintenance Tax and the image of the Great Lakes as international shipping market prove to be having a severe impact as institutional barrier.

While Haazen (2012) focuses on sub questions 2.2.2a and 2.2.2b, this part of the research has been focused on answering the third sub question 2.2.2c:

"To what extent could the implementation of a direct service between the port of Rotterdam and the Great Lakes or a HMT-free container feeder service to the ports of Cleveland and/or Toledo through Montreal, result in potential economic benefits for shippers and consignees in both North America and Europe, compared to the current routings between both regions?"

To cover this question, a distinction on two separate parts of the supply chain has been made: the transportation rate and the transit time. After this separation, several scenarios has been developed under which the baseline results from existing, direct and feeder services are being adjusted in terms of the assumptions made in the analysis. For the transportation rate, the scenarios include more expensive hinterland transportation by rail and road haulage, lower Harbor Maintenance Tax and more equal Terminal Handling Charges in Europe, in conjunction with the impact of switching costs due to the seasonal closure of the St. Lawrence Seaway system during 3 months of the year. Next to this, the impact of longer dwell times in the ports in North-America and slow steaming on existing services are being analyzed.

Transportation rate conclusions

Based on the different scenarios and various assumptions made, it proves the potential of a direct service between Rotterdam and the Great Lakes. Although on some routes heavy competition with existing services is noticeable, the direct service is overall positive under the various scenarios indicating a high potential for a direct service which is able to provide a benefit under positive (lower HMT rates) and negative (higher trucking and rail rates) external factors while the ocean carrier is able to make an 10% profit.

- The transportation of chemical products in the specialized 20” ISO Tank containers proves to be highly advantageous in terms of transportation rates. Although this type of cargo faces a low percentage of switching costs, the benefits of using a direct service into the Great Lakes are providing significantly lower door-to-door transportation rates than existing services in all scenarios.
- For High Valued Goods, the transportation through the Great Lakes is dependent on the final destination. Especially for the lower U.S. Midwest region around Columbus, a direct service would lead to lower transportation rates. But as rail hinterland transportation rates from the U.S. East Coast and Canadian ports prove to be competitive for cargo bounded for Chicago, only the abolishment of the HMT on all arriving cargo would also lead to a competitive advantage for this route.
- Car Parts are distinguished by its proximity from the port to the final destination. As the main markets are presumed Detroit and Cleveland, transportation of containers into the Great Lakes is beneficial under practically all scenarios. A winter premium for rail hinterland transportation though, results in a disadvantage versus existing services for Detroit bounded containers. As this is considered the most valued destination for car parts, the market power of the rail carriers should be taken into account.
- Based on the analysis of the feeder service, it is evident that even in the case that the HMT would be abolished on all Canada-US maritime feeder services; a feeder service is not competitive enough versus existing modes. Not only as a result of its seasonality, but also the additional costs involved for terminal handling contribute to a weaker position of a feeder service in terms of transportation rate, exceeding even the transportation rate above the level of rail hinterland transportation.

Transit time conclusions

Based on the different scenarios and various assumptions made, it proves that a direct service between the port of Rotterdam and the Great Lakes would benefit in terms of door-to-door transit time, but only for the less environmental friendly 18 knots service. The 14 knots service on the other hand, proves to have a competitive transit time which is comparable to existing services in its baseline situation on all routes. Although this 14 knots service proves to be competitive enough versus the existing services in terms of transit time, it diminishes the possibility of using a more environmental and cheaper hinterland transportation modality in Europe.

When applying the several scenarios on container dwell times and slow steaming, it is evident that the competitiveness of the direct service into the Great Lakes primarily depends on the actions taken by the large ocean carriers in terms of sailing speed. As a result of slow steaming for existing services, distance from point to point and connectivity becomes a more important factor as time will become an irrelevant factor. As this direct service into the Great Lakes achieves an interesting benefit in terms of routing, the achieved time advantage versus existing services are able to give the shipper a broader scope in terms of European hinterland modality, by choosing a more environmental friendly mode, while being able to have a comparable transit time versus the existing services which are highly dependent on the road modality for European hinterland transportation.

Although the 18 knots service is able to improve the transit time by several days during the sailing season, it faces a significant impact when switching towards existing services during the seasonal closure, when also facing a longer container dwell time during these winter months. Additionally, the impact of higher volumes as a result of a shift in the transportation chain from the U.S. West Coast to the U.S. East Coast will not have a severe impact on the port preference.

Similarly as the transportation rate analysis has shown, a feeder service will not be able to compete with existing rail services from Montreal. Although perceived more environmental friendly, the feeder service results in an additional 2 days of sailing time compared to rail haulage. Based on customer preferences, this additional transit time should be offset by a lower transportation but as the transportation rate analysis have shown, it is also more expensive.

General conclusion

In order to answer the research question, the analysis has been done in a narrow scale specifically focused on the position of the Dutch port network for providing an opportunity to offer a container service into the Great Lakes, either by a direct service or feeder service through Montreal. Based on the transportation rate analysis and the transit time analysis, it is clear that there is a potential for a direct service into the Great Lakes. Although this research included both the ports of Cleveland and Toledo, both ports have an interesting and good position in Lake Erie as a gateway for container cargo into the U.S. Midwest. Although the port of Cleveland is more strategically located for transportation in the lower U.S. Midwest region, the port of Toledo is more strategically located for the upper and western parts of the U.S. Midwest region like Detroit and Chicago. Both in transit time and transportation rates, this direct service, irrespectively if it's an 14 knots or 18 knots service, are able to outperform in offered transportation rates and at least match the transit time of the existing services when using a 14 knots service under all various scenarios with various modes of hinterland transportation on both sides of the Atlantic. Although the transportation rates are facing fluctuations from external factors like the global and local economy, the direct and feeder model assumes a rather low utilization rate of 70%. If the direct service between the port of Rotterdam and the Great Lakes will be able to increase this utilization rate, lower transportation rates could be offered, but as this is Greenfield research on container shipping into the Great Lakes, there are no comparable cases. As reliability is an important factor in the determination of success of a direct ocean services, it is important that both the performance, but also the image of the service will be positive. Next to this, governmental services on both sides of the Atlantic should promote the usage of the Great Lakes region as gateway into the U.S. Midwest because of its large size in terms of consumption and production facilities.

Its sailing speed though, is more dependable on the type of customer than on the economic condition. As the analysis on shipping networks has shown, Maersk and Hapag-Lloyd customers are more time-sensitive than their counterparts of MSC. But, as the capacity of the vessel is rather limited and because it is a niche market, a direct service into the Great Lakes will never be the only option for a shipper or global operating ocean liner, but as a complementary service. Also a flexible company policy is required for shippers that are missing a call at the port by transporting the container on another service route, without charging the customer additional charges for this service. To a limited extent, also participation of the Class I rail carriers could be interesting. As CSX and NS rail would be able to offer rail services from the Great Lakes ports, they are able to increase their utilization rate as containers from the East Coast, bounded for Cleveland for example, the empty spots can be filled by additional containers from the port of Cleveland on transportation to

Chicago. Also for the hazardous, overweight and odd-sized containers, being able to offer transportation through the Great Lakes would have a positive effect on the rail companies as they are no longer facing a cargo-penalty on their trains for the entire trip to or from Chicago but only partially.

Another interesting conclusion that can be made is the role of economies of scale. The classical economies of scale theory would indicate that it would be more economic to transport containers through the major ports of North-America as these ports can handle larger vessels. But, because of the niche market of container shipping on the Great Lakes is able to offer a competitive service as it requires a shorter hinterland distance and therefore also presumably lower hinterland transportation costs. In order to validate the economies of scale that are being achieved, a door-to-door transportation chain perspective should be used, instead of focusing specifically on the hinterland, port or ocean part of the container transportation. Over the last years, this chain perspective have been adopted by the major ocean carriers in order to compete with the 3PL logistic providers by internalizing this process in their operations and extensively influence the hinterland process as well as offering logistical services like warehousing.

6.2 Recommended measures

In order to successfully develop a direct service into the Great Lakes, active participation of all nodes in the transportation chain would be preferred. Additionally, the participation of both the supply and demand side with support from local and national institutions is required in order to make container shipping in the Great Lakes a success.

One of the first and most important measures that should be taken is researching the potential market for a direct service into the Great Lakes by the port authorities of Cleveland and Toledo together with the ocean carriers. Through their extensive customer database, the ocean carriers can access information about which parties in Europe and the U.S. Midwest would be interested in a direct service, while the port authorities would be able to present themselves as an alternative to the U.S. East Coast and Canadian ports to convince shippers and consignees. By researching the market, port authorities will be able to gain information about the potential market size as well as the strengths and weaknesses of their port in order to improve their competitive position.

Not only are the shippers and consignees of significant importance, also the role of 3rd party logistical companies and freight forwarders should not be neglected. Because of their focus on smaller volumes per shipper or cargo with specific characteristics, freight forwarders could represent a significant share of the containers transported through this service.

Another measure that is recommended is bringing together the supply and demand side. By bringing both sides together, carriers can show their commitment to offer this new ocean service, while on the other hand; shippers/consignees/freight forwarders can show their commitment to offer the ocean carrier a certain level of cargo. Ideally this could be done by the market itself, but as this would lead to a chicken and the egg dilemma, it is advised that the HWY H2O alliance as well as the port authorities themselves would take a leading role in this by hosting several meetings between both sides.

Also on a wider scale, involvement by public institutions like the St. Lawrence Seaway Development Corporation on the American side and the St. Lawrence Seaway Management Corporation on the Canadian side would be required. By marketing the usage of the St. Lawrence Seaway system and the Great Lakes as a new, more direct way of transporting containers to the U.S. Midwest through the HWY H2O alliance in both Europe and North-America, the image of a container service on the Great Lakes can be improved.

The final measure that should be taken is by the U.S. federal government. As academic and business literature as well as this analysis showed, the Harbor Maintenance Tax is considered to be the most influential factor to the viability of ocean shipping between the port of Rotterdam and the Great Lakes. Because the funds gathered from this tax exceed the expenditures, it is recommended to lower the level of the Harbor Maintenance Tax to at least 0.09%, as McIntosh and Skalberg advice. Although the abolishment of the entire Harbor Maintenance Tax would lead to the largest benefit for shippers, it is highly unlikely that this will pass the United States Congress; unless it is proven that the Harbor Maintenance Tax results in strong economical damage and the deferral of cargo.

6.3 Critics on own research

One of the important points of critic is the limited scope of the research with only 4 European originating regions and 5 U.S. Midwestern destinations. As the ocean shipping market proves to be a global network, it is unclear what impact this could have on the viability of a direct service into the Great Lakes by, for instance the transloading of African containers onto vessels bounded for the U.S. Midwest or Asian containers onto the feeder service from Montreal. Another important point of critique is the focus on the European-North American part of the ocean route. Although this is considered to be a heavily dominating leg containing 3/4th of the total Northwest European – North America and vice versa market, the return voyage to Europe could be influential up to a limited extent.

Although the direct and feeder model focuses on a single call on both continents, this research first of all focuses on the viability of this single call. As the volume required for this service is low with only approximately 800 TEU, vessels can be filled entirely at a single call, limiting the time required for a round trip voyage. The analysis on the existing routes into the St. Lawrence Seaway to Montreal showed a distinctive focus of having only a very limited amount of calls in Europe, while Montreal is considered the only import port of call for this service. Also the ports of Antwerp and Rotterdam are considered to be near-perfect substitutes for German and Swiss originating cargo in terms of transportation rate and transportation time. Although it would be possible to provide a direct service from the ports of Bremerhaven/Hamburg, additional ocean time would lead to higher fuel consumption as well as longer transit times.

The most important point of critique though is the usage of publicly available transportation rate data. As interviews have shown, the discount percentage offered by the major ocean carriers dependent on volume, varies between 10% to levels of 70% if the customer has a high volume. But because of severe competition between the ocean carriers, the level of this discount is presumed to be a company secret. As these discounts could be considered severe, the viability of a direct or feeder service depends on the level of discounts offered on the existing services. But in order to provide enough stability to the direct and feeder service model, a level of 10% “profit margin” is being used to cover a potential discount on container shipping into the Great Lakes as well as a bandwidth to cover additional costs that have not been included. But, also volume discounts in the level of harbor dues have not been taken into account, which could lead to a slight cost reduction for the ocean carrier.

6.4 Recommendations for further research

One of the most interesting subjects for further research would be on the volume discounts of the ocean carriers. As research through academic literature has shown, there is no information on the level of discounts that these ocean carriers offer on a global or transatlantic level. As mentioned before, this can be explained due to lacking incentive for ocean carriers to present their volume/customer-discount formula in public.

Another interesting topic for further research would be the development of these time and transportation rate models to a company specific level. By specifically looking on a company level, more information on volume discounts as well as the expected volume from the end-customer should become available. A company level based research would also give the opportunity to further analyze the role of switching costs and the viability of a seasonal direct or feeder service. As the transportation analysis has shown, the acceptable switching costs vary between 5% and 14%, based on research performed in the U.S. Midwest. As this level is generalized to the type of good (base materials or (semi-)finished products) it is not specified to specific categories of goods that have been used in this research.

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General websites used for data

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Hapag-Lloyd website: www.hapag-lloyd.com

APPENDIX A:

Assumptions Existing, Direct and Feeder services model

Ship characteristics and capacity

Next to this is the capacity factor. Because of the limitations for sailing through the St. Lawrence Seaway, the maximum size of a ship is based on the Seaway Max classification as stated in Table A.1.

	Metric System	**Imperial System**
Length	225.6 meter	740 feet
Beam	23.8 meter	78 feet
Draft	7.92 meter	26 feet

Table A.1: Maximum ship size for the St. Lawrence Seaway (Seaway Max) (Source: HWY H2O website)

In order to sail through the locks in the system, the capacity of a ship is bounded to the Seaway Max characteristics.

The direct service will be based on MV Lisa, which has been operating for Maersk between the Mediterranean and Mexico for several years after being built in 2003. Currently this vessel is owned by Baum & Co, which offers this vessel as a time-charter. Because the capacity of this vessel is slightly higher than other vessels in its class, the model will assume an effective 803 TEU capacity on ocean services. In Table A.2, more information on the characteristics of MV Lisa is given. When assuming a 28-day round trip voyage, the annual capacity per vessels will be 19,300 TEU and 77,200 TEU for the entire service, with 4 vessels.

Build	2003
TEU	814
Length	137.50m
Beam	21.30m
Draft	7.48m
Dead weight tonnage (dwt)	8,700
Gross Tonnage	7,519
Fuel (Propulsion) 14 kts	25 tons/day IFO 380
Fuel (Propulsion) 18 kts	33 tons/day IFO 380
Fuel (generators)	2 tons/day MDO

Table A.2: Vessel characteristics MV Lisa (Baum & Co, 2007)

Secondly, the feeder service will be based on the characteristics of the Damen Shipping Yard Container Feeder 800 class, currently operating for several container shipping lines, with Samskip as the most prominent user. These modern container feeder vessels are built in Romania, in order to reduce labor costs, but sold and designed by the Dutch Damen Shipping Yard for 22 – 24 million Euro each. One of the major advantages of this vessel is the capability to carry a mix of 20”, 40” and 45” containers on a short sea shipping or feeder operation. As these 45” containers are comparably to the standard container size offered by North American rail operators, it is possible that a feeder service has an additional effect in order to attract cargo. But as this model only looks at the maritime bounded containers, this effect will not be taken into account. When assuming a 7-day round trip voyage, the annual capacity per vessels will be 77,200 TEU and 154,400 TEU for the entire service, with 2 vessels if seasonality is excluded.

Build	2011
TEU	803
Length	140.60m
Beam	21.80m
Draft	7.30m
Dead weight tonnage (dwt)	9,340
Gross Tonnage	7,987
Fuel (Propulsion) 14 kts	22 tons/day IFO 380
Fuel (Propulsion) 18 kts	30 tons/day IFO 380
Fuel (generators)	2 tons/day MDO

Table A.3: Vessel characteristics MV Samskip Innovator (Damen Shipping Yard, 2012)

Mortgage costs

Because of limitation due to the St. Lawrence Seaway, there is a very limited amount of vessels capable of entering the system. Because of this, it is being assumed that in order to start a new service, vessels will have to be built in order to match the correct specifications and benefit from new technology. As data on MV Lisa (Maersk Falsterbo) is not available, it is assumed that the construction price of both MV Lisa and the Damen Container Feeder 800 is the same as these vessels are comparable. Based on information from Frost et al. (2005) and information from Damen Shipyards, the construction price of the vessel is set at 19 million Euros. This price will increase with 5% due to ice class specifications and after converting to U.S. Dollars, the price of this vessel is 26.0 Million U.S. Dollar.

Because of the current economic downturn and data from Frost et al. (2005) and information from Stopford (2009), the interest percentage will be set at 6% on an annual basis. Furthermore, it is assumed that the term of the mortgage is set at 17 years and is financed with 100% of rented money, which is comparable to regular operations.

Vessel Costs	25,935,000 U.S. Dollars
Term of mortgage	17 years
Interest percentage	6.0%
Monthly Payment	$ 203,100
Daily Cost	$ 6,770

Table A.4: Oceanic/Great Lakes transit time for Direct and Feeder services to Cleveland and Toledo

Operating costs

Next to the mortgage costs, operating costs is also assumed as a daily expenditure for vessel operations. Operating costs consist of crew, insurance, maintenance and administration costs and contain significant benefits with regards to the economies of scale. Research from HSH Nordbank, Ernst & Young and Econum from 2006 on the operating costs of German containerships show that the difference between a 1,200 TEU vessel (+- 4,600 USD/day) and an 8,500 TEU vessel (+- 7.00 USD/day) is only $ 2,400 U.S. Dollar per day. In the direct and feeder model, it is therefore assumed that the operating costs of an 800 TEU ship will be $ 4,000 U.S. Dollar a day. This number is, together with mortgage costs cross-referenced by looking at the charter rates for an 800 TEU vessel provided by Harper Petersen & Co in 2007 ($ 12,100 USD/day) and the Hamburg Index for 2011($ 10,867 USD/day), which both include mortgage costs.

Fuel price level

As figure A.1 and A.2 illustrate, over the last decade, the price of IFO 380, which is the main fuel used for ocean transportation, has exploded from $150 per ton to the current, relatively stable level of $700 per ton. Clearly, the fuel price has been an important factor for shipping lines. In order to cope with this rising cost of transportation, the shipping lines have introduced a bunker adjustment factor (BAF). Although shipping lines are not able to fully recover their bunker costs with this BAF charge, it is necessary to ask this surcharge from the customer in order to keep sailing with the current bunker price.

Figure A.1: Price per IFO380 tonnage between January 2003 and December 2007- Source: Poten & Partners Fuel oil Consultants weekly opinion December 21, 2007.

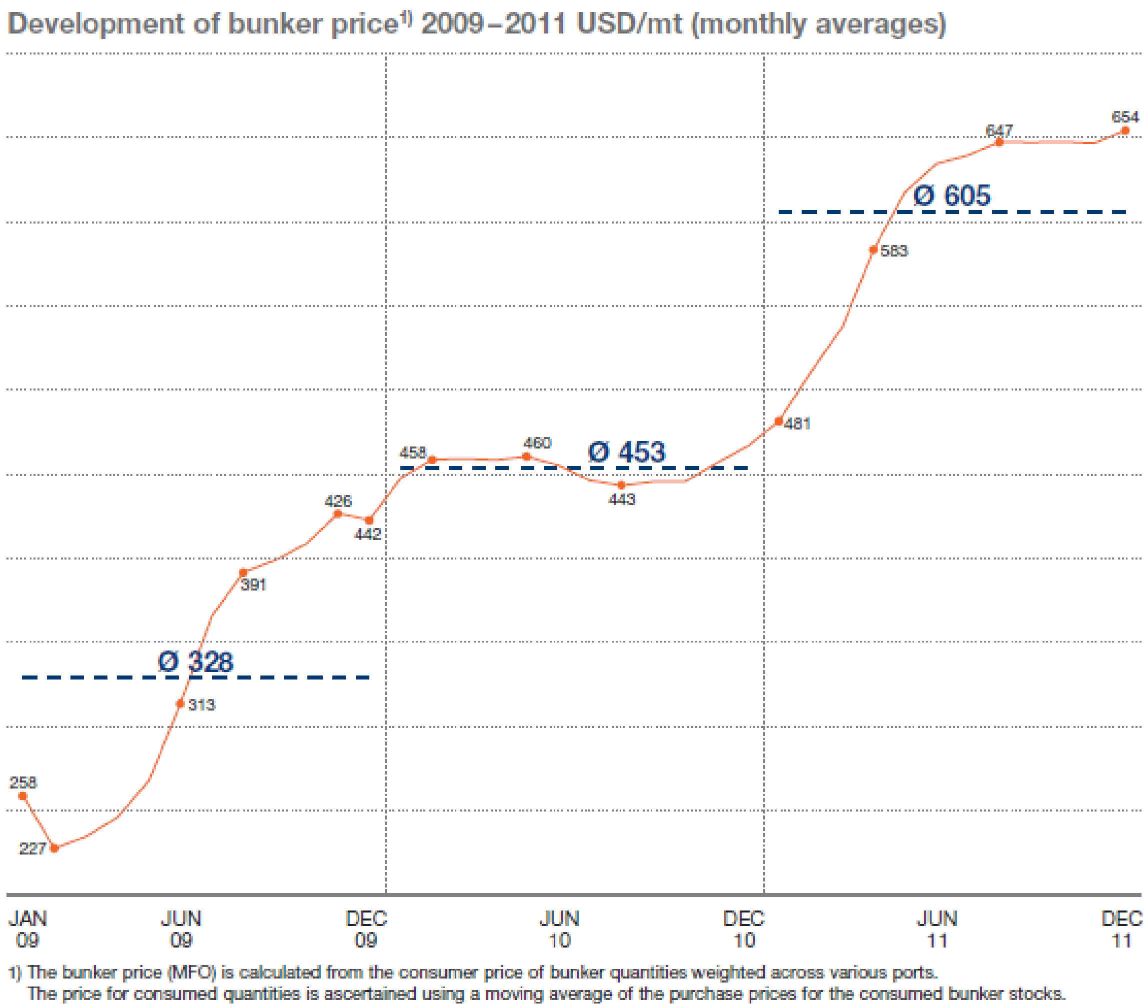

Figure A.2: Bunker fuel prices for Hapag-Lloyd between 2009 and 2011 per Metric Ton (Hapag-Lloyd, 2012)

In the direct model, analyzed in 5.2.2, the BAF has been included in the freight rate as it is a variable factor, related to the global economy. In order to create a good comparison, this BAF will also be included in the freight rate of the major shipping line services between Northwest Europe and the U.S. and Canadian Atlantic coast. In the direct and feeder model, the bunker fuel price IFO 380 is based on the global indexed price of 1 metric ton of IFO 380 on the 15th of November 2011 from the Bunker Index website http://bunkerindex.com/. Although this is a spot-rate, based on the daily market, its value corresponds with the average value of the second half of 2011. By using the global index provided by Bunker Index, regional effects are removed. Later on in this appendix, the effect of fluctuations in price level of IFO 380 with regards to the profit margin is being analyzed.

Secondly, in order to produce power for the generators on board of a container ship, Marine Diesel Oil (MDO) is required. Like the price trend in the IFO 380 market, MDO has become very expensive over the last decade exceeding the price of IFO 380 per ton. Unlike IFO 380, the MDO expenditure is completely financed by the container shipping line.

The following table A.5 shows the values used in the direct and feeder model, which are based on the indexed global spot-price on the 15th of November 2011 of IFO 380 and MDO per Metric Ton in U.S. Dollars.

	Price in U.S. Dollar ($) per Metric Ton
IFO 380	$ 700
MDO	$ 1,012

Table A.5: Bunker fuel price assumption, based on data from www.bunkerindex.com on 15th of November 2011

Exchange rate

To prevent the influence of exchange rate on the results, the model assumes a fixed exchange rate of 1 Euro=$1.30 U.S. Dollar, based on the average fluctuation in December 2011. Also the exchange rate between the Canadian and American dollar has been set to a fixed rate of $1.00 Canadian Dollar=$1.00 U.S. Dollar

Utilization and 20/40 ratio+weight+daily container costs

Another important factor in the economic feasibility of a new container service is the utilization rate. In order to become economically viable, sustainable utilization rates should be targeted under full capacity, but high enough to cover the costs involved versus other services. Another important issue with the utilization rate of a new service is the financial situation of the container shipping line. In the start-up level it is assumed that a new service, which is not an addition to the network like another Asia-Europe service, but entirely a Greenfield service, should be at least break even in the competitive container shipping network. Figure A.5 shows the effect of utilization rate on profitability for the direct service. For the comparison between existing and new services, it is assumed that the utilization rate will be 70% in the long term. Although this number is not supported by market research, in the end it depends on both the willingness of the shipping line and the local economic factors on both sides, it is a fair assumption in comparison with the economic cycles in global trade. Because of the stability of transport volumes between the U.S. and Europe, the model assumes a homogeneous utilization rate for the entire roundtrip voyage.

Next to the utilization rate is the ratio between 20 feet containers (TEU) and 40 feet containers (FEU). Because all major container shipping lines and ports publicize its statistics based on the TEU measurement it is difficult to determine the TEU/FEU ratio on a certain route, but it is a necessary value in analyzing a new direct or feeder service. To cope with this problem, a calculation has been made based on the specific Europe-North America statistics from the ports of New York/New Jersey, Norfolk, Rotterdam and Bremerhaven, which also provide the number of lifts.

Table A.6 shows the nominal and percentage values of TEU and FEU for these four ports, specified on the US-Europe and vice versa market in 2010. Based on these numbers, the direct and feeder models assume a 25%/75% split between 20" and 40" containers on the transatlantic route.

	# of TEU	# of FEU	% TEU	% FEU
Norfolk	266,455	814,281	25%	75%
NYNJ	860,770	2,215,625	28%	72%
Rotterdam	954,286	3,535,670	21%	79%
Bremerhaven	484,000	1,035,000	32%	68%

Table A.6: TEU/FEU Ratio for 4 ports, based on their annual volumes between the U.S. and Europe (and v.v.) in 2010

For determining the St. Lawrence Seaway tolls and the harbor dues in the port of Cleveland, the average weight of a container is required. Not only is the cargo inside the container the most important factor, after all a container full with feathers is lighter than a container with bricks, other uncertainties are playing a role. Another important aspect is that although a FEU has twice the volume of a TEU, the extra metal required to build this container, limits the maximum cargo tonnage. Furthermore, because of the lack of data on the average weight of a container for the specific US-Europe market and the lack of information on this topic in business articles, presentations and academic literature it was very difficult to make an assumption on this tonnage. But based on figures from the port of Antwerp (12.96t/TEU) and Maersk (Which uses 14t/TEU as guideline), the model has assumed an average weight of 13 ton per TEU. In Table A.7, the assumed tonnage per container, maximum net cargo tonnage and the ratio between the two will be shown.

	Assumed	Maximum cargo	Ratio
20" (TEU)	13.0 Metric Ton	21.6 Metric Ton	60.2
40" (FEU)	20.0 Metric Ton	26.5 Metric Ton	75.4

Table A.7: Assumed Cargo vs. Maximum Cargo for TEU and FEU containers (Based on data from Port of Antwerp and Maersk)

Another important aspect in the container shipping business is the daily container costs. These daily container costs, shown in Table A.8 based on Stopford (2009) and UNCTAD (2010), are related to the either the cost of leasing or the cost of ownership of such an ocean container. But, this amount does not cover the potential replacement costs for a new container. The model assumes that this cost is covered by the profit margin which has been determined.

	Daily Cost of a Container
20" (TEU)	$ 0.60
40" (FEU)	$ 1.10

Table A.8: Daily Cost of a container, based on Stopford (2009)

On a global scale, empty containers have proven to be a big issue for container shipping lines as a result of trade imbalances. On the Transatlantic, the trade balanced has been imbalanced, with the westbound trade as dominant leg. In order to cope with these imbalances, container shipping lines are often offering discounts in terms of freight rate to minimize the costs involved with empty container repositioning. Although the cost of repositioning is dependent on various uncertain and undeterminable factors as demand, container location and cost of hinterland transportation, the model expects that it costs $ 500 per container. Comparable research by Drewry (2002), Konings (2005), Veenstra (2005) and the USSEC (2006), has provided numbers within the $ 400-$ 850 range for empty container repositioning. When looking at the USA-market, several ocean-carriers published the cost of moving an empty container from the storage yard towards a hinterland destination. For the U.S. Midwest, this is averaged at $ 550. From a shipping line perspective, it is economically interesting to offer a discount to shippers on the North America – EU route, as filled discounted containers are still more profitable than moving an empty container. When looking to historical data on freight rates provided by the UNCTAD (2010), this view is supported by looking at the freight rates on both routes. Therefore the model assumes a discount of $ 500 from the westbound freight rates in order to balance the trade flow.

Transportation rate model

The transportation rate model is based on the inputs of the direct model, feeder model and various data provided by the major ocean shipping lines on the Atlantic route. This transportation model will, unlike the direct and feeder model, orientated from a shipper's perspective. The direct and feeder model will provide, under their specific assumptions, an ocean and feeder rate, which are being analyzed in a door-to-door transport chain perspective. These rates, together with the rates of hinterland transportation on both sides of the Atlantic, will be compared to the rates from existing services. As transportation rates are the main focus in this model, the choice of hinterland transportation will be decided from a rate-orientated focus, assuming time is not a decisive factor as this could be taken into account in the supply chain of the shipper/consignee.

For European hinterland transportation rates, several Atlantic ocean carriers has been consulted as well as the operators of scheduled barge and rail services as well in order to verify the this data with regards to the rates asked on the public market. With regards to this data one remark has to be made. Although the ocean carriers have been able to quote the rate to all four ports, one has to bear in mind that it is also related to other scheduled services like Asian trade routes. For instance the hinterland rates quoted by Maersk (which could be lower than Hapag Lloyd), which does not have a scheduled service between Antwerp and Montreal, will not be taken into account when looking at an EU-Antwerp-Montreal-US scheduled service route. Because of the lack of information from MSC, which does not organize its hinterland transportation itself, a value for hinterland transportation had to be determined by taking the average rate of hinterland transportation of Maersk and Hapag-Lloyd to the European ports. For MSC, the price of hinterland transportation in Europe is being assumed to be the average of the quoted hinterland transportation rates from Maersk and Hapag Lloyd.

With regards to the ocean freight rates quoted a distinction has been made between a potential direct service and existing services. Formula (4) consists of the formula of the total ocean freight rate for the existing direct services between the Northwest-European and North American ports as previously mentioned. For data on the Total Ocean Freight Rate for existing services, the three largest shipping lines on the Atlantic route, Maersk, MSC and Hapag Lloyd are consulted. Like the price of IFO 380, the model uses data on freight rates and bunker adjustment factors based on the 15^{th} of November 2011 to provide a clear comparison with the direct model, which is also based on the 15^{th} of November 2011. Although freight rates are known for their fluctuations throughout a year, based on supply and demand, it is impossible to predict these fluctuations because of its relationship with global economic development, oil price fluctuations and other external factors.

$$TOFR = OFR + BAF + THCO + THCD + SCO + SCD \qquad (4)$$

$$TOFR = Total\ Ocean\ Freight\ Rate$$
$$OFR = Ocean\ Freight\ Rate$$
$$BAF = Bunker\ Adjustment\ Factor$$
$$THCO = Terminal\ Handling\ Charge\ Origin$$
$$THCD = Terminal\ Handling\ Charge\ Destination$$
$$SCO = Security\ Charge\ Origin$$
$$SCD = Security\ Charge\ Destination$$

Also for the price of hinterland transportation, the three largest Atlantic Ocean carriers have been consulted. Although this limits the scope to contracted trucking companies, it also takes the market power of these ocean carriers into account, by offering their services with a discount.

In the case of hinterland transportation originating from Cleveland, a base charge of $ 200 has been chosen for deliveries in the Cleveland region from the port of Cleveland and for deliveries from the rail terminals across the U.S. Midwest. For all other truck deliveries, the model assumes the input from the ocean carriers, but if this is lacking an assumption based on the U.S. National Transportation Statistics have been made. In their most recent report on the trucking industry from 2007, the U.S. Department of Transportation and Census estimates the average revenue per ton-mile at $ 0.1654 per ton per mile. By implementing the 20 ton per FEU assumption, this would lead to a price of $ 3.308 per mile for trucking.

Next to the option of trucking, hinterland transportation from the port of Cleveland has also been possible by rail. In order to determine the rail rates, data on the total annual intermodal revenue and the total annual intermodal ton-miles transported have been collected in the financial reports of Norfolk Southern, CP and CSX Rail from 2011. Because market power of the ocean carrier plays an important role in the determination of the rail rates in the contract, it is assumed that these rates are subject to discounts and have already been accounted for in the financial report. Next to these options, the implementation of a potential feeder service between Montreal and the ports of Cleveland and Toledo are investigated. Like the direct model, Paragraph 5.2.1 will provide an in-depth analysis on the freight rate required, based on all data and assumptions previously mentioned.

Based on all these inputs, the analysis will be done from a door-to-door transportation rate perspective, leading to the construction of formula (5).

$$Total\ transportation\ rate_{Existing} = Hinterland\ EU + TOFR_{existing} + Hinterland\ US + HMT \qquad (5)$$

Container value and Harbor Maintenance Tax assumption

The baseline for this analysis is focused on the current situation with regards to transportation rates, taxes and other factors contributing to the total rate for transportation from door-to-door on the 15th of November. The baseline transportation rates consist of the rate of hinterland transportation in Europe, the Total Ocean Freight Rate (TOFR) as previously explained, the Harbor Maintenance Tax and the hinterland transportation rate in the United States.

For the Harbor Maintenance Tax (HMT), three specific values are used to cover the transportation of Chemicals, High Valued Goods and Car Parts. For Chemicals and High Valued goods, data from the Central Bureau of Statistics (CBS) in The Netherlands have been consulted. Although the analysis will be done on cargo originating from Germany and Switzerland, it is fair to use data from The Netherlands as the value of these goods are assumed to be near equal on the European continent. For Chemicals (NSTR 8), the CBS assumes a value of € 1.03 per kilogram for European exports to America, based on the export volume and value. By using the assumption of 20 ton per 20” ISO tank container and the exchange rate, the assumed value of a container with Chemicals would be $

26,780. For High Valued Goods (NSTR 9), the CBS assumes a value of € 8.89 per kilogram for European exports to America, based on the export volume and value of the so-called “Other goods and manufacturers” in the NSTR classification.

By using the assumption of 20 ton per 40” container and the exchange rate, the assumed value of a container with High Valued Goods would be $ 231,140. Based on information provided by the Journal of Commerce/Mongelluzzo (2012) on the Asia-US market, the value of a 40” container with car parts is estimated at $215,000. Furthermore, it is assumed that the value in a 40” container with car parts is globally stable, regardless of the trade lane. The HMT on all imports in the United States has been set at 0.125% of the value of the content of the container and the bulk product, imported through an American port. The presence of this HMT has led to being a contributing factor in both the ocean and hinterland decision making of a shipper. If the shipper decides to import through the port of Montreal and transport it through rail into the U.S. Midwest, the company does not have to pay a HMT, unlike using the U.S. East Coast and Great Lakes ports. For more in-depth information on institutional aspect of the HMT, the second part of this study, by Haazen (2012), will provide an oversight on regulatory barriers of the HMT. Table A.9 provides the assumed HMT for the three product-categories in the baseline, direct and feeder model with a stable HMT-percentage of 0.125%

	HMT	Source
Chemicals	$ 33.48	CBS (2009)
High Valued Goods	$ 288.93	CBS (2009)
Car Parts	$ 312.50	Journal Of Commerce (2012)

Table A.9: HMT for European Exports in three product-categories based on CBS and Journal of Commerce data.

Research by Haazen (2012) has shown that the Harbor Maintenance Tax is a national tax and incomparable with its Canadian competitors. As information provided by the Canadian ministry of Fisheries and Ocean shows, a charge of 0.0439 US Dollars are charged as per gross ton of the vessel destined for dredging of the St. Lawrence River. For the direct service into the Great Lakes as well as the existing service to Montreal, this would lead to a one-way charge of $ 350 for the entire vessel. Assuming a utilized capacity of 700 TEU, this would be only $ 0.50 per TEU and therefore diminishable in the analysis. Furthermore dredging in the Canadian part of the St. Lawrence Seaway system is funded by the income from the tolls charged by the St. Lawrence Seaway Management Corporation. For existing services, the way of financing dredging operations differs based on the port and port structure. As financial information on the Canadian ports is not publicly available it is assumed that the dredging funds come from a port level basis, through three types of charges: wharfage fees, dockage fees and the income gained from renting out land to the terminal operators.

For the existing services to Canadian ports, this amount has been internalized through the terminal handling charged.

The most important factor in the baseline of existing services as well as in all scenarios is the ocean freight rate. As indicated before, this is assumed on the routes between 4 European ports to 4 North-American ports for three ocean carriers. Another factor contributing to the total transportation rate for the chain are the hinterland rates on both sides of the ocean. As previously mentioned, the European hinterland consists of 4 regions/cities spread throughout Germany and Switzerland. Table A.18 and A.19 gives a compiled overview of the hinterland transportation rates in Europe and Table A.20 A.21 provides this for North America. Because the first part of the analysis is based on the tariffs of moving a container through the transportation chain, the cheapest option is leading and the preferred mode of choice and marked with green.

Pilotage rate, tolls, harbor dues and government charges

Pilotage in the port of Rotterdam is being performed by an organization called Het Loodswezen and is based on the draft in decimeter of a vessel. Based on data from Het Loodswezen, it is assumed that for pilotage in the port of Rotterdam, € 1,921 is being asked per entry or exit of the port. For both the port of Cleveland and Toledo, a pilotage rate is set by the U.S. Coast Guard and differs per port. In the case of Montreal, this rate is set by its Canadian counterpart. As shown in Table A.10, the difference between Cleveland and Toledo is quite big as a consequence to the very shallow southeast shoal near Toledo. Table A.10 shows the pilotage rates for these 4 ports.

Rotterdam	$ 2,497
Montreal	n/a
Cleveland	$ 609
Toledo	$ 2,389

Table A.10: Port Pilotage (Based on data from the Loodswezen website and the U.S. Coast Guard information)

Next to the port-pilotage, pilotage is offered on the Great Lakes, in the Welland Canal and on the St. Lawrence River. In the model it is assumed that the feeder service will be operated by either a U.S. or Canadian company and the captain and first mate are exempted from pilotage throughout the St. Lawrence Seaway system and that the costs of acquiring an exemption are neglected. In contrast to the feeder service, a direct service will require pilotage on the Great Lakes, but only where the draft of the vessel is close to the depth of the lake, namely Lake Erie.

First of all, on the St. Lawrence River between Les Escoumins and Quebec (District 2) and Montreal to Quebec (District 1) it is necessary for foreign flagged vessel to use pilotage from the governmental Laurentian Pilotage Authority. This authority calculates their pilotage rates based on 2 factors. First of all, the physical characteristics of the vessel play a role in determining the amount of pilotage units necessary. These units are multiplied with a district factor. Secondly, the pilotage consists of a fee based on the time necessary to sail through the river between Les Escoumins and Montreal. Also these time units are multiplied with a district factor. Table A.11 will provide the require fee for pilotage for 14 and 18 knots foreign flagged.

After reaching Montreal, pilotage will switch from the Laurentian Pilotage Authority to pilotage offered by pilots who are either associated with the Canadian Great Lakes Pilotage Authority (GLPA) or the American St. Lawrence Seaway Pilots Association (SSPA). Because these two organizations are allowed to operate in bi-national waters, it is not necessary to change pilots when crossing borders. The rates for the St. Lawrence River and Welland Canal are related to both distance and the amount of locks passed. After sailing through the St. Lawrence River, Lake Ontario will be the first lake visited. Because of its deep water, it is undesignated water, so pilotage is not necessary, but will require pilotage in the Welland Canal. The next lake that will be visited after the Welland Canal is the shallowest lake in the system, Lake Erie. Although pilotage is not required as it are undesignated waters, it is assumed in the model that for the direct services it will be necessary to have a pilot on board as the crew is unfamiliar with the waters. This pilotage is based on 6-hour blocks of sailing. Because of the distance between the Welland Canal and Toledo, it will require an additional unit of pilotage versus Cleveland.

Laurentian Pilotage	14 knots	18 knots
Pilotage Units	$ 2,184	$ 2,184
Time Factor Units	$ 2,417	$ 1,912
Pilotage Seaway	**Cleveland**	**Toledo**
St. Lawrence River + Welland Canal	$ 15,313	$ 15,313
Lake Erie	$ 1,582	$ 2,273

Table A.21: Laurentian and Seaway pilotage (Based on own calculations from U.S. Coast Guard, LPA and GLPA information)

For more in-depth information on institutional aspect of the pilotage regulation, the second part of this study, by Haazen (2012), provides an oversight on the bi-national regulatory barriers.

Next to pilotage, the payment of harbor dues and tolls are required for the majority of existing services. These harbor dues and tolls are applicable to both a feeder service and a direct service. In the port of Rotterdam harbor dues are related to the gross tonnage of a vessel which is multiplied by a service-factor in determining the harbor dues. Next to this, the tonnage of transshipped containers is being multiplied with a container-factor. Also the port of Cleveland characterizes itself by such a method based on weight and type of goods. Different to the port of Cleveland and Rotterdam, the port of Toledo authority does not charge harbor dues by itself. These harbor dues are charged by Midwest Terminals, the main concessionaire of terminal operation. The harbor dues charged by Midwest Terminals are based on a percentage of the revenue on product handling and vary per customer. Based on information from Midwest Terminals and comparing harbor dues with the port of Cleveland, a 6% fee for wharfage is assumed. Furthermore, a dockage fee of $ 889.20 per 12 hours will be charged by Midwest Terminals. Due to the lack of information from the port of Montreal, it was not possible to predict the harbor dues for a feeder service to Cleveland/Toledo. As a result of this, it has been assumed a fixed fee of $ 5,000, based on the level of harbor dues in the ports of Cleveland, Toledo and Rotterdam. Although this is a rough assumption, the amount of $ 5,000 only has a limited effect on the economic feasibility on the direct service and feeder service model. An in-depth calculation for the harbor dues of Cleveland, Toledo and Rotterdam will be given in a later section of this appendix.

	Direct	Feeder
Rotterdam	$ 6,188	X
Montreal	X	$ 5,000
Cleveland	$ 5,541	$ 5,553
Toledo	$ 4,940	$ 4,940

Table A.123: Harbor Dues (Based on own calculations from information provided by the Port of Rotterdam authority and the Port of Cleveland websites and Midwest Terminals information)

For transiting the Welland Canal, the payment of tolls is required in order to finance maintenance of the Seaway. These tolls consist of 4 parts: gross tonnage charge, the cargo charge, the passenger charge and lockage charge. Because this model focuses on cargo transportation, the passenger charge is not accounted for, as crew is exempted from this charge. In order to attract cargo, the St. Lawrence Seaway Management Authority has introduced several business incentives based on cargo volume, new business and additional service totaling a maximum of 50%. In this model, these incentives will not be taken into account due to the fact that most of them are temporary of use, if the service does not provide enough grounds to improve on an annual basis. To give a comparison, Table A.13 gives both the total tolls for transiting the Welland Canal and the various applicable discounts based on a 70% utilization rate.

	Direct	Feeder
Seaway Toll (one way)	$ 14,174	$ 14,242
New Business Incentive	$ 2,835	$ 2,848
Volume Rebate Incentive	$ 1,417	$ 1,424
Service Incentive Program	$ 2,835	$ 2,848

Table A.43: Seaway tolls based on a one-way voyage under the assumption of 70% utilization rate and previous mentioned container ratio assumptions (Based on information from the St. Lawrence Seaway Management Corporation website)

In addition to these tolls and harbor dues, the Canadian government has a $ 391 governmental charge for marine services as estimated in Frost et al. (2005). In the model, it will be assumed that this charge will be charged for 2 days as total in the case of the roundtrip of a direct service and 4 days in case of a feeder service. Further elaboration on the calculation of harbor dues and tolls will be provided in Tables A.14, A.15 and A.16.

Harbor Dues and Tolls In-depth analysis

The harbor dues in the port of Rotterdam consist of two parts: one in correspondence with the gross tonnage of the vessel and the other with the loaded/unloaded cargo. In order to determine the gross tonnage harbor dues, the gross tonnage of the container vessel is multiplied by € 0.24 per ton leading to a sum of € 1,884.48 for the vessel in the direct service, or $ 2,449.82 in dollars.

Additionally, the cargo harbor dues that are charged are related to the total weight of the containers that are transshipped through the port, multiplied by € 0.475 per ton. Under the assumption of a 70% utilization rate as well as a 25/75 TEU-FEU ratio and 13 ton/TEU and 20 ton/FEU weights, this would lead to a charge of € 2,875.175 or $ 3,737.73.

For the port of Cleveland, harbor dues are consisting of a charge for the dockage of the vessel and the wharfage, comparable to the port of Rotterdam system. For the dockage of the vessel, the port of Cleveland charges an amount of $ 0.09 per 24-hour period, multiplied by the gross tonnage of the vessel, leading to an amount of $ 707 per day, which is lower than Rotterdam. But the factor of the wharfage part of the harbor dues is higher than Rotterdam, at $ 0.80 per ton for container transportation. By using the previously mentioned container assumption, this leads to a wharfage charge of $ 4,834.

For the port of Toledo, a different structure is noticeable. Unlike the port of Rotterdam and Cleveland, it is the terminal operator who sets the charge for dockage and wharfage. The dockage in the port of Toledo is higher, at a level of $ 889.20 per 12-hours. As unloading and loading the vessels takes approximately 17 to 20 hours, a charge of $ 1,778.40 in accounted for. The wharfage is also different than most ports. As this is set by the terminal operator, they are able to vary with this amount and sometimes include this in the container handling charge and are based at a percentage of the revenue. For the direct and feeder service, an assumption of 6% of the revenue will be assumed as being a wharfage fee, leading to an amount of $ 3,162.

Additionally to the harbor dues, a toll has to be paid for using the St. Lawrence Seaway system. This toll is specified into several charges for the gross tonnage of the vessel, cargo volume in terms of tonnage and a lockage charge. First of all, the vessels gross tonnage charge. This charge can be calculated by multiplying the gross tonnage of the vessel times $ 0.2512 per ton. As the weight of the vessels used for the direct and feeder service differ, table A.14 will provide the calculated values. Secondly, a cargo charge of $ 1.6846 per ton is charge for both 20" and 40" containers. Under the assumptions made on container weight, ratio and utilization rate, this leads to a charge of $ 3.077 for the TEUs and $ 7.102 for FEUs on board per passage of the Seaway system. Finally, a lockage charge based on the gross tonnage of the vessel is charge of $ 0.2575 per ton.

	Direct service	Feeder Service
1.1 Gross Tonnage Charge	$ 1,972	$ 2,006
1.2 Cargo charge 20"	$ 3,077	$ 3,077
1.2 Cargo charge 40"	$ 7,102	$ 7,102
1.3 Passenger charge	n/a	n/a
1.4 Lockage charge	$ 2,022	$ 2,057
Total	$ 14,174	$ 14,242

Table A.14: Seaway tolls in-depth analysis based on a one-way voyage under the assumption of 70% utilization rate and previous mentioned container ratio assumptions (Based on information from the St. Lawrence Seaway Management Corporation website)

Pilotage fees In-depth analysis

While the amount of U.S. Dollars for pilotage is fixed in the port of Rotterdam based on the draft of the vessel at $ 2,497, pilotage in the Laurentian part of the St. Lawrence Seaway between Les Escoumins and Montreal uses another system. First of all, the pilotage area has been split into two parts, Les Escoumins and Quebec (District 2) and Montreal to Quebec (District 1). The pilotage tariff of the LPA consists of two parts: a pilotage unit tariff based on the characteristics of the vessel and a time factor tariff which is both based on the vessel characteristics and the sailing time.

$$LPA\ pilotage\ unit\ tariff\ (in\ CAD) = \frac{Beam^2\ x\ draft}{100}\ x\ District\ factor \qquad (1)$$

This formula, applicable for both districts is then multiplied with a factor of 40.17 Canadian Dollars for District 1 and 24.2 Canadian Dollars for district 2.

Additionally, a time factor is applicable to the pilotage on the Laurentian part of the Seaway system. The outcome of this time factor is dependent on the draft of the vessel, multiplied by the amount of hours required for sailing in these two districts. This is characterized by the following formula:

$$LPA\ time\ factor\ tariff\ (in\ CAD) = draft\ x\ required\ sailing\ time\ x\ district\ factor \qquad (2)$$

In this formula, a district factor of 19.77 Canadian Dollars is applied for District 1, while District 2 has a district factor of 13.93 Canadian Dollars.

Pilotage Units	34		
	14 knots	18 knots	Factor
Time Factor District 1	$ 1,479	$ 1,183	19.77
Time Factor District 2	$ 938	$ 729	13.93
Pilotage Units District 1	$ 1,363	$ 1,363	40.17
Pilotage Units District 2	$ 821	$ 821	24.2
Total	$ 4,601	$ 4,097	

Table A.15: Laurentian pilotage tariff (Based on information from Laurentian Pilotage Authority website)

After passing the port of Montreal, pilotage is required for all vessels if the captain or first mate does not possess the correct licenses for sailing on the Great Lakes. For the direct model, it is assumed that the crew is not in possession of the correct license, while for a feeder service this is the case. Therefore, the pilotage charges for the Great Lakes are only applicable to the direct service.

Also for the pilotage charge in the Great Lakes, size is a contributing factor to the level of the pilotage charge. In order to determine the required amount of pilotage units the following formula is used:

$$Pilotage\ Units\ GLPA = \frac{Length\ (m)\ x\ Draft\ (m) x\ Breadth\ (m)}{283.17} \qquad (3)$$

This amount of pilotage units then subsequently leads to a weighting factor. Based on the specifications of the vessel used for a direct service, the amount of pilotage units leads to a weighting factor of 1.15. After passing Montreal, the first district that the vessel will need to pass is the Cornwall district from the St. Lambert Lock near Montreal. For this Cornwall district an amount of $ 4,047 (Multiplied by 1.15 results in $ 4,654 in total) is charged as a basic charge representing the entire voyage from the Eastern entry into the district till St. Regis.

After passing St. Regis, the vessel will be in international waters in International District 1, from St. Regis to Wolfe Island. For this district, the distance as well as the amount of locks passed is decisive for the pilotage charge in this district. For the locks, a base charge of $ 380 per lock is charged, added with a charge of $ 28.52 per statute mile sailed. The International District 1 from St. Regis to Wolfe Island is 109 miles of length and equipped with 3 locks. This leads to a total base charge of $ 4,139.50 ($ 4,760.25 after the weighting factor is applied). But regulations have fixed the total base charge at a maximum of $ 3,657. After applying the weighting factor, an amount of $ 4,206 is charged for transiting International District 1.

Following this district are the undesignated waters of Lake Ontario. Although pilotage is not compulsory, in this area, a direct service would most likely use this pilotage service as the crew is unknown with the area. For this undesignated water a charge of $ 906 per six-hour period is charged resulting in a $ 2,084 total charge for crossing Lake Ontario to the entrance of the Welland Canal.

The Welland Canal is defined as being International District 2. For the Welland Canal, a base charge of $ 3,800 is used, resulting in a total of $ 4,370 after applying the weighting factor. After exiting the Welland Canal, the direct model will use pilotage offered by the United States Coast Guard. Like the undesignated waters in Lake Ontario, also the waters of Lake Erie are mostly assigned as undesignated waters. In order to reach the ports of Cleveland and Toledo, respectively 2 and 3 six-hour periods are charged at an amount of $ 791.

Pilotage Units	**70.9**	
	Cleveland	**Toledo**
Cornwall District 1	$ 4,654	$ 4,654
International District 1	$ 4,206	$ 4,206
Undesignated waters Lake Ontario	$ 2,084	$ 2,084
International District 2	$ 4,370	$ 4,370
Undesignated waters Lake Erie	$ 1,582	$ 2,373
Total	$ 16,896	$ 17,687

Table A.16: US and Canadian Great Lakes pilotage tariff (Based on information from GLPA and US Coast Guard website)

The final step in the voyage is the pilotage to and from the ports. As a result of the location of the port of Toledo, west of the Southeast Shoal, an amount of $ 2,389 is charged for pilotage to Toledo, while the vessels destined for the port of Cleveland are only charged with $ 609 per pilotage request.

Historical transatlantic freight rate development

Over the last decade, the ocean freight rate on transatlantic services has been fluctuating severely with a difference of $ 800 between Q1 1996 and Q3 2006 for Europe-North America cargo and $ 1,000 between Q1 2004 and Q4 2008 for North America-European trades as Figure A.3 illustrates. Nonetheless there are interesting aspects to be discovered based on this historical data. Between the freight rates of the westbound and eastbound service there has been historically been a difference of approximately $ 500 between 2001 and 2007 in the favor of the westbound service. But as a result of the U.S. financial crisis in the end of 2007 and 2008, demand for ocean services has declined in terms of volume in the period after 2007. Because producers and consumers have not been able to predict this financial meltdown and the consequences on consumption, adjustment in terms of production volume and the demand for transportation services face an economic lag situation. As the United States is considered to be a consumption nation with higher imports than exports, the volume on Europe-North America trade faced a considerable impact with a decline of 19.3% between 2008 and 2009. As a result of this, ocean carriers were forced to lower the freight rate even further, as vessels were no longer able keep economically sustainable levels of utilization rate. Furthermore with the increasing bunker price, the ocean carriers saw their profits drop to a minimum, even deep into the red figures.

As the westbound trade route has proven to be leading in terms of volume for nearly two decades, ocean carriers have been quoting low freight rates on the eastbound trade route, in order to cover their costs. When looking at the historical freight rate and volumes it proves that in order to have a lower the freight rate on eastbound routes, the westbound route should transport 1 million containers more than the eastbound route. When looking in depth to the trade volumes, it should be noted that the North-American to Europe trade route has faced a lesser decline than its westbound counterpart. As the European economy was also impacted by the financial crisis, ocean carriers faced the situation of declining demand on both sides of the Atlantic while also facing higher bunker costs. To fight this trend, their first decision has been to increase the freight rate on the eastbound service with approximately 30% while keeping the EU-US freight rate equal. Another reason for the declining volume could be the strong position of Euro during 2007-2008, as uncertainty on the markets led to appreciation of the Euro currency versus the US Dollar. As this exchange rate shifted in favor of the Euro dramatically, European imports in North-America have become more expensive for companies in the U.S.. As North-America-European transportation would most likely be paid by European companies, the stronger Euro could have impacted this enormous increase.

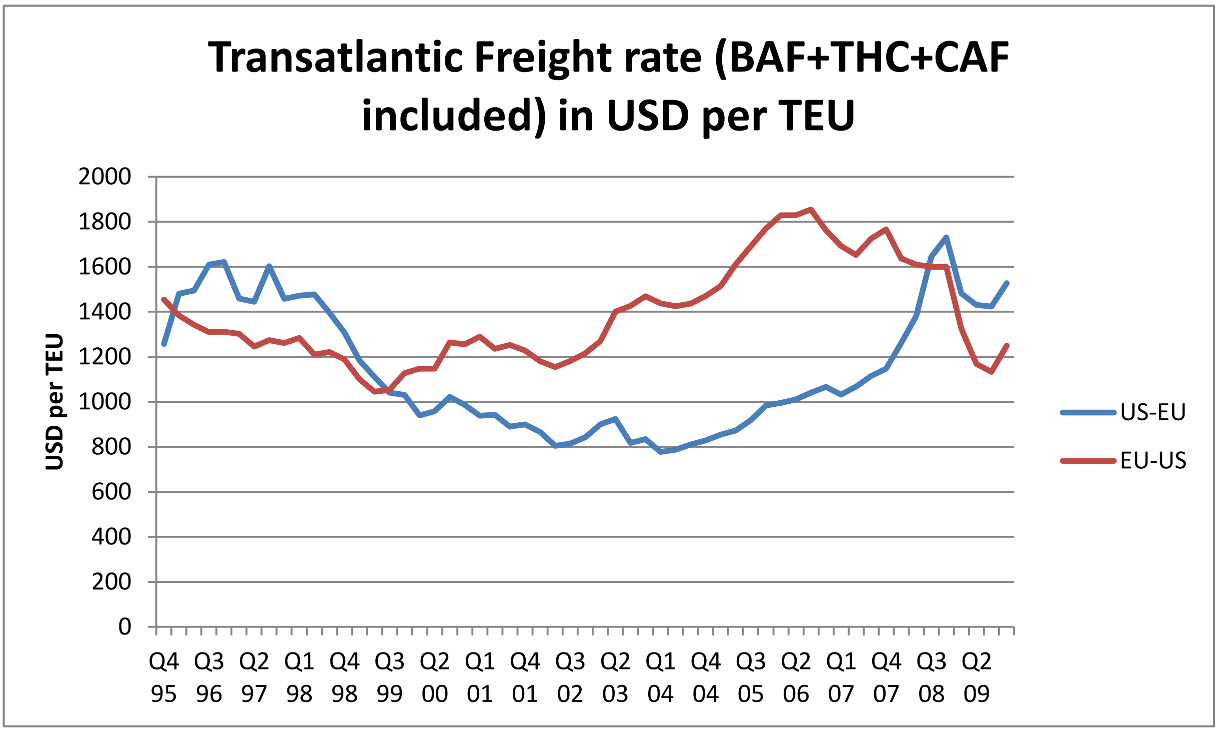

Figure A.3: Total operational ship costs per round-trip (Based on own calculations from the direct/feeder model)

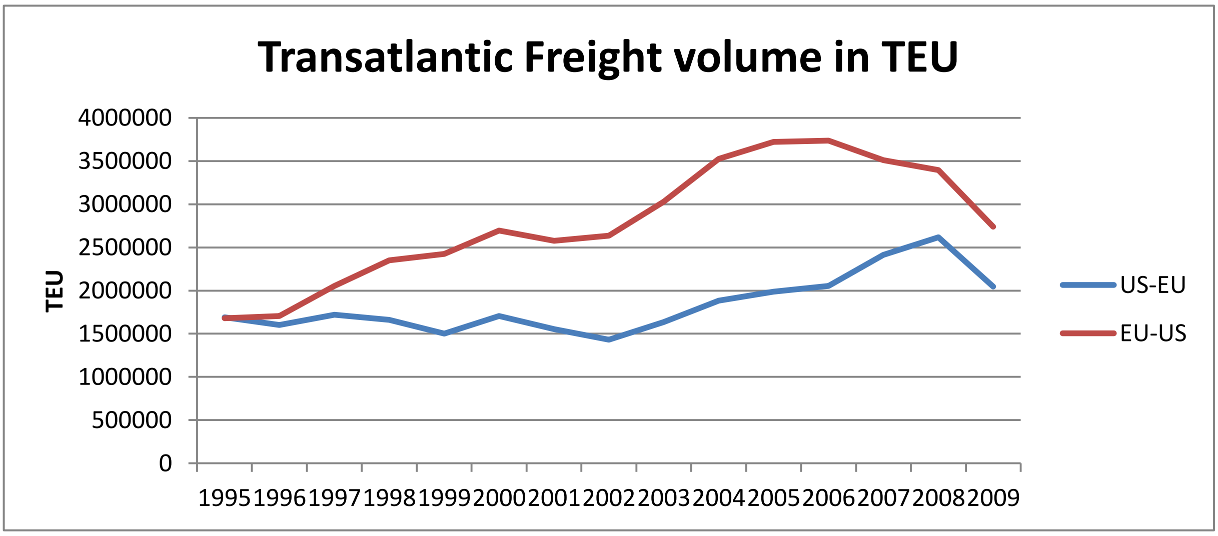

Figure A.4: Total operational ship costs per round-trip (Based on own calculations from the direct/feeder model)

With regards to the future development of the freight rates and volumes there are a lot of uncertainties, but in general it is expected that the Euro zone will pick up again on container volume after the double-dip recession and the Euro crisis are solved, while the North American demand for (import) transportation services will stay stable around the pre-2007 situation as indicators like the balance of trade for the United States for 2011 and 2012 already shows.

Baseline transportation rates

The baseline transportation rates for the direct and feeder models consist of the rate of hinterland transportation in Europe; the Total Ocean Freight Rate (TOFR) as explained in this Appendix contains the Harbor Maintenance Tax and the hinterland transportation rate in the United States. The direct service model looks specifically at the port of Rotterdam as transportation node in the transportation chain and will have to compete with existing services between the ports of Rotterdam, Antwerp, Hamburg and Bremerhaven and the ports along the Atlantic coast of Canada and the United States. Because unknown information on the percentage of containers loaded and unloaded per vessel in a specific scheduled route, for instance a vessel arriving on the 1st of January in the port of Antwerp, it is assumed that the direct service only has one call on either side of the ocean where the vessel is loaded or unloaded entirely.

As it is a new service route, because container transportation on the Great Lakes is not common, it can be initiated by all ocean carriers interested to operate this service. Therefore, the price of hinterland transportation is an unknown variable, because not only Maersk, MSC or Hapag-Lloyd can start this service, but also the smaller ocean carriers like Samskip, APL or ACL. To analyze this potential service, the price of hinterland transportation in Europe is based on the average transportation rate from Maersk and Hapag-Lloyd. Tables A.18 and A.20 shows the average transportation rate per modality for the locations in the model, to the port of Rotterdam, with the light-green colors marking the cheapest option, which will be used in this model.

MAERSK (TEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	$2,099.00	$2,092.00	$2,099.00	$2,095.00
Antwerp	$2,058.70	$2,051.70	$2,058.70	$2,054.70
Hamburg	X	X	X	X
Bremerhafen	$2,127.60	$2,120.60	$2,127.60	$2,123.60

MAERSK(FEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	$2,509.00	$2,502.00	$2,579.00	$2,575.00
Antwerp	$2,468.70	$2,461.70	$2,538.70	$2,534.70
Hamburg	X	X	X	X
Bremerhafen	$2,537.60	$2,530.60	$2,607.60	$2,603.60

Hapag Lloyd(TEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	X	$2,234.05	$2,578.05	$2,539.80
Antwerp	$2,189.70	$2,234.05	$2,526.70	$2,488.45
Hamburg	$2,254.70	$2,247.70	$2,591.70	$2,553.45
Bremerhafen	$2,234.70	X	X	$2,553.45

Hapag Lloyd(FEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	X	$2,917.05	$3,446.05	$3,372.80
Antwerp	$2,872.70	$2,917.05	$3,394.70	$3,321.45
Hamburg	$2,937.70	$2,930.70	$3,459.70	$3,386.45
Bremerhafen	$2,937.70	X	X	$3,386.45

MSC(TEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	X	X	X	X
Antwerp	$2,091.70	X	$2,116.20	$2,116.20
Hamburg	X	X	X	X
Bremerhafen	$2,030.70	X	$2,155.20	$2,155.20

MSC(FEU)

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Rotterdam	X	X	X	X
Antwerp	$2,668.70	X	$2,663.20	$2,463.20
Hamburg	X	X	X	X
Bremerhafen	$2,733.70	X	$2,702.20	$2,502.20

Table A.17: Ocean freight rate (Source: Maersk, Hapag-Lloyd and MSC websites)

Maersk	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	$ 557	X	X	$ 995	$ 848	$ 848	X	$ 1058	$ 644	$ 644	X	X
Mannheim	$ 718	X	X	$ 878	$ 1620	$ 1620	X	$ 1758	$ 830	$ 830	X	X
Stuttgart	$ 950	X	X	$ 829	$ 2190	$ 2190	X	$ 1988	$ 1099	$ 1099	X	X
Basel	$ 1639	$ 1653	X	$ 1602	X	X	X	X	$ 1396	$ 1524	X	X
Hapag	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	X	X	X	X	$ 861	$ 826	$ 1221	$ 1109	$ 537	$ 537	X	X
Mannheim	X	X	$ 752	$ 752	$ 1762	$ 1459	$ 1873	$ 1792	$ 698	$ 698	X	X
Stuttgart	X	X	$ 858	$ 858	$ 1940	$ 1914	$ 1970	$ 2035	$ 771	$ 767	X	X
Basel	$ 1489	$ 1468	$ 1501	$ 1501	X	X	X	X	$ 1521	$ 1521	X	X
MSC	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	X	X	X	$ 995	X	$ 837	X	$ 1084	X	$ 591	X	X
Mannheim	X	X	X	$ 815	X	$ 1540	X	$ 1775	X	$ 764	X	X
Stuttgart	X	X	X	$ 843	X	$ 2052	X	$ 2012	X	$ 933	X	X
Basel	X	$ 1560	X	$ 1552	X	X	X	X	X	$ 1522	X	X

Table A.18: 20” Container European hinterland transportation rates for Maersk, Hapag-Lloyd and MSC on 15-11-11 (Data from company websites)

Maersk	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	$454	X	X	$819	$575	$575	X	$718	$454	$454	X	X
Mannheim	$621	$621	X	$728	$1099	$1099	X	$1192	$621	$621	X	X
Stuttgart	$811	$811	X	$962	$1485	$1485	X	$1348	$811	$811	X	X
Basel	$1429	$1439	X	$1396	X	X	X	X	$1052	$1148	X	X
Hapag	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	X	X	X	X	$599	$575	$781	$710	$399	$399	X	X
Mannheim	X	X	$696	$696	$1226	$1015	$1199	$1147	$524	$524	X	X
Stuttgart	X	X	$737	$737	$1377	$1331	$1261	$1303	$607	$607	X	X
Basel	$1717	$1680	$1645	$1645	X	X	X	X	$1733	$1733	X	X
MSC	Rail				Truck				Barge			
	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE	RTM	ANT	HAM	BRE
Duisburg	X	X	X	$706	X	$575	X	$714	X	$427	X	X
Mannheim	X	$621	X	$712	X	$1057	X	$1170	X	$573	X	X
Stuttgart	X	$811	X	$850	X	$1408	X	$1326	X	$709	X	X
Basel	X	$1560	X	$1390	X	X	X	X	X	$1441	X	X

Table A.19: 40” Container European hinterland transportation rates for Maersk, Hapag-Lloyd and MSC on 15-11-11 (Data from company websites)

Maersk	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$ 720	X	$ 955	$ 1005	$4574	X	$2400	$3000	$ 520	X	$ 680	$ 810
Detroit	$ 651	X	$ 955	$ 1200	$3081	X	$1940	$2085	$ 451	X	$ 735	$ 1025
Minneapolis	X	X	X	X	X	X	X	X	X	X	X	X
Cleveland	$ 1013	X	$ 970	$ 1230	$3815	X	$1655	$2340	$ 451	X	$ 860	$ 975
Columbus	$ 1129	X	$ 955	$ 1075	$3800	X	$1740	$1800	$ 451	X	$ 730	$ 830
Hapag	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$ 823	$ 765	$ 918	$ 864	$4574	X	$2389	$3246	$ 536	$ 485	$ 630	$ 583
Detroit	$ 598	$ 660	$ 914	$840	$3081	X	$2753	X	$ 425	$ 485	$ 742	$ 668
Minneapolis	$ 1158	$ 2418	$ 1934	$ 1615	$7074	X	$5203	$4861	$ 928	$ 485	$ 1487	$ 1385
Cleveland	$ 864	$ 1060	$ 909	$ 779	$3815	X	$2029	$2239	$ 425	$ 485	$ 713	$ 584
Columbus	$ 1159	$ 1354	$ 941	$ 769	$3800	X	$1956	$2291	$ 425	$ 620	$ 769	$ 596
MSC	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$ 772	X	$ 937	$ 935	$4574	X	$2395	$3123	$ 528	X	$ 655	$ 697
Detroit	$ 625	X	$ 935	$ 1020	$3081	X	$2347	$2085	$ 438	X	$ 739	$ 847
Minneapolis	X	X	X	X	X	X	X	X	X	X	X	X
Cleveland	$ 939	X	$ 940	$ 1005	$3815	X	$1842	$2290	$ 438	X	$ 769	$ 780
Columbus	$ 1144	X	$ 949	$ 922	$3800	X	$1848	$2046	$ 438	X	$ 750	$ 713

Table A.20: 20" Container North-American hinterland transportation rates for Maersk, Hapag-Lloyd and MSC on 15-11-11 (Data from company websites)

Maersk	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$911	X	$1,035	$1,090	$4574	X	$2400	$3000	$ 620	X	$ 755	$ 895
Detroit	$777	X	$1,035	$1,305	$3081	X	$1940	$2085	$ 580	X	$ 815	$ 1135
Minneapolis	X	X	X	X	X	X	X	X	X	X	X	X
Cleveland	$1,044	X	$1,050	$1,340	$3815	X	$1655	$2340	$ 580	X	$ 955	$ 1080
Columbus	$1,338	X	$1,060	$1,075	$3800	X	$1740	$1800	$ 580	X	$ 810	$ 920
Hapag	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$911	$1,012	$1,002	$938	$4574	X	$2389	$3246	$ 624	$ 744	$ 714	$ 651
Detroit	$777	$952	$953	$950	$3081	X	$2753	X	$ 604	$ 792	$ 780	$ 777
Minneapolis	$1,399	$2,541	$2,511	$1,740	$7074	X	$5203	$4861	$ 1169	$ 744	$ 1593	$ 1510
Cleveland	$1,044	$1,223	$1,010	$854	$3815	X	$2029	$2239	$ 604	$ 792	$ 814	$ 658
Columbus	$1,338	$1,525	$998	$863	$3800	X	$1956	$2291	$ 604	$ 792	$ 826	$690
MSC	Rail+Truck				Truck				Rail -Rail			
	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR	MON	HAL	NYC	NOR
Chicago	$911	X	$1019	$1014	$4574	X	$2395	$3123	$ 622	X	$ 735	$ 773
Detroit	$777	X	$994	$1128	$3081	X	$2347	$2085	$ 592	X	$ 798	$ 956
Minneapolis	X	X	X	X	X	X	X	X	X	X	X	X
Cleveland	$1,044	X	$1030	$1097	$3815	X	$1842	$2290	$ 592	X	$ 885	$ 869
Columbus	$1,338	X	$1029	$969	$3800	X	$1848	$2046	$ 592	X	$ 818	$ 805

Table A.21: 20" Container North-American hinterland transportation rates for Maersk, Hapag-Lloyd and MSC on 15-11-11 (Data from company websites)

Direct model	Rail	Truck	Barge
	RTM	RTM	RTM
Duisburg	$557	$854	$591
Mannheim	$718	$1691	$764
Stuttgart	$950	$2065	$935
Basel	$1564	X	$1458

Table A.22: Price of hinterland transportation in Europe based on Maersk and Hapag-Lloyd public quoted tariffs for 20" ISO Tank containers

Direct model	Rail	Truck	Barge
	RTM	RTM	RTM
Duisburg	$535	$684	$509
Mannheim	$733	$1353	$684
Stuttgart	$957	$1652	$846
Basel	$1706	X	$1487

Table A.23: Price of hinterland transportation in Europe based on Maersk and Hapag-Lloyd public quoted tariffs for 40" containers

The next step in the transportation chain is the hinterland transportation from Cleveland and Toledo onwards into the hinterland. For this purpose, rates have been calculated for both rail and road haulage. For the rail haulage, the annual reports of several Class I rail operators have been consulted. Based on this financial information, it was possible to determine the average revenue per ton-mile for the separate Class I rail operators who are operating from Cleveland and Toledo, Norfolk Southern and CSX, and additionally CP rail for haulage between Chicago and Minneapolis. The price of road haulage has proven to be more difficult as the sector is very scattered in terms of national coverage, company size and the individual cost structure of the companies. As road haulage is an important hinterland transportation mode for especially the short-haul distances, an independent source of data had to be used. In its publication on the National Transportation Statistics of 2011, the U.S. Department of Transport calculated an average of $ 0.1654 per ton-mile for road haulage. Table A.24 provides an overview of the average revenue per ton-mile used in the direct service and feeder service model.

	Revenue per ton-mile	Revenue per mile for a 20 ton container
Road Haulage	$ 0.1654	$ 3.308
Norfolk Southern	$ 0.0619	$ 1.238
CSX	$ 0.0657	$ 1.314
CP Rail	$ 0.0545	$ 1.09

Table A.24: Revenue per ton mile and per 40" container per mile for road and rail haulage in the United States (Based on the financial reports of Norfolk Southern, CSX and CP rail and the National Transportation Statistics 2011)

After determining the projected revenue per mile for 40" containers, it is possible to calculate the hinterland transportation rates per mode and carrier, based on the mileage between both cities. For rail mileage, it is important to take into account the structure of the rail network. While both CSX and

Norfolk Southern are using Cleveland and Toledo as intermodal terminals, the network of the Class I carriers are also related to the hub and spoke principle. Over the last few years, CSX has developed their network around their new facility in North-Baltimore, Ohio which operates as a hub for the US-Midwest. Norfolk Southern on the contrary has focused their operations on a hub in Columbus, Ohio. Table A.25 provides the distances of road and rail haulage specified by Class I rail operator. With regards to the mileage on routes to Minneapolis it is necessary to interchange cargo between CSX/Norfolk Southern onto the network of CP Rail. Because of this interchange, 419 miles are added on top of the regular mileage between Cleveland/Toledo and Chicago.

Distances (miles)						
Destination/Origin	Road haulage		CSX		Norfolk Southern	
	Cleveland	Toledo	Cleveland	Toledo	Cleveland	Toledo
Chicago	345	250	339	274	339	242
Detroit	170	70	223	158	158	56
Minneapolis	751	656	419*	419*	419*	419*
Cleveland	0	115	0	174	0	108
Columbus	150	150	222	157	158	145

Table A.25: Distances between the ports of Cleveland and Toledo and the cities used in the model for road and rail haulage (Based on Google maps for road haulage distances and ALK Technologies Rail Miler for CSX and NS)

Direct Truck		
Origin/Destination	Cleveland	Toledo
Chicago	$1,243.26	$929.00
Detroit	$664.36	$333.56
Minneapolis	$2,586.31	$2,272.05
Cleveland	$302.00	$482.42
Columbus	$598.20	$598.20

Direct Rail CSX		
Origin/Destination	Cleveland	Toledo
Chicago	$903.17	$787.34
Detroit	$697.40	$581.57
Minneapolis	$1,520.17	$1,404.34
Cleveland		$609.77
Columbus	$696.52	$580.68

Direct Rail NS		
Origin/Destination	Cleveland	Toledo
Chicago	$869.24	$706.79
Detroit	$566.57	$396.09
Minneapolis	$1,486.24	$1,323.79
Cleveland		$481.83
Columbus	$566.40	$544.84

CHEAPEST		
Origin/Destination	Cleveland	Toledo
Chicago	$869.24	$706.79
Detroit	$664.36	$333.56
Minneapolis	$1,486.24	$1,323.79
Cleveland	$302.00	$482.42
Columbus	$598.20	$598.20

Table A.26: Calculated hinterland transportation rate for several modalities and carriers from the ports of Cleveland/Toledo towards 5 regions in the U.S. Midwest

By combining the mileage with the revenue per mile, it is possible to project the transportation rates for road and rail haulage originating from the ports of Cleveland and Toledo. Additionally, the rate for CSX and Norfolk Southern contains a charge of $ 200.00 to deliver the container to the door of the recipient. One exception has been made with regards to the preferred hinterland transportation. Although rail haulage between Cleveland/Toledo proves to be cheaper to Columbus, Ohio, the difference in transportation rate between rail and road haulage is very small, given the close distance between both cities. Therefore it is decided that road haulage will be the preferred hinterland transportation mode for transportation of a 40”container to and from Columbus, Ohio.

For the ocean transportation rate, a separate analysis has been made. Like mentioned before, this transportation rate is determined on inputs based on the 15th of November 2011. In order to calculate the ocean freight rate, it is necessary to determine a profit margin in order to make the service economically feasible for the operator. Over the last few years, profitability in the ocean shipping industry has been very unstable primarily results of the lacking demand in transportation services as a result of the economic crisis and the impact of higher diesel fuel prices. Especially for Maersk, 2011 has been a bad year (Maersk, 2012). Compared to 2010, when Maersk reached an EBITDA (Earnings before interest, tax, depreciation and amortization) of 18.6%, it dropped to 4% in 2011. Also for one of its competitors, Hapag-Lloyd, 2011 has resulted in a drop from 14.6% to 6.0% (Hapag-Lloyd, 2012). Because of this flexibility, it has been determined that the potential services, both direct and as a feeder, require a profit margin of 10% to contribute to the profitability of the ocean line and as a buffer for higher than expected expenditures.

Based on the parameters used in the direct service and feeder service model it was possible to determine the total ocean freight rate (TOFR) as sum of the ocean freight rate (OFR) and the security charge for the originating (SCO) port and destination (SCD). Table A.27 and A.28 provide these rates for both the Westbound and Eastbound voyages between the port of Rotterdam and the port of Cleveland/Toledo for 14 and 18 knots routes. Furthermore, the feeder transportation rate is given. Both rates exclude the HMT (which is included in a later stage), but include the Bunker Adjustment Factor (BAF) and Terminal Handling Costs (THC) involved in the transportation.

20" ISO Tank Container		SCO	THCO	OFR+BAF	THCD	SCD	TOFR	
CLEVELAND	Westbound	$6,50	$260,00	$1.056,67	$150,00	$7,00	$1.480,17	Direct 14
		$6,50	$260,00	$1.140,00	$150,00	$7,00	$1.563,50	Direct 18
		$7,00	$200,00	$190,00	$150,00	$7,00	$554,00	Feeder 14
		$7,00	$200,00	$220,00	$150,00	$7,00	$584,00	Feeder 18
	Eastbound	$6,50	$260,00	$723,33	$150,00	$7,00	$1.146,83	Direct 14
		$6,50	$260,00	$806,67	$150,00	$7,00	$1.230,17	Direct 18
		$7,00	$200,00	$455,00	$150,00	$7,00	$819,00	Feeder 14
		$7,00	$200,00	$480,00	$150,00	$7,00	$844,00	Feeder 18
TOLEDO	Westbound	$6,50	$260,00	$1.073,33	$150,00	$7,00	$1.496,83	Direct 14
		$6,50	$260,00	$1.156,67	$150,00	$7,00	$1.580,17	Direct 18
		$7,00	$200,00	$200,00	$150,00	$7,00	$564,00	Feeder 14
		$7,00	$200,00	$233,33	$150,00	$7,00	$597,33	Feeder 18
	Eastbound	$6,50	$260,00	$740,00	$150,00	$7,00	$1.163,50	Direct 14
		$6,50	$260,00	$973,33	$150,00	$7,00	$1.396,83	Direct 18
		$7,00	$200,00	$455,00	$150,00	$7,00	$819,00	Feeder 14
		$7,00	$200,00	$480,00	$150,00	$7,00	$844,00	Feeder 18

Table A.27: Assumed freight rate for direct and feeder services to and from the ports of Cleveland and Toledo for 20" ISO tank containers (Based on own calculations)

40" Container		SCO	THCO	OFR+BAF	THCD	SCD	TOFR	
CLEVELAND	Westbound	$6,50	$260,00	$1.790,00	$150,00	$7,00	$2.213,50	Direct 14
		$6,50	$260,00	$1.915,00	$150,00	$7,00	$2.338,50	Direct 18
		$7,00	$200,00	$460,00	$150,00	$7,00	$824,00	Feeder 14
		$7,00	$200,00	$505,00	$150,00	$7,00	$869,00	Feeder 18
	Eastbound	$6,50	$260,00	$1.815,00	$150,00	$7,00	$2.238,50	Direct 14
		$6,50	$260,00	$1.940,00	$150,00	$7,00	$2.363,50	Direct 18
		$7,00	$200,00	$475,00	$150,00	$7,00	$839,00	Feeder 14
		$7,00	$200,00	$525,00	$150,00	$7,00	$889,00	Feeder 18
TOLEDO	Westbound	$6,50	$260,00	$1.290,00	$150,00	$7,00	$1.713,50	Direct 14
		$6,50	$260,00	$1.415,00	$150,00	$7,00	$1.838,50	Direct 18
		$7,00	$200,00	$460,00	$150,00	$7,00	$824,00	Feeder 14
		$7,00	$200,00	$505,00	$150,00	$7,00	$869,00	Feeder 18
	Eastbound	$6,50	$260,00	$1.315,00	$150,00	$7,00	$1.738,50	Direct 14
		$6,50	$260,00	$1.665,00	$150,00	$7,00	$2.088,50	Direct 18
		$7,00	$200,00	$475,00	$150,00	$7,00	$839,00	Feeder 14
		$7,00	$200,00	$525,00	$150,00	$7,00	$889,00	Feeder 18

Table A.28: Assumed freight rate for direct and feeder services to and from the ports of Cleveland and Toledo for 40"standard containers (Based on own calculations)

When looking at the profit margin as function of the utilization rate, under a fixed price of IFO 380 per ton and a fixed total ocean freight rate mentioned in Table A.27 and A.28, it is possible to calculate the optimal utilization rate, to fulfill the demanded profit margin of the direct service. Figure A.5 shows, that in order to fulfill to the demanded profit margin, a utilization rate of 70% is required. Furthermore, with Figure A.5 it is possible to determine the breakeven utilization rate, which is calculated at 61% for both the 14 knots and 18 knots service. When a utilization rate of higher than 70% is reached, under the assumption of a 25%/75% ratio for 20"/40" containers, the carrier is able to reduce its total ocean freight rate, if the market for transportation services proves to be competitive. But, if the utilization rate will drop below this 70%, it is up to the ocean carrier to respond to either increase the ocean transportation rate if shippers are not reluctant to switch towards another route or decrease the ocean transportation rate to gain cargo resulting in a higher utilization rate.

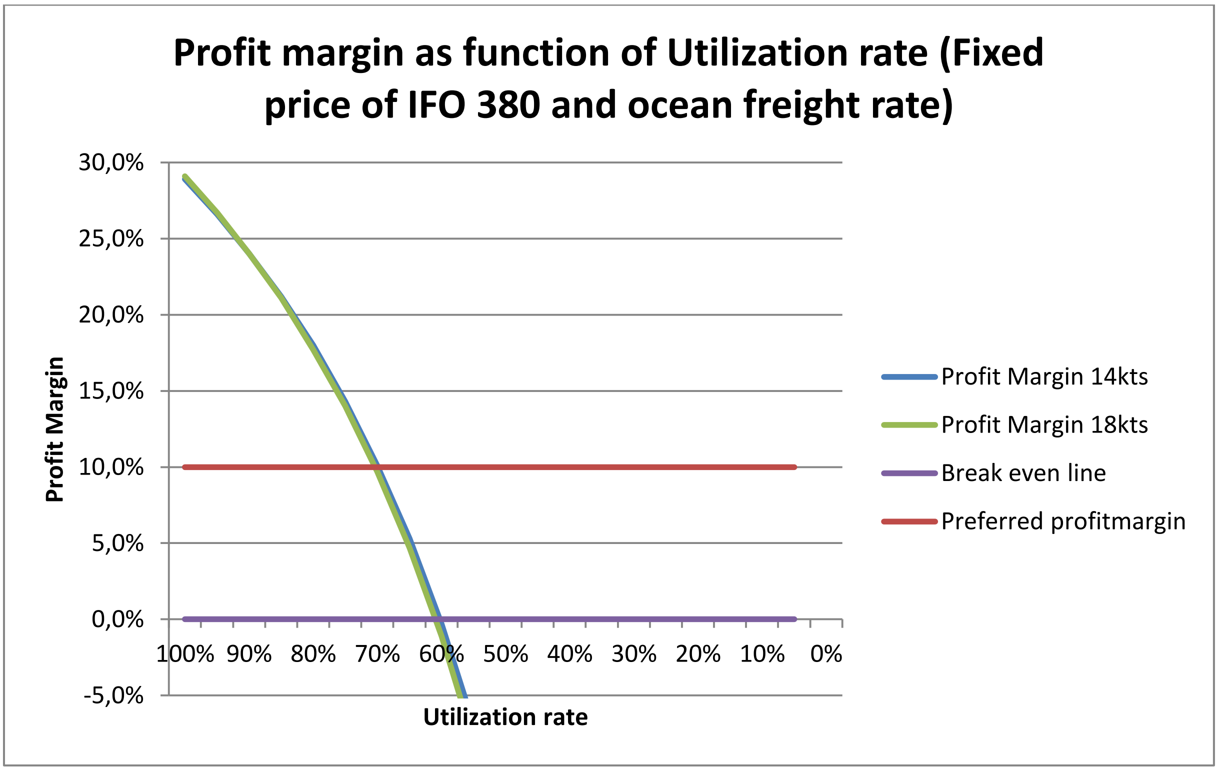

Figure A.5: Profit margin as a function of utilization rate under fixed prices of IFO 380 and ocean freight rate (Based on own calculations)

Another highly discussed factor in the profitability of ocean services has been the price of IFO 380 per ton. While the total ocean freight rate is closely related to the Bunker Adjustment Factor, there is an effect of the IFO 380 on the profitability-margin, which differs for the direct service of 14 and 18 knots. Under a stable total ocean freight rate mentioned before in Table A.27 and A.28, with a fixed utilization rate of 70% a fluctuation of $ 15/ton more or less could decrease or increase the profit margin with 0.7% to 0.8%. Figure A.6 also gives a clear example of the relationship between profit margin and the fuel consumption. When the oil price will increase further above the level of $ 700/ton, the effect on the profit margin of the 18 knots direct service route, which consumes more fuel per day, will rapidly decline. In the case of a lower oil price, the 18 knots direct service route is able to improve its profit margin under the fixed ocean transportation rate.

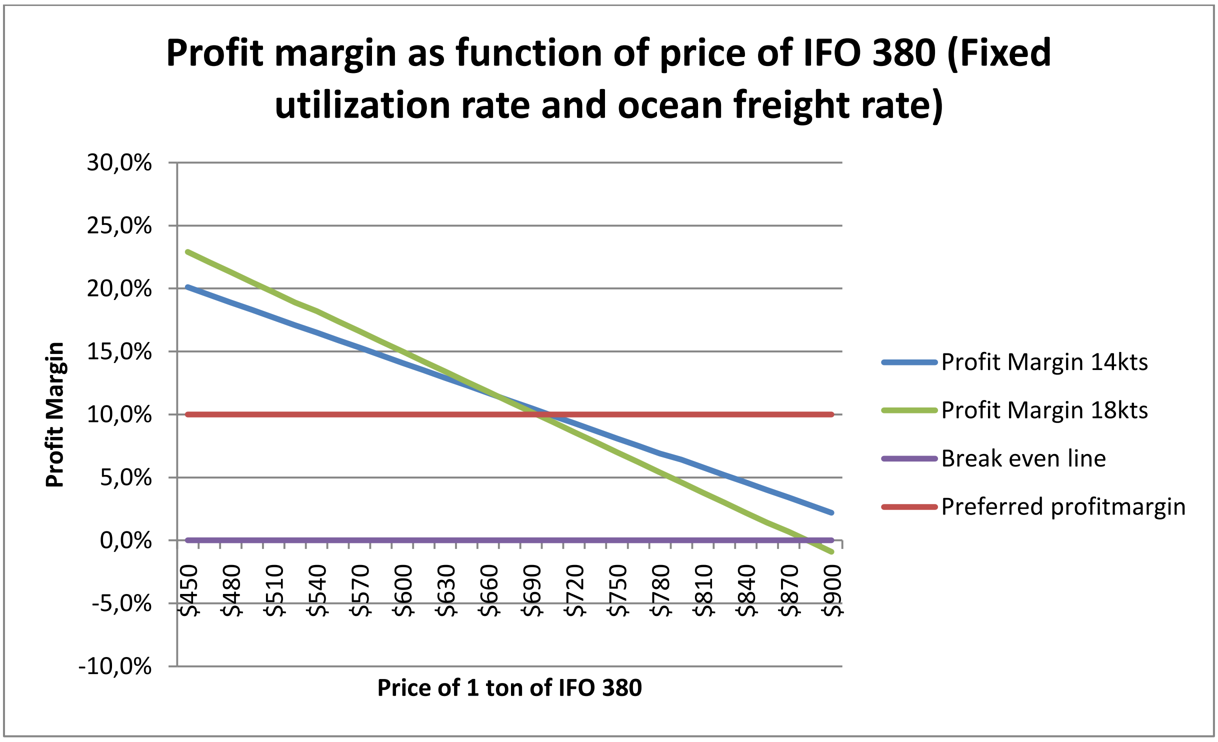

Figure A.6: Profit margin as a function of the price of IFO 380 per ton under fixed utilization rate and ocean freight rate (Based on own calculations)

As both graphs show, the difference between the profit margins of normal steaming at 18 knots and slow steaming at 14 knots is only very small. Based on the theory and various business articles on slow steaming, it was assumed that this difference would be larger. When looking specifically at the operational ship costs per round-trip containing ship mortgage, operating costs, IFO 380 consumption, MDO consumption, pilotage and administrative costs, the 14 knot service to Cleveland is only 8.7% cheaper than an 18 knots service as shown in figure A.7, while the freight rate is only reduced with 5.4% from $ 2,325 per 40” container to 2,200 per 40” container. As figure A.7 shows, slow steaming leads to lower fuel consumption, but this advantage is partially offset by the increased mortgage, operating costs and MDO consumption. The savings related to 18-knots steaming are clearly a result of cutting the days required for a roundtrip from 28-days (14 knots service) to 24-days (18 knots service). As a result of this cut, a vessel with a 24-day roundtrip schedule is able to perform 14.6 roundtrips annually versus 12.5 roundtrips when assuming a 350-day operational year.

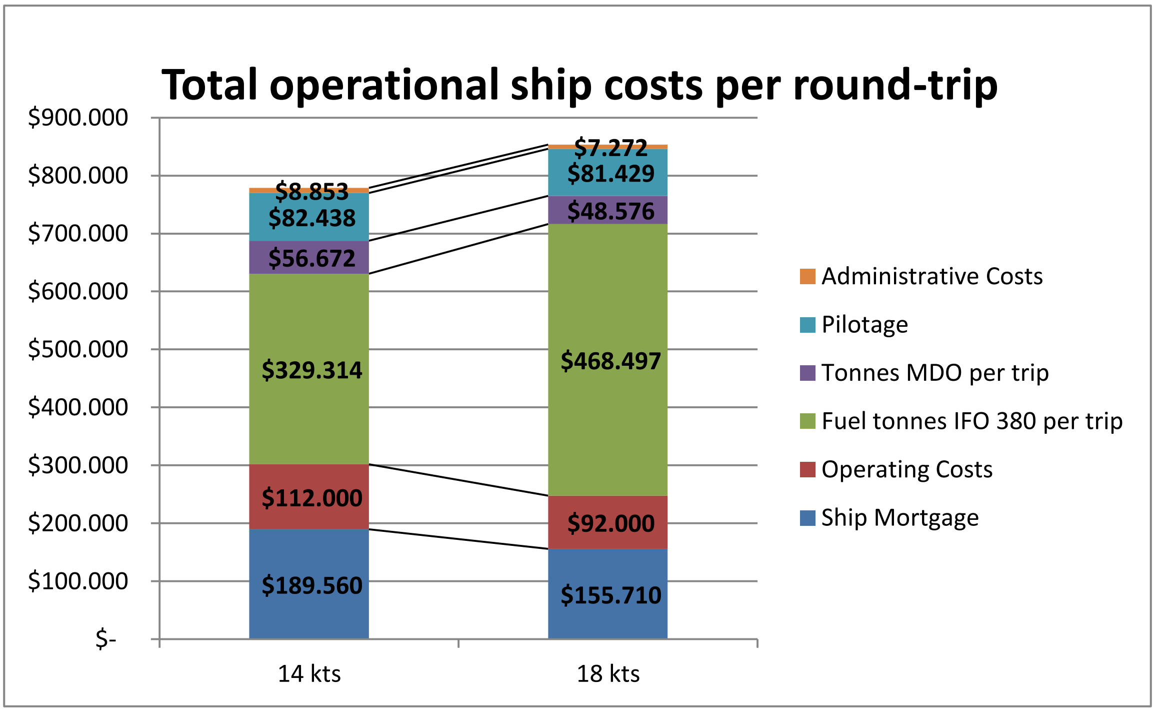

Figure A.7: Total operational ship costs per round-trip (Based on own calculations from the direct/feeder model)

Switching costs

One of the major factors contributing to the viability of a container service into the Great Lakes is the seasonal switching costs. In order for the consignee to switch its supply chain from a service into the Great Lakes to existing services through the major ports with existing services, extra costs will have to be made during this switch. In the analysis of transportation rates, three categories of goods have been used: Chemicals, High Valued Goods and Car Parts, with their individual switching cost characteristics. In order to effectively analyze the potential of a container service into the Great Lakes, it is assumed that these new services should at least be cheaper than this switching cost percentage. On a global scale, several academics have researched the impact of switching costs, but only one of them specifically on a local, U.S. Midwest/Great Lakes scale. In the paper by Tems Inc. and RAND Corporation (2007) for the U.S. Department of Transportation: Maritime Administration and Transport Canada, a focus has been made on this specific region.

In its survey with 200 respondents in both countries, Tems Inc and Rand have been able to provide a representative percentage on the switching costs for the shippers of raw materials, semi-finished goods, finished goods and food products. When applying these categories on the three selected type of goods it is evident that Chemicals would represent raw materials, Car Parts as semi-finished goods and high valued goods as finished goods. Table A.29 provides an overview of the assumed switching costs used in the analysis of the viability of a container service into the Great Lakes.

Type of goods	Switching costs (in %)
Chemicals (Raw Materials)	5%
High Valued Goods (Finished Products)	14%
Car Parts (Semi-finished Products)	14%

Table A.29: Switching costs for the Great Lakes (Tems Inc. and RAND Corporation, 2007)

Port selection and performance

Based on location and hinterland connectivity of the four European regions with regards to the contestable hinterland of the ports within the Hamburg – Le Havre range four ports have been selected briefly discussed in chapter 3.2.

The port performance is measured as a function of the number of container moves per hour and container dwell times. Because the data is subject to various unpredictable factors like port congestion and priority and the lack of information on individual terminal performance which is not publicly available, assumptions has been made. When looking to the port of Rotterdam, which is part of direct service model, container handling speed is required to project the necessary time for loading and unloading. This number is based on the following formula with the comment that this assumes a 24/7 operation of all cranes 365 days a year. In order to compensate for the time the cranes are not operating, an assumption has been made of an average container lifting speed of 30 containers per hour per crane.

$$Container\ lifts\ per\ year = \frac{Total\ TEU\ Cap\ (ECT\ Delta{+}ECT\ City{+}APMT)}{Quay\ Cranes\ (ECT\ Delta{+}ECT\ City{+}APMT)} \quad (1)$$

$$Container\ lifts\ per\ hour = \frac{Containerlifts\ per\ year}{(365 * 24\ hour)} \quad (2)$$

Furthermore it is assumed that two quay cranes are being used for loading and unloading the vessel in Rotterdam, leading to an average of 60 container lifts per hour.

In order to measure transit time in the transit time model, data is required on the dwell times of containers for imports and exports. Research by Dekker (2005) barely shows differences between the ports in the Hamburg – Le Havre range. Based on public available information and research by Dekker (2005), Table A.30 provides an overview of the dwell times for exports for the European ports.

	Truck	Rail	Barge
Rotterdam	110.4 hrs	112.8 hrs	103.2 hrs
Antwerp	110.4 hrs	112.8 hrs	103.2 hrs
Hamburg	110.4 hrs	112.8 hrs	N/a
Bremerhaven	110.4 hrs	112.8 hrs	N/a

Table A.30: Average export Dwell times imports/exports within the Hamburg - Le Havre range (Dekker, 2005)

Also for the U.S. Midwest, four major ports have been selected on various criteria with regards to location, hinterland connectivity and the availability of ocean container shipping services. But in contrast to the European situation, not all 4 ports are part of an ocean containers shipping service route. For the direct and feeder service model, Cleveland, Toledo and Montreal play an important role in calculation the expected costs of transportation and the desired freight rate. In contrast to the direct/feeder model, the time and transportation rate model are also taking the ports of Halifax, New York/New Jersey and Norfolk into account in its analysis.

With regards to the direct and feeder routes, container lifts in the ports of Montreal, Cleveland and Toledo play an important role in terms of time required for loading and unloading the vessel. As mentioned before, the port of Toledo has been investing in two new Liebherr cranes as part of the "American Recovery and Reinvestment Act 2009". Based on information from the manufacturer, it is assumed that these new cranes are capable of lifting 20 containers per hour in its initial stage. By simultaneously operating, it would lead to an average of 40 container lifts per hour when using the two cranes. In order to stay competitive with the port of Toledo as well as modernizing the port, the Port of Cleveland Authority has requested federal money to invest in new quay cranes, with a potential speed of 20 to 25 containers lifts per hour. Because these plans are still based on future decision making and expectations with regards to productivity, the model assumes the current productivity of 15 container lifts per hour as leading. When using 2 cranes, this number will double to the 30 container lifts per hour that are being assumed. In comparison to Cleveland and Toledo, the port of Montreal operates fixed quay cranes for their operation. Because of the specialization of these cranes in container handling and the experience of local personnel in container loading and unloading, the model assumes that it in the port of Montreal 45 containers can be loaded and unloaded in a dual-crane operation.

Montreal	45 containers lifts/hour
Cleveland	30 containers lifts/hour
Toledo	40 containers lifts/hour

Table A.31: Assumed container lifts per hour based on calculations and quay crane specifications, using 2 cranes for loading/unloading

Next to the container lifting speed, container dwell times play an important role in the time model. Because the ports of Toledo and Cleveland are currently not operating on the container market, an assumption has been made based on the results from other ports within the region.

	Rail/Truck
Cleveland	48.0 hrs
Toledo	48.0 hrs
Montreal	72.0 hrs
Halifax	120.0 hrs
New York/New Jersey	120.0 hrs
Norfolk	39.0 hrs

Table A.52: Assumed Container dwell times for imports and exports based on assumptions and various data sources

Transit time

The transit time of the ocean voyage is dependent on two specific factors, the speed of the service on one hand and the schedule network on the other hand. In order to determine

The direct service assumes a 28-day round trip voyage for both the 14 knots service and 24-day round trip for the 18 knots service. This period covers loading the vessel in Rotterdam, its ocean voyage across the Atlantic Ocean and the Great Lakes both ways, passing the Welland Canal twice, unloading and loading at a port in the Great Lakes and finally unloading the containers in the port of Rotterdam. Because of maintenance, it is assumed that a vessel can be operated for 350 days a year. By dividing this through 28 days, it will be possible to have 12.5 roundtrips on a yearly basis per ship for the 14 knots service and 14.6 roundtrips for the 18 knots service. Based on the assumed port performance previously mentioned, Table A.33 will show the transit time in hours necessary for the oceanic and Great Lakes part of the a round trip voyage, while the entire voyage time can be found in tables A.34 and A.35. For terminal handling, an extra hour is added for port congestion when entering or exiting the port and extra required labor like docking. Furthermore, a Seaway-delay of 10 hours each way is added to take into account the additional time required for transiting the locks and because of the lower operational speed, based on information from vessel operators and the St. Lawrence Seaway Management Corporation.

	Direct service from Rotterdam		**Feeder service from Montreal**	
	14 knots	**18 knots**	**14knots**	**18 knots**
Cleveland	277:30 Hours	218:00 Hours	47:45 Hours	39:30 Hours
Toledo	283:00 Hours	222:30 Hours	53:15 Hours	43:45 Hours

Table A.33: Oceanic/Great Lakes transit time for Direct and Feeder services to Cleveland and Toledo

To keep a 24/28 day round trip schedule, the trip has spare time left to cover either delays originating from port operations, mechanical issues, bad weather situations and to cover the time needed to reach the service speed after undocking at the port. As a result, half of the hours that are part of this spare time, will be assumed to be water hours, meaning that the vessel is underway between both ports. Another distinction has been made with regards to sailing speed. Based on information by the container lines or business articles, a speed of 14 knots is being considered as slow steaming, while 18 knots are assumed to be normal speed. As speed is a determining factor for fuel consumption of a vessel, a distinction has been made on this. Table A.34 provides the hours required for a round trip between the port of Rotterdam and the port of Cleveland/Toledo.

Transit Time		**Cleveland**	**Toledo**		**Roundtrip hours**
Direct	**Port of origin (Load+Unload)**	7:00:00	7:00:00	594.25	**Ocean hours CLE**
14 kts	**Ocean/Lakes**	267:30:00	273:00:00	672	**Trip hours CLE**
	Seaway extra	10:00:00	10:00:00	603.5	**Ocean hours TOL**
	Port of destination (Unload+Load)	12:15:00	8:30:00	672	**Trip hours TOL**
	Spare time	39:15:00	37:30:00		
Direct	**Port of origin (Load+Unload)**	7:00:00	7:00:00	486.75	**Ocean hours CLE**
18 kts	**Ocean/Lakes**	208:03:20	212:20:00	576	**Trip hours CLE**
	Seaway extra	10:00:00	10:00:00	494.66	**Ocean hours TOL**
	Port of destination (Unload+Load)	12:15:00	8:30:00	576	**Trip hours TOL**
	Spare time	50:45:00	50:00:00		

Table A.34: Transit time for direct service between Rotterdam and Cleveland/Toledo, with varying speeds (Based on calculations from the direct model)

The feeder service though, is based on a 7 day roundtrip for 14 and 18 knots services. Like the direct service, this could be operated by all carriers that are interested in this service. But because this is a short service, it could also be operated by an independent carrier, which could take cargo from all shipping lines calling in Montreal. Table A.35 provides the hours required for a one-way trip between the port of Montreal and the port of Cleveland/Toledo.

Transit Time		Cleveland	Toledo		Roundtrip hours
Feeder	Port of origin (Load)	9:00:00	9:00:00	110.50	Ocean hours CLE
14 kts	Ocean/Lakes	37:47:09	43:17:09	168	Trip hours CLE
	Seaway extra	10:00:00	10:00:00	119.75	Ocean hours TOL
	Port of destination (Unload)	12:15:00	8:30:00	168	Trip hours TOL
	Spare time	15:00:00	13:15:00		
Feeder	Port of origin (Load)	9:00:00	9:00:00	102.16	Ocean hours CLE
18 kts	Ocean/Lakes	29:23:20	33:40:00	168	Trip hours CLE
	Seaway extra	10:00:00	10:00:00	110.32	Ocean hours TOL
	Port of destination (Unload)	12:15:00	8:30:00	168	Trip hours TOL
	Spare time	23:30:00	23:00:00		

Table A.35: Transit time for feeder service between Montreal and Cleveland/Toledo, with varying speeds (Based on calculations from the feeder model)

Analysis structure

In order to judge the viability in paragraph 5.2.4 on the direct service between the ports of Rotterdam and Cleveland/Toledo and a feeder service between the port of Montreal and Cleveland/Toledo, a comparison on the door-to-door transportation rate has been made on a percentage level as the analysis in paragraphs 5.2.2 and 5.2.3 will provide. In order to take into account the effect of the switching costs in order to cope with the additional costs during the winter closure of the St. Lawrence Seaway System, the direct service and feeder service transportation rate should at least be 95% of the door-to-door transportation rates of the existing services in case of chemical containers, while for high valued goods and car parts this is set at 86%.To limit the effect of outliers in terms of this percentage, they have been categorized on a 5-number scale ranging from -2 to 2 as shown in Table A.36.

Score	Chemicals	High Valued Goods/Car Parts
-2	Over 100%	Over 91.0%
-1	95.1% - 99.9%	86.1% - 90.9%
0	95.0%	86.0%
1	90.0% - 94.9%	81.0% - 85.9%
2	Less than 90%	Less than 81%

Table A.36: Scorings-table

After this step, a weighted average score on state imports is being calculated between The Netherlands and the respective states of Illinois, Michigan and Ohio provided by the Dutch Embassy in the United States in conjunction with the several consulates across the nation by using a factor based on the value of imports per state divided by total value of the specific type of good of all three states together to determine the ratio on a type of state-level.

	Chemicals	High Valued Goods	Car Parts
Illinois	0.32	0.41	
Michigan	0.26	0.18	0.54
Ohio	0.41	0.41	0.46
Total	1.00	1.00	1.00

Table A.37: Factor weights on state level

Together with this step, weighted factors on the total market for the three types of goods are calculated by dividing the total value of imports of the specific goods by the total value of imports for all three types of goods together to determine the ratio on a type of goods level as shown in Table A.38. Although this not compromises the entire market with all possible types of goods, it is the main types of cargo transported on the transatlantic trade route.

Type of goods	Factor Weight
Chemicals	0.59
High Valued Goods	0.31
Car Parts	0.10

Table A.38: Factor weights on a type of goods level

The final step in this process is to convert the average weighted scores to the final scale, indicated by + and - scores of the weighted averages.

Weighted average interval	Score
-2.00 – -1.50	---
-1.49 – - 1.00	--
-0.99 – - 0.50	-
-0.49 – + 0.49	+-
+0.50 – + 0.99	+
+1.00 – + 1.49	++
+1.50 – + 2.00	+++

Table A.39: Weighted Average Scale

APPENDIX B:

Baseline Existing Services (5.2.1)

CHEMICALS BASELINE													
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,039	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,924	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,399	$4,498	$4,518	$4,472	$4,472	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,147	$4,130	$4,181	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,158	$4,189	$4,215	$4,187	$4,276	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,901	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,238	$4,855	$4,986	$4,693	$4,693	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$4,012	$3,977	$4,057	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,997	$4,015	$4,041	$4,018	$4,116	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$3,999	$4,030	$4,122	$4,050	$4,151	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,852	$3,908	$3,961	$3,907	$4,040	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,468	$4,604	$4,624	$4,565	$4,565	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,166	$4,174	$4,310	$4,216	$4,296	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,298	$4,307	$4,333	$4,313	$4,383	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,656	$4,687	$4,637	$4,769	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,659	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,169	$5,247	$5,267	$5,227	$5,227	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,851	$4,861	$4,874	$4,862	$4,911	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,836	$4,925	$4,947	$4,903	$5,013	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 0.1: Table 21: Door-to-door transportation rates for a 20" ISO Chemical Container (Data compiled from various sources: Company websites and the sales department of the shipping lines)

HIGH VALUED GOODS BASELINE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,419	$4,645	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,591	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,259	$5,394	$5,394	$5,349	$5,349	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,697	$4,737	$4,790	$4,741	$4,878	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,758	$4,813	$4,844	$4,805	$5,000	Antwerp	Antwerp	Bremen	Norfolk	Montreal	Norfolk
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,535	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,311	$4,208	$4,497	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,108	$5,577	$5,666	$5,450	$5,450	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,499	$4,539	$4,673	$4,570	$4,749	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,583	$4,615	$4,655	$4,618	$4,874	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,794	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,740	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,410	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,921	$4,961	$5,004	$4,962	$5,027	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,920	$4,986	$5,037	$4,981	$5,149	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,923	$4,996	$5,163	$5,027	$5,459	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$4,987	$5,404	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,313	$6,343	$6,343	$6,333	$6,333	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,245	$5,318	$5,485	$5,349	$5,691	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,361	$5,434	$5,522	$5,439	$5,805	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 0.2: Door-to-door transportation rates for a 40" Container with High Valued Goods (Data compiled from various sources: Company websites and the sales department of the shipping lines)

CAR PARTS BASELINE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,419	$4,648	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,594	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,259	$5,394	$5,394	$5,349	$5,349	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,697	$4,737	$4,790	$4,741	$4,880	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,781	$4,813	$4,853	$4,816	$5,005	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,538	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,311	$4,208	$4,500	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,108	$5,577	$5,666	$5,450	$5,450	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,499	$4,539	$4,673	$4,570	$4,756	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,607	$4,615	$4,655	$4,626	$4,882	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,797	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,743	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,410	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,921	$4,961	$5,004	$4,962	$5,029	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,944	$5,010	$5,037	$4,997	$5,155	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,923	$4,996	$5,163	$5,027	$5,461	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$4,987	$5,407	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,313	$6,343	$6,343	$6,333	$6,333	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,245	$5,318	$5,485	$5,349	$5,694	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,361	$5,434	$5,546	$5,447	$5,813	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

Table 0.3: Door-to-door transportation rates for a 40" Container with Car Parts (Data compiled from various sources: Company websites and the sales department of the shipping lines)

APPENDIX C:

Direct/Feeder Service Model (5.2.2)

CHEMICALS DIRECT SERVICE											
							EU			NA	
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$2,955	$3,038	$3,101	$3,031	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,572	$3,655	$3,718	$3,648	$4,472	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,130	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,187	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,794	$2,877	$2,940	$2,870	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,411	$3,494	$3,557	$3,487	$4,693	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$3,977	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,018	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,172	$3,255	$3,318	$3,248	$4,050	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,799	$2,882	$3,113	$2,931	$3,907	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,789	$3,872	$3,935	$3,865	$4,565	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,751	$2,834	$2,948	$2,844	$4,216	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,047	$3,063	$3,130	$3,080	$4,313	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,695	$3,779	$3,841	$3,772	$4,637	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,312	$4,396	$4,458	$4,389	$5,227	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,862	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$4,903	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$935	-$852	-$789	-$859	76.9%
Mannheim	**Detroit**	-$1,239	-$1,156	-$925	-$1,107	70.9%
Mannheim	**Minneapolis**	-$827	-$743	-$681	-$750	81.6%
Mannheim	**Cleveland**	-$1,571	-$1,488	-$1,374	-$1,478	63.6%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.4%
Duisburg	**Chicago**	-$935	-$852	-$789	-$859	76.1%
Duisburg	**Detroit**	-$1,239	-$1,156	-$925	-$1,107	69.6%
Duisburg	**Minneapolis**	-$827	-$744	-$681	-$751	74.3%
Duisburg	**Cleveland**	-$1,571	-$1,488	-$1,374	-$1,478	62.0%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.2%
Stuttgart	**Chicago**	-$827	-$743	-$681	-$750	80.2%
Stuttgart	**Detroit**	-$1,053	-$970	-$739	-$920	75.0%
Stuttgart	**Minneapolis**	-$679	-$596	-$533	-$602	84.7%
Stuttgart	**Cleveland**	-$1,415	-$1,332	-$1,218	-$1,322	67.5%
Stuttgart	**Columbus**	-$1,251	-$1,234	-$1,168	-$1,218	71.4%
Basel	**Chicago**	-$873	-$789	-$727	-$796	81.3%
Basel	**Detroit**	-$1,177	-$1,094	-$863	-$1,045	75.9%
Basel	**Minneapolis**	-$856	-$773	-$710	-$780	84.0%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	69.3%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.5%

HIGH VALUED GOODS DIRECT SERVICE													
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,918	$4,043	$4,055	$4,005	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,545	$3,670	$3,850	$3,688	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,535	$4,660	$4,672	$4,622	$5,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,488	$3,613	$3,693	$3,598	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,784	$3,809	$3,909	$3,834	$4,805	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,743	$3,868	$3,881	$3,831	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,370	$3,495	$3,676	$3,514	$4,208	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,360	$4,485	$4,498	$4,448	$5,450	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,314	$3,439	$3,519	$3,424	$4,570	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,618	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,080	$4,205	$4,218	$4,168	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,707	$3,832	$4,013	$3,850	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,697	$4,822	$4,835	$4,785	$5,410	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,650	$3,775	$3,856	$3,760	$4,962	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$4,981	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,722	$4,847	$4,859	$4,809	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,348	$4,473	$4,654	$4,492	$4,987	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,339	$5,464	$5,476	$5,426	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,292	$4,417	$4,497	$4,402	$5,349	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,588	$4,613	$4,713	$4,638	$5,439	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$457	-$332	-$320	-$370	90.6%
Mannheim	**Detroit**	-$790	-$665	-$485	-$647	84.2%
Mannheim	**Minneapolis**	-$724	-$599	-$586	-$636	86.4%
Mannheim	**Cleveland**	-$1,209	-$1,084	-$1,004	-$1,099	75.9%
Mannheim	**Columbus**	-$974	-$949	-$849	-$924	79.8%
Duisburg	**Chicago**	-$434	-$309	-$296	-$346	90.2%
Duisburg	**Detroit**	-$767	-$642	-$461	-$623	83.5%
Duisburg	**Minneapolis**	-$747	-$622	-$610	-$660	81.6%
Duisburg	**Cleveland**	-$1,186	-$1,061	-$980	-$1,075	74.9%
Duisburg	**Columbus**	-$974	-$949	-$849	-$924	79.3%
Stuttgart	**Chicago**	-$519	-$394	-$381	-$431	89.8%
Stuttgart	**Detroit**	-$852	-$727	-$546	-$708	83.7%
Stuttgart	**Minneapolis**	-$662	-$537	-$525	-$575	88.4%
Stuttgart	**Cleveland**	-$1,271	-$1,146	-$1,065	-$1,160	75.8%
Stuttgart	**Columbus**	-$974	-$949	-$849	-$924	80.2%
Basel	**Chicago**	-$201	-$76	-$64	-$114	95.7%
Basel	**Detroit**	-$535	-$410	-$229	-$391	90.1%
Basel	**Minneapolis**	-$975	-$850	-$837	-$887	85.7%
Basel	**Cleveland**	-$953	-$828	-$748	-$843	82.3%
Basel	**Columbus**	-$773	-$748	-$648	-$723	85.3%

CAR PART DIRECT SERVICE

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,941	$4,066	$4,079	$4,029	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,558	$4,683	$4,696	$4,646	$5,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,808	$3,833	$3,933	$3,858	$4,816	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,767	$3,892	$3,904	$3,854	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,394	$3,519	$3,699	$3,537	$4,208	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,384	$4,509	$4,521	$4,471	$5,450	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,337	$3,462	$3,543	$3,447	$4,570	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,633	$3,658	$3,758	$3,683	$4,626	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,104	$4,229	$4,241	$4,191	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,721	$4,846	$4,858	$4,808	$5,410	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$4,962	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,970	$3,995	$4,095	$4,020	$4,997	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,745	$4,870	$4,883	$4,833	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,372	$4,497	$4,678	$4,516	$4,987	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,362	$5,487	$5,500	$5,450	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,315	$4,440	$4,521	$4,426	$5,349	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,612	$4,637	$4,737	$4,662	$5,447	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PART BASELINE+DIRECT SERVICE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$434	-$309	-$296	-$346	91.2%
Mannheim	**Detroit**	-$767	-$642	-$461	-$623	84.8%
Mannheim	**Minneapolis**	-$700	-$575	-$563	-$613	86.9%
Mannheim	**Cleveland**	-$1,185	-$1,060	-$980	-$1,075	76.4%
Mannheim	**Columbus**	-$974	-$949	-$849	-$924	80.1%
Duisburg	**Chicago**	-$410	-$285	-$273	-$323	90.7%
Duisburg	**Detroit**	-$743	-$618	-$438	-$600	84.1%
Duisburg	**Minneapolis**	-$724	-$599	-$586	-$636	82.0%
Duisburg	**Cleveland**	-$1,162	-$1,037	-$957	-$1,052	75.4%
Duisburg	**Columbus**	-$974	-$949	-$849	-$924	79.6%
Stuttgart	**Chicago**	-$495	-$370	-$358	-$408	90.3%
Stuttgart	**Detroit**	-$828	-$703	-$523	-$685	84.2%
Stuttgart	**Minneapolis**	-$639	-$514	-$501	-$551	88.9%
Stuttgart	**Cleveland**	-$1,247	-$1,122	-$1,042	-$1,137	76.3%
Stuttgart	**Columbus**	-$973	-$948	-$848	-$923	80.5%
Basel	**Chicago**	-$178	-$53	-$40	-$90	96.1%
Basel	**Detroit**	-$511	-$386	-$205	-$367	90.5%
Basel	**Minneapolis**	-$951	-$826	-$814	-$864	86.0%
Basel	**Cleveland**	-$930	-$805	-$724	-$819	82.7%
Basel	**Columbus**	-$749	-$724	-$624	-$699	85.6%

APPENDIX D:

Harbor Maintenance Tax (5.2.3.1)

CHEMICALS BASELINE WITH 0.09% HMT												
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,037	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,923	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,399	$4,498	$4,518	$4,472	$4,472	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,147	$4,130	$4,178	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,149	$4,179	$4,205	$4,178	$4,267	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,898	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,839	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,238	$4,855	$4,986	$4,693	$4,693	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$4,003	$3,974	$4,052	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,988	$4,006	$4,032	$4,009	$4,109	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$3,999	$4,030	$4,122	$4,050	$4,149	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,852	$3,908	$3,961	$3,907	$4,039	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,468	$4,604	$4,624	$4,565	$4,565	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,166	$4,174	$4,303	$4,214	$4,292	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,288	$4,298	$4,324	$4,303	$4,375	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,656	$4,678	$4,634	$4,767	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,658	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,169	$5,247	$5,267	$5,227	$5,227	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,842	$4,861	$4,874	$4,859	$4,908	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,827	$4,915	$4,938	$4,893	$5,004	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH 0.09% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$2,945	$3,029	$3,091	$3,022	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,572	$2,656	$2,886	$2,705	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,562	$3,646	$3,708	$3,639	$4,472	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,524	$2,607	$2,721	$2,617	$4,130	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,820	$2,837	$2,903	$2,853	$4,178	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,785	$2,868	$2,930	$2,861	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,411	$2,495	$2,726	$2,544	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,402	$3,485	$3,547	$3,478	$4,693	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,363	$2,447	$2,560	$2,457	$3,974	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,659	$2,676	$2,743	$2,693	$4,009	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,163	$3,246	$3,308	$3,239	$4,050	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,789	$2,873	$3,104	$2,922	$3,907	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,780	$3,863	$3,925	$3,856	$4,565	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,741	$2,825	$2,938	$2,835	$4,214	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,037	$3,054	$3,121	$3,071	$4,303	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,686	$3,769	$3,832	$3,762	$4,634	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,313	$3,396	$3,627	$3,445	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,303	$4,386	$4,449	$4,379	$5,227	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,264	$3,348	$3,462	$3,358	$4,859	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,561	$3,577	$3,644	$3,594	$4,893	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 0.09% HMT						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	Chicago	-$944	-$861	-$799	-$868	76.7%
Mannheim	Detroit	-$1,249	-$1,165	-$935	-$1,116	70.7%
Mannheim	Minneapolis	-$836	-$753	-$690	-$760	81.4%
Mannheim	Cleveland	-$1,581	-$1,497	-$1,383	-$1,487	63.4%
Mannheim	Columbus	-$1,329	-$1,312	-$1,245	-$1,295	68.3%
Duisburg	Chicago	-$944	-$861	-$799	-$868	75.9%
Duisburg	Detroit	-$1,249	-$1,165	-$935	-$1,116	69.4%
Duisburg	Minneapolis	-$836	-$753	-$691	-$760	74.1%
Duisburg	Cleveland	-$1,581	-$1,497	-$1,384	-$1,487	61.8%
Duisburg	Columbus	-$1,329	-$1,312	-$1,245	-$1,295	67.2%
Stuttgart	Chicago	-$836	-$753	-$690	-$760	80.0%
Stuttgart	Detroit	-$1,062	-$979	-$748	-$930	74.8%
Stuttgart	Minneapolis	-$688	-$605	-$542	-$612	84.5%
Stuttgart	Cleveland	-$1,424	-$1,341	-$1,227	-$1,331	67.3%
Stuttgart	Columbus	-$1,251	-$1,234	-$1,168	-$1,218	71.4%
Basel	Chicago	-$882	-$799	-$736	-$806	81.2%
Basel	Detroit	-$1,186	-$1,103	-$872	-$1,054	75.7%
Basel	Minneapolis	-$866	-$782	-$720	-$789	83.8%
Basel	Cleveland	-$1,578	-$1,494	-$1,380	-$1,484	69.1%
Basel	Columbus	-$1,266	-$1,250	-$1,183	-$1,233	73.4%

HIGH VALUED GOODS BASELINE WITH 0.09% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,419	$4,636	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,582	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,259	$5,394	$5,394	$5,349	$5,349	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,697	$4,737	$4,790	$4,741	$4,861	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,677	$4,763	$4,813	$4,751	$4,978	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,526	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,311	$4,208	$4,488	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,108	$5,577	$5,666	$5,450	$5,450	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,499	$4,539	$4,630	$4,556	$4,722	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,502	$4,615	$4,655	$4,591	$4,841	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,785	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,731	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,410	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,921	$4,961	$4,967	$4,950	$5,010	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Columbus	$4,839	$4,906	$5,037	$4,927	$5,125	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,923	$4,996	$5,163	$5,027	$5,450	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$4,987	$5,395	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,313	$6,343	$6,343	$6,333	$6,333	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,245	$5,318	$5,431	$5,331	$5,668	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,361	$5,434	$5,441	$5,412	$5,775	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

HIGH VALUED GOODS DIRECT SERVICE WITH 0.09% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,837	$3,962	$3,974	$3,924	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,464	$3,589	$3,769	$3,607	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,454	$4,579	$4,591	$4,541	$5,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,407	$3,532	$3,613	$3,517	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,703	$3,728	$3,828	$3,753	$4,751	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,662	$3,787	$3,800	$3,750	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,289	$3,414	$3,595	$3,433	$4,208	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,279	$4,404	$4,417	$4,367	$5,450	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,233	$3,358	$3,438	$3,343	$4,556	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,529	$3,554	$3,654	$3,579	$4,591	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,999	$4,124	$4,137	$4,087	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,626	$3,751	$3,932	$3,770	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,616	$4,741	$4,754	$4,704	$5,410	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,569	$3,694	$3,775	$3,680	$4,950	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,866	$3,891	$3,991	$3,916	$4,927	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,641	$4,766	$4,778	$4,728	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,268	$4,393	$4,573	$4,411	$4,987	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,258	$5,383	$5,395	$5,345	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,211	$4,336	$4,416	$4,321	$5,331	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,507	$4,532	$4,632	$4,557	$5,412	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 0.09% HMT						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$538	-$413	-$401	-$451	88.8%
Mannheim	Detroit	-$871	-$746	-$565	-$728	82.4%
Mannheim	Minneapolis	-$805	-$680	-$667	-$717	84.9%
Mannheim	Cleveland	-$1,290	-$1,165	-$1,084	-$1,180	74.2%
Mannheim	Columbus	-$974	-$949	-$849	-$924	79.0%
Duisburg	Chicago	-$515	-$390	-$377	-$427	88.3%
Duisburg	Detroit	-$848	-$723	-$542	-$704	81.6%
Duisburg	Minneapolis	-$828	-$703	-$691	-$741	80.1%
Duisburg	Cleveland	-$1,266	-$1,141	-$1,061	-$1,156	73.4%
Duisburg	Columbus	-$974	-$949	-$849	-$924	78.0%
Stuttgart	Chicago	-$600	-$475	-$462	-$512	88.0%
Stuttgart	Detroit	-$933	-$808	-$627	-$789	81.9%
Stuttgart	Minneapolis	-$743	-$618	-$606	-$656	86.9%
Stuttgart	Cleveland	-$1,351	-$1,226	-$1,146	-$1,241	74.3%
Stuttgart	Columbus	-$973	-$948	-$848	-$923	79.5%
Basel	Chicago	-$282	-$157	-$145	-$195	94.1%
Basel	Detroit	-$615	-$490	-$310	-$472	88.4%
Basel	Minneapolis	-$1,056	-$931	-$918	-$968	84.4%
Basel	Cleveland	-$1,034	-$909	-$829	-$924	81.0%
Basel	Columbus	-$854	-$829	-$729	-$804	84.2%

CAR PARTS BASELINE WITH 0.09% HMT

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,419	$4,638	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,584	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,259	$5,394	$5,394	$5,349	$5,349	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,697	$4,737	$4,790	$4,741	$4,865	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,694	$4,780	$4,813	$4,762	$4,985	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,248	$4,528	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,311	$4,208	$4,490	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,108	$5,577	$5,666	$5,450	$5,450	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,499	$4,539	$4,647	$4,562	$4,727	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,519	$4,615	$4,655	$4,597	$4,849	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,599	$4,639	$4,688	$4,642	$4,787	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,733	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,410	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,921	$4,961	$4,984	$4,955	$5,014	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Columbus	$4,856	$4,923	$5,037	$4,939	$5,132	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,923	$4,996	$5,163	$5,027	$5,451	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$4,987	$5,397	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,313	$6,343	$6,343	$6,333	$6,333	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,245	$5,318	$5,448	$5,337	$5,674	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,361	$5,434	$5,458	$5,418	$5,782	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CAR PARTS DIRECT SERVICE WITH 0.09% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,854	$3,979	$3,991	$3,941	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,481	$3,606	$3,786	$3,624	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,471	$4,596	$4,608	$4,558	$5,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,424	$3,549	$3,630	$3,534	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,720	$3,745	$3,845	$3,770	$4,762	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,679	$3,804	$3,817	$3,767	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,306	$3,431	$3,612	$3,450	$4,208	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,296	$4,421	$4,434	$4,384	$5,450	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,250	$3,375	$3,455	$3,360	$4,562	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,546	$3,571	$3,671	$3,596	$4,597	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,016	$4,141	$4,154	$4,104	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,643	$3,768	$3,949	$3,787	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,633	$4,758	$4,771	$4,721	$5,410	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,586	$3,711	$3,792	$3,697	$4,955	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,883	$3,908	$4,008	$3,933	$4,939	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,658	$4,783	$4,795	$4,745	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,285	$4,410	$4,590	$4,428	$4,987	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,275	$5,400	$5,412	$5,362	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,228	$4,353	$4,433	$4,338	$5,337	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,524	$4,549	$4,649	$4,574	$5,418	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 0.09% HMT						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$521	-$396	-$384	-$434	89.2%
Mannheim	**Detroit**	-$854	-$729	-$549	-$711	82.8%
Mannheim	**Minneapolis**	-$788	-$663	-$650	-$700	85.2%
Mannheim	**Cleveland**	-$1,273	-$1,148	-$1,067	-$1,163	74.5%
Mannheim	**Columbus**	-$974	-$949	-$849	-$924	79.2%
Duisburg	**Chicago**	-$498	-$373	-$360	-$410	88.7%
Duisburg	**Detroit**	-$831	-$706	-$525	-$687	82.0%
Duisburg	**Minneapolis**	-$811	-$686	-$674	-$724	80.4%
Duisburg	**Cleveland**	-$1,249	-$1,124	-$1,044	-$1,139	73.6%
Duisburg	**Columbus**	-$974	-$949	-$849	-$924	78.2%
Stuttgart	**Chicago**	-$583	-$458	-$445	-$495	88.4%
Stuttgart	**Detroit**	-$916	-$791	-$610	-$772	82.3%
Stuttgart	**Minneapolis**	-$726	-$601	-$589	-$639	87.3%
Stuttgart	**Cleveland**	-$1,335	-$1,210	-$1,129	-$1,224	74.6%
Stuttgart	**Columbus**	-$973	-$948	-$848	-$923	79.6%
Basel	**Chicago**	-$265	-$140	-$128	-$178	94.4%
Basel	**Detroit**	-$599	-$474	-$293	-$455	88.8%
Basel	**Minneapolis**	-$1,039	-$914	-$901	-$951	84.7%
Basel	**Cleveland**	-$1,017	-$892	-$812	-$907	81.3%
Basel	**Columbus**	-$837	-$812	-$712	-$787	84.4%

CHEMICALS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT												
					Average	Average		EU			NA	
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	1-3 choice	1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,890	$3,962	$3,971	$4,148	$3,941	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,753	$3,785	$3,787	$3,775	$3,826	Antwerp	Antwerp	Rotterdam	Toledo	Toledo	Toledo
Mannheim	Minneapolis	$4,399	$4,498	$4,518	$4,765	$4,472	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$3,712	$3,742	$3,744	$3,732	$4,130	Antwerp	Antwerp	Antwerp	Cleveland	Cleveland	Cleveland
Mannheim	Columbus	$4,008	$4,018	$4,038	$4,021	$4,187	Antwerp	Antwerp	Antwerp	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,971	$3,771	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,580	$3,601	$3,613	$3,598	$3,666	Bremen	Rotterdam	Bremen	Toledo	Toledo	Toledo
Duisburg	Minneapolis	$4,238	$4,570	$4,591	$4,588	$4,693	Antwerp	Bremen	Rotterdam	Montreal	Toledo	Toledo
Duisburg	Cleveland	$3,538	$3,559	$3,568	$3,555	$3,977	Bremen	Rotterdam	Bremen	Cleveland	Cleveland	Cleveland
Duisburg	Columbus	$3,835	$3,845	$3,855	$3,845	$4,018	Bremen	Bremen	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,999	$4,030	$4,122	$4,261	$4,050	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,852	$3,854	$3,888	$3,888	$3,907	Bremen	Antwerp	Antwerp	Montreal	Toledo	Toledo
Stuttgart	Minneapolis	$4,468	$4,604	$4,624	$4,878	$4,565	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$3,813	$3,843	$3,881	$3,846	$4,216	Antwerp	Antwerp	Bremen	Cleveland	Cleveland	Cleveland
Stuttgart	Columbus	$4,109	$4,119	$4,139	$4,122	$4,313	Antwerp	Antwerp	Antwerp	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,568	$4,656	$4,687	$4,913	$4,637	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,480	$4,499	$4,513	$4,540	$4,549	Bremen	Rotterdam	Bremen	Toledo	Montreal	Toledo
Basel	Minneapolis	$5,169	$5,247	$5,267	$5,530	$5,227	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,438	$4,468	$4,586	$4,497	$4,862	Bremen	Bremen	Rotterdam	Cleveland	Cleveland	Cleveland
Basel	Columbus	$4,734	$4,744	$4,764	$4,748	$4,903	Bremen	Bremen	Bremen	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT						
		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	$0	$72	$81	$51	105.3%
Mannheim	**Detroit**	-$68	-$36	-$34	-$46	98.7%
Mannheim	**Minneapolis**	$0	$100	$120	$73	106.6%
Mannheim	**Cleveland**	-$393	-$363	-$361	-$372	90.4%
Mannheim	**Columbus**	-$150	-$140	-$120	-$137	96.0%
Duisburg	**Chicago**	$0	$47	$78	$42	105.3%
Duisburg	**Detroit**	-$80	-$60	-$47	-$62	98.1%
Duisburg	**Minneapolis**	$0	$332	$353	$228	97.8%
Duisburg	**Cleveland**	-$405	-$385	-$375	-$389	89.4%
Duisburg	**Columbus**	-$163	-$153	-$142	-$153	95.7%
Stuttgart	**Chicago**	$0	$31	$123	$51	105.2%
Stuttgart	**Detroit**	$0	$3	$36	$13	99.5%
Stuttgart	**Minneapolis**	$0	$136	$156	$97	106.9%
Stuttgart	**Cleveland**	-$353	-$323	-$285	-$320	91.2%
Stuttgart	**Columbus**	-$189	-$179	-$159	-$175	95.6%
Basel	**Chicago**	$0	$88	$119	$69	106.0%
Basel	**Detroit**	-$19	$0	$14	-$2	99.8%
Basel	**Minneapolis**	$0	$78	$98	$59	105.8%
Basel	**Cleveland**	-$413	-$383	-$266	-$354	92.5%
Basel	**Columbus**	-$102	-$92	-$72	-$89	96.8%

HIGH VALUED GOODS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,814	$4,419	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,375	$4,441	$4,379	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Mannheim	Minneapolis	$5,259	$5,365	$5,394	$5,431	$5,349	Antwerp	Rotterdam	BREHA	Montreal	Toledo	Montreal
Mannheim	Cleveland	$4,328	$4,373	$4,478	$4,393	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Mannheim	Columbus	$4,624	$4,639	$4,669	$4,644	$4,805	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,616	$4,248	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,177	$4,251	$4,208	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Duisburg	Minneapolis	$5,108	$5,167	$5,217	$5,233	$5,450	Bremen	Rotterdam	Rotterdam	Montreal	Toledo	Toledo
Duisburg	Cleveland	$4,130	$4,175	$4,304	$4,203	$4,570	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Duisburg	Columbus	$4,426	$4,441	$4,471	$4,446	$4,618	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,599	$4,639	$4,688	$5,018	$4,642	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,598	$4,599	$4,645	$4,602	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,635	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,552	$4,597	$4,641	$4,596	$4,962	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Stuttgart	Columbus	$4,848	$4,863	$4,893	$4,868	$4,981	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,923	$4,996	$5,163	$5,601	$5,027	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$5,278	$4,987	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,152	$6,202	$6,300	$6,218	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$5,116	$5,161	$5,245	$5,196	$5,349	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Montreal
Basel	Columbus	$5,361	$5,412	$5,427	$5,432	$5,439	Rotterdam	Rotterdam	Rotterdam	Montreal	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT						
		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	$373	$423	$520	$439	108.9%
Mannheim	**Detroit**	$40	$90	$190	$106	101.4%
Mannheim	**Minneapolis**	$106	$156	$254	$172	101.5%
Mannheim	**Cleveland**	-$369	-$324	-$219	-$304	92.7%
Mannheim	**Columbus**	-$134	-$119	-$89	-$114	96.7%
Duisburg	**Chicago**	$373	$423	$520	$439	108.6%
Duisburg	**Detroit**	$40	$90	$213	$114	101.0%
Duisburg	**Minneapolis**	$59	$109	$207	$125	96.0%
Duisburg	**Cleveland**	-$369	-$324	-$195	-$296	92.0%
Duisburg	**Columbus**	-$157	-$142	-$112	-$137	96.3%
Stuttgart	**Chicago**	$373	$423	$461	$419	108.1%
Stuttgart	**Detroit**	$40	$90	$128	$86	100.9%
Stuttgart	**Minneapolis**	$229	$279	$318	$276	104.2%
Stuttgart	**Cleveland**	-$369	-$324	-$280	-$324	92.6%
Stuttgart	**Columbus**	-$72	-$57	-$27	-$52	97.7%
Basel	**Chicago**	$612	$662	$760	$678	111.4%
Basel	**Detroit**	$279	$329	$576	$395	105.8%
Basel	**Minneapolis**	-$161	-$111	-$14	-$95	98.2%
Basel	**Cleveland**	-$129	-$84	$66	-$49	97.1%
Basel	**Columbus**	$51	$66	$96	$71	99.9%

CAR PARTS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,814	$4,419	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,375	$4,441	$4,379	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Mannheim	Minneapolis	$5,259	$5,365	$5,394	$5,431	$5,349	Antwerp	Rotterdam	BREHA	Montreal	Toledo	Montreal
Mannheim	Cleveland	$4,328	$4,373	$4,478	$4,393	$4,741	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Mannheim	Columbus	$4,624	$4,639	$4,669	$4,644	$4,816	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$4,177	$4,217	$4,351	$4,616	$4,248	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,137	$4,177	$4,177	$4,251	$4,208	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Duisburg	Minneapolis	$5,108	$5,167	$5,217	$5,233	$5,450	Bremen	Rotterdam	Rotterdam	Montreal	Toledo	Toledo
Duisburg	Cleveland	$4,130	$4,175	$4,304	$4,203	$4,570	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Duisburg	Columbus	$4,426	$4,441	$4,471	$4,446	$4,626	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,599	$4,639	$4,688	$5,018	$4,642	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,559	$4,598	$4,599	$4,645	$4,602	Antwerp	Rotterdam	Rotterdam	Montreal	Toledo	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,635	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,552	$4,597	$4,641	$4,596	$4,962	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Cleveland
Stuttgart	Columbus	$4,848	$4,863	$4,893	$4,868	$4,997	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,923	$4,996	$5,163	$5,601	$5,027	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$5,278	$4,987	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,152	$6,202	$6,300	$6,218	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$5,116	$5,161	$5,245	$5,196	$5,349	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Montreal
Basel	Columbus	$5,361	$5,412	$5,427	$5,432	$5,447	Rotterdam	Rotterdam	Rotterdam	Montreal	Cleveland	Toledo

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+ FEEDER SERVICE WITH 0.00% HMT FOR CANADA-US TRANSPORT						
		1st choice Feeder vs. 1st choice Existing	2nd choice Feeder vs. 1st choice Existing	3rd choice Feeder vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	$373	$423	$520	$439	108.9%
Mannheim	**Detroit**	$40	$90	$190	$106	101.4%
Mannheim	**Minneapolis**	$106	$156	$254	$172	101.5%
Mannheim	**Cleveland**	-$369	-$324	-$219	-$304	92.7%
Mannheim	**Columbus**	-$157	-$142	-$112	-$137	96.4%
Duisburg	**Chicago**	$373	$423	$520	$439	108.6%
Duisburg	**Detroit**	$40	$90	$213	$114	101.0%
Duisburg	**Minneapolis**	$59	$109	$207	$125	96.0%
Duisburg	**Cleveland**	-$369	-$324	-$195	-$296	92.0%
Duisburg	**Columbus**	-$181	-$166	-$136	-$161	96.1%
Stuttgart	**Chicago**	$373	$423	$461	$419	108.1%
Stuttgart	**Detroit**	$40	$90	$128	$86	100.9%
Stuttgart	**Minneapolis**	$229	$279	$318	$276	104.2%
Stuttgart	**Cleveland**	-$369	-$324	-$280	-$324	92.6%
Stuttgart	**Columbus**	-$95	-$80	-$50	-$75	97.4%
Basel	**Chicago**	$612	$662	$760	$678	111.4%
Basel	**Detroit**	$279	$329	$576	$395	105.8%
Basel	**Minneapolis**	-$161	-$111	-$14	-$95	98.2%
Basel	**Cleveland**	-$129	-$84	$66	-$49	97.1%
Basel	**Columbus**	$51	$66	$96	$71	99.7%

CHEMICALS BASELINE WITH 0.00% HMT												
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,890	$3,962	$3,971	$3,941	$4,031	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,821	$3,824	$3,833	$3,826	$3,920	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,399	$4,498	$4,518	$4,472	$4,472	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,105	$4,138	$4,140	$4,127	$4,169	Antwerp	Bremen	Rotterdam	Montreal	Montreal	NYNJ
Mannheim	Columbus	$4,125	$4,155	$4,181	$4,154	$4,246	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,729	$3,776	$3,807	$3,771	$3,890	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,660	$3,660	$3,678	$3,666	$3,834	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,238	$4,855	$4,986	$4,693	$4,693	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,944	$3,974	$3,979	$3,966	$4,039	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Duisburg	Columbus	$3,964	$3,982	$4,008	$3,985	$4,090	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$3,999	$4,030	$4,115	$4,048	$4,143	Bremen	Bremen	Bremen	Montreal	Montreal	Norfolk
Stuttgart	Detroit	$3,852	$3,908	$3,961	$3,907	$4,037	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,468	$4,604	$4,624	$4,565	$4,565	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,166	$4,174	$4,279	$4,206	$4,284	Bremen	Antwerp	Bremen	Montreal	Montreal	NYNJ
Stuttgart	Columbus	$4,264	$4,274	$4,300	$4,279	$4,353	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,568	$4,654	$4,656	$4,626	$4,761	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	Montreal
Basel	Detroit	$4,499	$4,560	$4,587	$4,549	$4,656	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,169	$5,247	$5,267	$5,227	$5,227	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,818	$4,861	$4,874	$4,851	$4,900	Rotterdam	Rotterdam	Bremen	NYNJ	Montreal	Montreal
Basel	Columbus	$4,803	$4,891	$4,914	$4,869	$4,983	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH 0.00% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$2,921	$3,005	$3,067	$2,998	$3,941	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,548	$2,631	$2,862	$2,681	$3,826	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,538	$3,622	$3,684	$3,615	$4,472	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,500	$2,583	$2,697	$2,593	$4,127	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,796	$2,813	$2,879	$2,829	$4,154	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,761	$2,844	$2,906	$2,837	$3,771	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,387	$2,471	$2,701	$2,520	$3,666	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,378	$3,461	$3,523	$3,454	$4,693	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,339	$2,422	$2,536	$2,433	$3,966	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,635	$2,652	$2,719	$2,669	$3,985	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,139	$3,222	$3,284	$3,215	$4,048	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,765	$2,849	$3,079	$2,898	$3,907	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,756	$3,839	$3,901	$3,832	$4,565	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,717	$2,800	$2,914	$2,811	$4,206	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,013	$3,030	$3,097	$3,047	$4,279	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,662	$3,745	$3,808	$3,738	$4,626	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,289	$3,372	$3,603	$3,421	$4,549	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,279	$4,362	$4,425	$4,355	$5,227	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,240	$3,324	$3,437	$3,334	$4,851	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,537	$3,553	$3,620	$3,570	$4,869	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 0.00% HMT						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$969	-$885	-$823	-$892	76.1%
Mannheim	**Detroit**	-$1,273	-$1,190	-$959	-$1,140	70.1%
Mannheim	**Minneapolis**	-$860	-$777	-$714	-$784	80.8%
Mannheim	**Cleveland**	-$1,605	-$1,521	-$1,408	-$1,511	62.8%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.1%
Duisburg	**Chicago**	-$969	-$885	-$823	-$892	75.2%
Duisburg	**Detroit**	-$1,273	-$1,189	-$959	-$1,140	68.7%
Duisburg	**Minneapolis**	-$860	-$777	-$715	-$784	73.6%
Duisburg	**Cleveland**	-$1,605	-$1,522	-$1,408	-$1,511	61.3%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.0%
Stuttgart	**Chicago**	-$860	-$777	-$714	-$784	79.4%
Stuttgart	**Detroit**	-$1,086	-$1,003	-$772	-$954	74.2%
Stuttgart	**Minneapolis**	-$712	-$629	-$567	-$636	83.9%
Stuttgart	**Cleveland**	-$1,449	-$1,365	-$1,251	-$1,355	66.8%
Stuttgart	**Columbus**	-$1,251	-$1,234	-$1,168	-$1,218	71.2%
Basel	**Chicago**	-$906	-$823	-$761	-$830	80.8%
Basel	**Detroit**	-$1,211	-$1,127	-$896	-$1,078	75.2%
Basel	**Minneapolis**	-$890	-$806	-$744	-$813	83.3%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	68.7%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.3%

HIGH VALUED GOODS AND CAR PARTS BASELINE WITH 0.00% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,375	$4,415	$4,468	$4,419	$4,609	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,335	$4,375	$4,428	$4,379	$4,559	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,259	$5,394	$5,394	$5,349	$5,349	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,597	$4,675	$4,683	$4,652	$4,787	Antwerp	Antwerp	Bremen	Norfolk	NYNJ	Norfolk
Mannheim	Columbus	$4,469	$4,555	$4,685	$4,570	$4,828	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	NYNJ
Duisburg	Chicago	$4,177	$4,217	$4,339	$4,245	$4,471	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Detroit	$4,137	$4,177	$4,311	$4,208	$4,439	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,108	$5,577	$5,666	$5,450	$5,450	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,422	$4,477	$4,499	$4,466	$4,650	Antwerp	Antwerp	Antwerp	Norfolk	NYNJ	Montreal
Duisburg	Columbus	$4,294	$4,487	$4,498	$4,426	$4,686	Antwerp	Antwerp	Antwerp	Norfolk	NYNJ	Norfolk
Stuttgart	Chicago	$4,599	$4,639	$4,676	$4,638	$4,758	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Detroit	$4,559	$4,599	$4,648	$4,602	$4,708	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,359	$5,436	$5,436	$5,410	$5,410	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,759	$4,826	$4,892	$4,826	$4,934	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	NYNJ
Stuttgart	Columbus	$4,631	$4,698	$4,891	$4,740	$4,988	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	NYNJ
Basel	Chicago	$4,923	$4,996	$5,163	$5,027	$5,422	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,883	$4,956	$5,123	$4,987	$5,372	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,313	$6,343	$6,343	$6,333	$6,333	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,223	$5,245	$5,296	$5,255	$5,584	Rotterdam	Rotterdam	Antwerp	NYNJ	Montreal	NYNJ
Basel	Columbus	$5,233	$5,244	$5,306	$5,261	$5,646	Rotterdam	Rotterdam	Antwerp	NYNJ	Norfolk	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

HIGH VALUED GOODS AND CAR PARTS DIRECT SERVICE WITH 0.00% HMT												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,629	$3,754	$3,766	$3,716	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,256	$3,381	$3,561	$3,399	$4,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,246	$4,371	$4,383	$4,333	$5,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,199	$3,324	$3,405	$3,309	$4,652	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,495	$3,520	$3,620	$3,545	$4,570	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,454	$3,579	$3,592	$3,542	$4,245	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,081	$3,206	$3,387	$3,225	$4,208	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,071	$4,196	$4,209	$4,159	$5,450	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,025	$3,150	$3,230	$3,135	$4,466	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,321	$3,346	$3,446	$3,371	$4,426	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,791	$3,916	$3,929	$3,879	$4,638	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,418	$3,543	$3,724	$3,562	$4,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,408	$4,533	$4,546	$4,496	$5,410	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,361	$3,486	$3,567	$3,472	$4,826	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,658	$3,683	$3,783	$3,708	$4,740	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,433	$4,558	$4,570	$4,520	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,060	$4,185	$4,365	$4,203	$4,987	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,050	$5,175	$5,187	$5,137	$6,333	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,003	$4,128	$4,208	$4,113	$5,255	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,299	$4,324	$4,424	$4,349	$5,261	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS AND CAR PARTS BASELINE+DIRECT SERVICE WITH 0.00% HMT						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$969	-$885	-$823	-$892	76.1%
Mannheim	**Detroit**	-$1,273	-$1,190	-$959	-$1,140	70.1%
Mannheim	**Minneapolis**	-$860	-$777	-$714	-$784	80.8%
Mannheim	**Cleveland**	-$1,605	-$1,521	-$1,408	-$1,511	62.8%
Mannheim	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	68.1%
Duisburg	**Chicago**	-$969	-$885	-$823	-$892	75.2%
Duisburg	**Detroit**	-$1,273	-$1,189	-$959	-$1,140	68.7%
Duisburg	**Minneapolis**	-$860	-$777	-$715	-$784	73.6%
Duisburg	**Cleveland**	-$1,605	-$1,522	-$1,408	-$1,511	61.3%
Duisburg	**Columbus**	-$1,329	-$1,312	-$1,245	-$1,295	67.0%
Stuttgart	**Chicago**	-$860	-$777	-$714	-$784	79.4%
Stuttgart	**Detroit**	-$1,086	-$1,003	-$772	-$954	74.2%
Stuttgart	**Minneapolis**	-$712	-$629	-$567	-$636	83.9%
Stuttgart	**Cleveland**	-$1,449	-$1,365	-$1,251	-$1,355	66.8%
Stuttgart	**Columbus**	-$1,251	-$1,234	-$1,168	-$1,218	71.2%
Basel	**Chicago**	-$906	-$823	-$761	-$830	80.8%
Basel	**Detroit**	-$1,211	-$1,127	-$896	-$1,078	75.2%
Basel	**Minneapolis**	-$890	-$806	-$744	-$813	83.3%
Basel	**Cleveland**	-$1,578	-$1,494	-$1,380	-$1,484	68.7%
Basel	**Columbus**	-$1,266	-$1,250	-$1,183	-$1,233	73.3%

APPENDIX E:

Trucking Tariff Increase (5.2.3.2)

CHEMICALS BASELINE WITH 20% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,930	$4,002	$4,011	$3,981	$4,085	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,861	$3,864	$3,873	$3,866	$3,962	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,445	$4,544	$4,564	$4,518	$4,518	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,192	$4,195	$4,237	$4,208	$4,256	Antwerp	Rotterdam	Antwerp	Montreal	NYNJ	NYNJ
Mannheim	Columbus	$4,203	$4,231	$4,254	$4,229	$4,323	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,769	$3,816	$3,847	$3,811	$3,950	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,700	$3,700	$3,713	$3,704	$3,880	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,284	$4,901	$5,032	$4,739	$4,739	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,032	$4,034	$4,064	$4,043	$4,121	Antwerp	Rotterdam	Antwerp	Montreal	NYNJ	NYNJ
Duisburg	Columbus	$4,042	$4,057	$4,081	$4,060	$4,180	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,039	$4,070	$4,162	$4,090	$4,197	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,892	$3,943	$4,001	$3,945	$4,079	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,514	$4,650	$4,670	$4,611	$4,611	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,262	$4,278	$4,335	$4,292	$4,368	Antwerp	Bremen	Bremen	Montreal	Montreal	NYNJ
Stuttgart	Columbus	$4,343	$4,349	$4,373	$4,355	$4,434	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,608	$4,696	$4,726	$4,677	$4,815	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,539	$4,600	$4,627	$4,589	$4,697	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,215	$5,293	$5,313	$5,273	$5,273	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,873	$4,962	$4,962	$4,932	$4,986	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,881	$4,970	$4,989	$4,947	$5,058	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CHEMICALS DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average1-3choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,015	$3,098	$3,161	$3,091	$3,981	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,628	$2,711	$3,008	$2,782	$3,866	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,632	$3,715	$3,778	$3,708	$4,518	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,594	$2,677	$2,807	$2,692	$4,207	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,929	$2,945	$3,012	$2,962	$4,229	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,854	$2,938	$3,000	$2,931	$3,811	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,467	$2,550	$2,847	$2,622	$3,704	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,471	$3,555	$3,617	$3,548	$4,739	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,433	$2,516	$2,646	$2,532	$4,042	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,768	$2,785	$2,851	$2,801	$4,060	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,232	$3,316	$3,378	$3,309	$4,090	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,845	$2,928	$3,225	$3,000	$3,945	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,849	$3,933	$3,995	$3,926	$4,611	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,811	$2,894	$3,024	$2,910	$4,291	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,146	$3,163	$3,229	$3,179	$4,354	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,756	$3,839	$3,901	$3,832	$4,677	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,368	$3,452	$3,749	$3,523	$4,589	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,373	$4,456	$4,518	$4,449	$5,273	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,334	$3,418	$3,547	$3,433	$4,931	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,669	$3,686	$3,753	$3,703	$4,947	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$915	-$832	-$769	-$839	77.7%
Mannheim	**Detroit**	-$1,233	-$1,150	-$853	-$1,079	72.0%
Mannheim	**Minneapolis**	-$813	-$729	-$667	-$736	82.1%
Mannheim	**Cleveland**	-$1,599	-$1,515	-$1,386	-$1,500	64.0%
Mannheim	**Columbus**	-$1,274	-$1,258	-$1,191	-$1,241	70.0%
Duisburg	**Chicago**	-$915	-$832	-$769	-$839	76.9%
Duisburg	**Detroit**	-$1,233	-$1,150	-$853	-$1,078	70.8%
Duisburg	**Minneapolis**	-$813	-$729	-$667	-$736	74.9%
Duisburg	**Cleveland**	-$1,599	-$1,515	-$1,386	-$1,500	62.6%
Duisburg	**Columbus**	-$1,274	-$1,258	-$1,191	-$1,241	69.0%
Stuttgart	**Chicago**	-$806	-$723	-$661	-$730	80.9%
Stuttgart	**Detroit**	-$1,047	-$963	-$666	-$892	76.0%
Stuttgart	**Minneapolis**	-$665	-$581	-$519	-$588	85.1%
Stuttgart	**Cleveland**	-$1,451	-$1,367	-$1,238	-$1,352	67.8%
Stuttgart	**Columbus**	-$1,197	-$1,180	-$1,113	-$1,163	73.0%
Basel	**Chicago**	-$853	-$769	-$707	-$776	81.9%
Basel	**Detroit**	-$1,171	-$1,087	-$790	-$1,016	76.8%
Basel	**Minneapolis**	-$842	-$759	-$696	-$766	84.4%
Basel	**Cleveland**	-$1,539	-$1,456	-$1,326	-$1,440	69.6%
Basel	**Columbus**	-$1,212	-$1,195	-$1,129	-$1,179	74.9%

CHEMICALS BASELINE WITH 25% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,940	$4,012	$4,021	$3,991	$4,097	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,871	$3,874	$3,882	$3,875	$3,972	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,456	$4,556	$4,576	$4,529	$4,529	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,201	$4,214	$4,244	$4,220	$4,274	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Mannheim	Columbus	$4,214	$4,241	$4,264	$4,240	$4,333	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,779	$3,826	$3,857	$3,821	$3,962	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,710	$3,710	$3,721	$3,714	$3,889	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,295	$4,912	$5,044	$4,751	$4,751	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,040	$4,054	$4,071	$4,055	$4,135	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Duisburg	Columbus	$4,054	$4,068	$4,091	$4,071	$4,196	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,049	$4,080	$4,172	$4,100	$4,208	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,902	$3,951	$4,011	$3,954	$4,088	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,525	$4,661	$4,681	$4,623	$4,623	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,284	$4,306	$4,340	$4,310	$4,385	Antwerp	Bremen	Bremen	Montreal	Montreal	NYNJ
Stuttgart	Columbus	$4,354	$4,359	$4,383	$4,365	$4,445	Bremen	Bremen	Bremen	Norfolk	NYNJ	NYNJ
Basel	Chicago	$4,618	$4,706	$4,736	$4,687	$4,827	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,549	$4,610	$4,637	$4,599	$4,707	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,226	$5,304	$5,324	$5,285	$5,285	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,879	$4,967	$4,984	$4,943	$5,004	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,893	$4,981	$4,999	$4,958	$5,068	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CHEMICALS DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,030	$3,114	$3,176	$3,107	$3,991	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,639	$2,723	$3,036	$2,800	$3,875	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,647	$3,731	$3,793	$3,724	$4,529	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,609	$2,692	$2,826	$2,709	$4,218	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,954	$2,970	$3,037	$2,987	$4,239	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,870	$2,953	$3,015	$2,946	$3,821	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,479	$2,562	$2,876	$2,639	$3,714	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,487	$3,570	$3,632	$3,563	$4,751	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,448	$2,531	$2,665	$2,548	$4,053	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,793	$2,809	$2,876	$2,826	$4,070	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,248	$3,331	$3,393	$3,324	$4,100	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,857	$2,940	$3,254	$3,017	$3,954	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,865	$3,948	$4,010	$3,941	$4,623	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,826	$2,909	$3,043	$2,926	$4,309	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,171	$3,188	$3,254	$3,204	$4,365	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,771	$3,854	$3,917	$3,847	$4,687	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,380	$3,463	$3,777	$3,540	$4,599	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,388	$4,471	$4,534	$4,464	$5,285	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,349	$3,433	$3,566	$3,449	$4,941	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,694	$3,711	$3,777	$3,727	$4,958	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$910	-$826	-$764	-$833	77.8%
Mannheim	**Detroit**	-$1,231	-$1,148	-$835	-$1,071	72.2%
Mannheim	**Minneapolis**	-$809	-$725	-$663	-$732	82.2%
Mannheim	**Cleveland**	-$1,592	-$1,509	-$1,375	-$1,492	64.2%
Mannheim	**Columbus**	-$1,261	-$1,244	-$1,178	-$1,228	70.4%
Duisburg	**Chicago**	-$910	-$826	-$764	-$833	77.1%
Duisburg	**Detroit**	-$1,231	-$1,148	-$835	-$1,071	71.1%
Duisburg	**Minneapolis**	-$809	-$726	-$663	-$733	75.0%
Duisburg	**Cleveland**	-$1,592	-$1,509	-$1,375	-$1,492	62.8%
Duisburg	**Columbus**	-$1,261	-$1,244	-$1,178	-$1,228	69.4%
Stuttgart	**Chicago**	-$801	-$718	-$655	-$725	81.1%
Stuttgart	**Detroit**	-$1,045	-$962	-$648	-$885	76.3%
Stuttgart	**Minneapolis**	-$661	-$578	-$515	-$584	85.3%
Stuttgart	**Cleveland**	-$1,458	-$1,374	-$1,241	-$1,358	67.9%
Stuttgart	**Columbus**	-$1,183	-$1,167	-$1,100	-$1,150	73.4%
Basel	**Chicago**	-$847	-$764	-$702	-$771	82.1%
Basel	**Detroit**	-$1,169	-$1,086	-$772	-$1,009	77.0%
Basel	**Minneapolis**	-$838	-$755	-$692	-$762	84.5%
Basel	**Cleveland**	-$1,530	-$1,446	-$1,313	-$1,430	69.8%
Basel	**Columbus**	-$1,199	-$1,182	-$1,115	-$1,165	75.2%

CHEMICALS BASELINE WITH 30% TRUCK TARIFF INCREASE													
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,950	$4,022	$4,031	$4,001	$4,108	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,881	$3,884	$3,890	$3,885	$3,981	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,468	$4,567	$4,587	$4,541	$4,541	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,206	$4,236	$4,252	$4,232	$4,293	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Mannheim	Columbus	$4,226	$4,251	$4,274	$4,250	$4,343	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,789	$3,836	$3,867	$3,831	$3,974	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,720	$3,720	$3,730	$3,723	$3,899	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,307	$4,924	$5,055	$4,762	$4,762	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,045	$4,076	$4,079	$4,067	$4,149	Rotterdam	Antwerp	Antwerp	NYNJ	Montreal	NYNJ
Duisburg	Columbus	$4,065	$4,078	$4,101	$4,081	$4,210	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,059	$4,090	$4,182	$4,110	$4,220	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,912	$3,960	$4,021	$3,964	$4,098	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,537	$4,673	$4,693	$4,634	$4,634	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,306	$4,334	$4,346	$4,329	$4,401	Antwerp	Bremen	Bremen	Montreal	Montreal	NYNJ
Stuttgart	Columbus	$4,365	$4,370	$4,393	$4,376	$4,455	Bremen	Bremen	Bremen	Norfolk	NYNJ	NYNJ
Basel	Chicago	$4,628	$4,716	$4,746	$4,697	$4,839	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,559	$4,620	$4,647	$4,609	$4,716	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,238	$5,316	$5,336	$5,296	$5,296	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,884	$4,973	$5,006	$4,954	$5,023	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Montreal
Basel	Columbus	$4,904	$4,992	$5,010	$4,969	$5,078	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
CHEMICALS DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE												
Mannheim	Chicago	$3,045	$3,129	$3,191	$3,122	$4,001	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,651	$2,734	$3,064	$2,817	$3,885	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,662	$3,746	$3,808	$3,739	$4,541	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,624	$2,707	$2,845	$2,725	$4,229	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,978	$2,995	$3,062	$3,012	$4,250	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,885	$2,968	$3,030	$2,961	$3,831	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,490	$2,574	$2,904	$2,656	$3,723	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,502	$3,585	$3,647	$3,578	$4,762	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,463	$2,546	$2,684	$2,564	$4,064	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,818	$2,834	$2,901	$2,851	$4,081	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,263	$3,346	$3,408	$3,339	$4,110	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,868	$2,952	$3,282	$3,034	$3,964	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,880	$3,963	$4,025	$3,956	$4,634	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,841	$2,925	$3,062	$2,943	$4,327	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,196	$3,212	$3,279	$3,229	$4,375	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,786	$3,869	$3,932	$3,862	$4,697	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,392	$3,475	$3,805	$3,557	$4,609	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,403	$4,486	$4,549	$4,479	$5,296	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,364	$3,448	$3,585	$3,466	$4,952	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,719	$3,736	$3,802	$3,752	$4,969	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$905	-$821	-$759	-$828	78.0%
Mannheim	**Detroit**	-$1,230	-$1,147	-$817	-$1,064	72.5%
Mannheim	**Minneapolis**	-$805	-$722	-$659	-$729	82.3%
Mannheim	**Cleveland**	-$1,582	-$1,499	-$1,362	-$1,481	64.4%
Mannheim	**Columbus**	-$1,247	-$1,231	-$1,164	-$1,214	70.9%
Duisburg	**Chicago**	-$905	-$821	-$759	-$828	77.3%
Duisburg	**Detroit**	-$1,230	-$1,147	-$816	-$1,064	71.3%
Duisburg	**Minneapolis**	-$805	-$722	-$660	-$729	75.1%
Duisburg	**Cleveland**	-$1,582	-$1,499	-$1,362	-$1,481	63.1%
Duisburg	**Columbus**	-$1,247	-$1,231	-$1,164	-$1,214	69.9%
Stuttgart	**Chicago**	-$796	-$713	-$650	-$720	81.2%
Stuttgart	**Detroit**	-$1,043	-$960	-$630	-$878	76.5%
Stuttgart	**Minneapolis**	-$657	-$574	-$511	-$581	85.4%
Stuttgart	**Cleveland**	-$1,464	-$1,381	-$1,244	-$1,363	68.0%
Stuttgart	**Columbus**	-$1,170	-$1,153	-$1,086	-$1,136	73.8%
Basel	**Chicago**	-$842	-$759	-$696	-$766	82.2%
Basel	**Detroit**	-$1,168	-$1,084	-$754	-$1,002	77.2%
Basel	**Minneapolis**	-$835	-$751	-$689	-$758	84.6%
Basel	**Cleveland**	-$1,520	-$1,437	-$1,299	-$1,419	70.0%
Basel	**Columbus**	-$1,185	-$1,168	-$1,102	-$1,152	75.5%

HIGH VALUED GOODS BASELINE WITH 20% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,415	$4,455	$4,508	$4,459	$4,692	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,375	$4,415	$4,468	$4,419	$4,628	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,305	$5,440	$5,440	$5,395	$5,395	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,809	$4,850	$4,902	$4,854	$4,968	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,791	$4,877	$4,949	$4,872	$5,109	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,217	$4,257	$4,391	$4,288	$4,582	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,177	$4,217	$4,351	$4,248	$4,535	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,154	$5,623	$5,712	$5,496	$5,496	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,611	$4,652	$4,757	$4,673	$4,826	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,616	$4,751	$4,791	$4,719	$4,969	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,639	$4,679	$4,728	$4,682	$4,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,599	$4,639	$4,688	$4,642	$4,778	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,405	$5,482	$5,482	$5,456	$5,456	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,033	$5,074	$5,092	$5,066	$5,118	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,953	$5,019	$5,173	$5,048	$5,256	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,963	$5,036	$5,203	$5,067	$5,505	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,923	$4,996	$5,163	$5,027	$5,442	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,359	$6,389	$6,389	$6,379	$6,379	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,357	$5,431	$5,531	$5,440	$5,774	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,497	$5,564	$5,570	$5,543	$5,906	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	Montreal

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

HIGH VALUED GOODS DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,978	$4,103	$4,115	$4,065	$4,459	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,591	$3,716	$3,963	$3,757	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,595	$4,720	$4,732	$4,682	$5,395	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,548	$3,673	$3,770	$3,664	$4,854	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,883	$3,908	$4,008	$3,933	$4,872	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,804	$3,929	$3,941	$3,891	$4,288	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,416	$3,541	$3,788	$3,582	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,421	$4,546	$4,558	$4,508	$5,496	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,374	$3,499	$3,595	$3,489	$4,673	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,709	$3,734	$3,834	$3,759	$4,719	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,140	$4,265	$4,278	$4,228	$4,682	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,753	$3,878	$4,125	$3,919	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,757	$4,882	$4,895	$4,845	$5,456	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,711	$3,836	$3,932	$3,826	$5,066	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,046	$4,071	$4,171	$4,096	$5,048	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,782	$4,907	$4,919	$4,869	$5,067	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,395	$4,520	$4,767	$4,560	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,399	$5,524	$5,536	$5,486	$6,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,352	$4,477	$4,573	$4,468	$5,440	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,687	$4,712	$4,812	$4,737	$5,543	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
14 Knots Direct Cleveland		18 Knots Direct Cleveland			MAERSK	MSC	RAIL			ROAD		BARGE
14 Knots Direct Toledo		18 Knots Direct Toledo			HAPAG-LLOYD							

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$437	-$312	-$300	-$349	91.2%
Mannheim	Detroit	-$784	-$659	-$412	-$618	85.0%
Mannheim	Minneapolis	-$710	-$585	-$572	-$622	86.8%
Mannheim	Cleveland	-$1,261	-$1,136	-$1,040	-$1,146	75.5%
Mannheim	Columbus	-$907	-$882	-$782	-$857	80.7%
Duisburg	Chicago	-$414	-$289	-$276	-$326	90.7%
Duisburg	Detroit	-$761	-$636	-$389	-$595	84.3%
Duisburg	Minneapolis	-$733	-$608	-$596	-$646	82.0%
Duisburg	Cleveland	-$1,238	-$1,113	-$1,016	-$1,122	74.7%
Duisburg	Columbus	-$907	-$882	-$782	-$857	79.7%
Stuttgart	Chicago	-$499	-$374	-$361	-$411	90.3%
Stuttgart	Detroit	-$846	-$721	-$474	-$680	84.4%
Stuttgart	Minneapolis	-$648	-$523	-$511	-$560	88.8%
Stuttgart	Cleveland	-$1,323	-$1,198	-$1,101	-$1,207	75.5%
Stuttgart	Columbus	-$907	-$882	-$782	-$857	81.1%
Basel	Chicago	-$181	-$56	-$44	-$94	96.1%
Basel	Detroit	-$528	-$403	-$156	-$363	90.7%
Basel	Minneapolis	-$961	-$836	-$823	-$873	86.0%
Basel	Cleveland	-$1,005	-$880	-$784	-$890	82.1%
Basel	Columbus	-$809	-$784	-$684	-$759	85.5%

HIGH VALUED GOODS BASELINE WITH 25% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,425	$4,465	$4,518	$4,469	$4,704	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,385	$4,425	$4,478	$4,429	$4,638	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,316	$5,452	$5,452	$5,407	$5,407	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,878	$4,930	$4,882	$4,991	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,799	$4,885	$4,982	$4,889	$5,132	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,227	$4,267	$4,401	$4,298	$4,594	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,187	$4,227	$4,361	$4,258	$4,544	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,165	$5,634	$5,724	$5,508	$5,508	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,640	$4,680	$4,768	$4,696	$4,845	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,624	$4,785	$4,825	$4,745	$4,989	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,649	$4,689	$4,738	$4,692	$4,853	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,609	$4,649	$4,698	$4,652	$4,787	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,417	$5,493	$5,493	$5,468	$5,468	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,102	$5,105	$5,089	$5,140	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Columbus	$4,961	$5,027	$5,206	$5,065	$5,280	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,973	$5,046	$5,213	$5,077	$5,517	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,933	$5,006	$5,173	$5,037	$5,451	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,371	$6,401	$6,401	$6,391	$6,391	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,386	$5,459	$5,536	$5,460	$5,794	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,531	$5,572	$5,584	$5,562	$5,928	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

HIGH VALUED GOODS DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE												
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,993	$4,118	$4,131	$4,081	$4,469	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,602	$3,727	$3,991	$3,774	$4,429	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,610	$4,735	$4,748	$4,698	$5,407	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,564	$3,689	$3,789	$3,680	$4,882	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,908	$3,933	$4,033	$3,958	$4,889	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,819	$3,944	$3,956	$3,906	$4,298	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,428	$3,553	$3,817	$3,599	$4,258	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,436	$4,561	$4,573	$4,523	$5,508	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,389	$3,514	$3,614	$3,506	$4,696	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,734	$3,759	$3,859	$3,784	$4,745	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,156	$4,281	$4,293	$4,243	$4,692	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,765	$3,890	$4,153	$3,936	$4,652	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,773	$4,898	$4,910	$4,860	$5,468	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,726	$3,851	$3,951	$3,843	$5,089	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,071	$4,096	$4,196	$4,121	$5,065	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,797	$4,922	$4,935	$4,885	$5,077	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,406	$4,531	$4,795	$4,577	$5,037	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,414	$5,539	$5,552	$5,502	$6,391	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,367	$4,492	$4,592	$4,484	$5,460	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,712	$4,737	$4,837	$4,762	$5,562	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$432	-$307	-$294	-$344	91.3%
Mannheim	**Detroit**	-$782	-$657	-$394	-$611	85.2%
Mannheim	**Minneapolis**	-$706	-$581	-$568	-$618	86.9%
Mannheim	**Cleveland**	-$1,274	-$1,149	-$1,049	-$1,157	75.4%
Mannheim	**Columbus**	-$890	-$865	-$765	-$840	81.0%
Duisburg	**Chicago**	-$408	-$283	-$271	-$321	90.9%
Duisburg	**Detroit**	-$759	-$634	-$371	-$588	84.5%
Duisburg	**Minneapolis**	-$729	-$604	-$592	-$642	82.1%
Duisburg	**Cleveland**	-$1,251	-$1,126	-$1,025	-$1,134	74.7%
Duisburg	**Columbus**	-$890	-$865	-$765	-$840	79.8%
Stuttgart	**Chicago**	-$493	-$368	-$356	-$406	90.4%
Stuttgart	**Detroit**	-$844	-$719	-$456	-$673	84.6%
Stuttgart	**Minneapolis**	-$644	-$519	-$507	-$557	88.9%
Stuttgart	**Cleveland**	-$1,336	-$1,211	-$1,111	-$1,219	75.5%
Stuttgart	**Columbus**	-$890	-$865	-$765	-$840	81.4%
Basel	**Chicago**	-$176	-$51	-$38	-$88	96.2%
Basel	**Detroit**	-$527	-$402	-$138	-$356	90.9%
Basel	**Minneapolis**	-$957	-$832	-$819	-$869	86.1%
Basel	**Cleveland**	-$1,018	-$893	-$793	-$901	82.1%
Basel	**Columbus**	-$818	-$793	-$693	-$768	85.6%

HIGH VALUED GOODS BASELINE WITH 30% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,435	$4,475	$4,528	$4,479	$4,715	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,395	$4,435	$4,488	$4,439	$4,647	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,328	$5,463	$5,463	$5,418	$5,418	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,866	$4,906	$4,954	$4,909	$5,013	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,807	$4,893	$5,016	$4,905	$5,151	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,237	$4,277	$4,411	$4,308	$4,605	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,197	$4,237	$4,371	$4,268	$4,554	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,177	$5,646	$5,735	$5,519	$5,519	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,668	$4,708	$4,780	$4,718	$4,864	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,632	$4,818	$4,833	$4,761	$5,008	Antwerp	Antwerp	Antwerp	Norfolk	Montreal	Norfolk
Stuttgart	Chicago	$4,659	$4,699	$4,748	$4,702	$4,864	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,619	$4,659	$4,708	$4,662	$4,796	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,428	$5,505	$5,505	$5,479	$5,479	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,090	$5,116	$5,130	$5,112	$5,162	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Columbus	$4,969	$5,036	$5,240	$5,082	$5,303	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,983	$5,056	$5,223	$5,087	$5,529	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,943	$5,016	$5,183	$5,047	$5,461	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,382	$6,412	$6,412	$6,402	$6,402	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,414	$5,487	$5,540	$5,480	$5,814	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,564	$5,579	$5,597	$5,580	$5,949	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

HIGH VALUED GOODS DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,008	$4,133	$4,146	$4,096	$4,479	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,614	$3,739	$4,019	$3,791	$4,439	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,625	$4,750	$4,763	$4,713	$5,418	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,579	$3,704	$3,808	$3,697	$4,909	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,933	$3,958	$4,058	$3,983	$4,905	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,834	$3,959	$3,971	$3,921	$4,308	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,440	$3,565	$3,845	$3,616	$4,268	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,451	$4,576	$4,588	$4,538	$5,519	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,404	$3,529	$3,633	$3,522	$4,718	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,759	$3,784	$3,884	$3,809	$4,761	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,171	$4,296	$4,308	$4,258	$4,702	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,776	$3,901	$4,181	$3,953	$4,662	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,788	$4,913	$4,925	$4,875	$5,479	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,741	$3,866	$3,970	$3,859	$5,112	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,095	$4,120	$4,220	$4,145	$5,082	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,812	$4,937	$4,950	$4,900	$5,087	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,418	$4,543	$4,823	$4,595	$5,047	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,429	$5,554	$5,567	$5,517	$6,402	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,382	$4,507	$4,611	$4,500	$5,480	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,737	$4,762	$4,862	$4,787	$5,580	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$427	-$302	-$289	-$339	91.4%
Mannheim	**Detroit**	-$781	-$656	-$376	-$604	85.4%
Mannheim	**Minneapolis**	-$702	-$577	-$565	-$615	87.0%
Mannheim	**Cleveland**	-$1,287	-$1,162	-$1,058	-$1,169	75.3%
Mannheim	**Columbus**	-$874	-$849	-$749	-$824	81.2%
Duisburg	**Chicago**	-$403	-$278	-$266	-$316	91.0%
Duisburg	**Detroit**	-$757	-$632	-$352	-$581	84.7%
Duisburg	**Minneapolis**	-$726	-$601	-$588	-$638	82.2%
Duisburg	**Cleveland**	-$1,264	-$1,139	-$1,035	-$1,146	74.6%
Duisburg	**Columbus**	-$874	-$849	-$749	-$824	80.0%
Stuttgart	**Chicago**	-$488	-$363	-$351	-$401	90.6%
Stuttgart	**Detroit**	-$843	-$718	-$438	-$666	84.8%
Stuttgart	**Minneapolis**	-$641	-$516	-$503	-$553	89.0%
Stuttgart	**Cleveland**	-$1,349	-$1,224	-$1,120	-$1,231	75.5%
Stuttgart	**Columbus**	-$874	-$849	-$749	-$824	81.6%
Basel	**Chicago**	-$171	-$46	-$33	-$83	96.3%
Basel	**Detroit**	-$525	-$400	-$120	-$348	91.0%
Basel	**Minneapolis**	-$953	-$828	-$816	-$866	86.2%
Basel	**Cleveland**	-$1,031	-$906	-$802	-$913	82.1%
Basel	**Columbus**	-$827	-$802	-$702	-$777	85.8%

CAR PARTS BASELINE WITH 20% TRUCK TARIFF INCREASE							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,415	$4,455	$4,508	$4,459	$4,695	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,375	$4,415	$4,468	$4,419	$4,631	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,305	$5,440	$5,440	$5,395	$5,395	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,809	$4,850	$4,902	$4,854	$4,974	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,814	$4,900	$4,949	$4,888	$5,120	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,217	$4,257	$4,391	$4,288	$4,585	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,177	$4,217	$4,351	$4,248	$4,538	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,154	$5,623	$5,712	$5,496	$5,496	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,611	$4,652	$4,780	$4,681	$4,834	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,640	$4,751	$4,791	$4,727	$4,982	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,639	$4,679	$4,728	$4,682	$4,844	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,599	$4,639	$4,688	$4,642	$4,780	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,405	$5,482	$5,482	$5,456	$5,456	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,033	$5,074	$5,092	$5,066	$5,123	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,976	$5,043	$5,173	$5,064	$5,267	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,963	$5,036	$5,203	$5,067	$5,508	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,923	$4,996	$5,163	$5,027	$5,444	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,359	$6,389	$6,389	$6,379	$6,379	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,357	$5,431	$5,555	$5,448	$5,782	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,497	$5,570	$5,588	$5,551	$5,917	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	Norfolk
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CAR PARTS DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,002	$4,127	$4,139	$4,089	$4,459	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,614	$3,739	$3,986	$3,780	$4,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,619	$4,744	$4,756	$4,706	$5,395	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,572	$3,697	$3,793	$3,687	$4,854	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,907	$3,932	$4,032	$3,957	$4,888	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,827	$3,952	$3,965	$3,915	$4,288	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,440	$3,565	$3,812	$3,606	$4,248	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,444	$4,569	$4,582	$4,532	$5,496	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,398	$3,523	$3,619	$3,513	$4,681	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,733	$3,758	$3,858	$3,783	$4,727	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,164	$4,289	$4,301	$4,251	$4,682	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,777	$3,902	$4,149	$3,942	$4,642	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,781	$4,906	$4,918	$4,868	$5,456	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,734	$3,859	$3,955	$3,850	$5,066	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,069	$4,094	$4,194	$4,119	$5,064	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,805	$4,930	$4,943	$4,893	$5,067	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,418	$4,543	$4,790	$4,584	$5,027	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,422	$5,547	$5,560	$5,510	$6,379	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,376	$4,501	$4,597	$4,491	$5,448	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,711	$4,736	$4,836	$4,761	$5,551	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 20% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$413	-$288	-$276	-$326	91.7%
Mannheim	Detroit	-$760	-$635	-$389	-$595	85.5%
Mannheim	Minneapolis	-$686	-$561	-$549	-$599	87.2%
Mannheim	Cleveland	-$1,237	-$1,112	-$1,016	-$1,122	76.0%
Mannheim	Columbus	-$907	-$882	-$782	-$857	81.0%
Duisburg	Chicago	-$390	-$265	-$252	-$302	91.3%
Duisburg	Detroit	-$737	-$612	-$365	-$571	84.9%
Duisburg	Minneapolis	-$709	-$584	-$572	-$622	82.4%
Duisburg	Cleveland	-$1,214	-$1,089	-$993	-$1,099	75.0%
Duisburg	Columbus	-$907	-$882	-$782	-$857	80.0%
Stuttgart	Chicago	-$475	-$350	-$338	-$388	90.8%
Stuttgart	Detroit	-$822	-$697	-$450	-$656	84.9%
Stuttgart	Minneapolis	-$624	-$499	-$487	-$537	89.2%
Stuttgart	Cleveland	-$1,299	-$1,174	-$1,078	-$1,184	76.0%
Stuttgart	Columbus	-$907	-$882	-$782	-$857	81.3%
Basel	Chicago	-$158	-$33	-$20	-$70	96.6%
Basel	Detroit	-$505	-$380	-$133	-$339	91.2%
Basel	Minneapolis	-$937	-$812	-$800	-$849	86.4%
Basel	Cleveland	-$982	-$857	-$760	-$866	82.4%
Basel	Columbus	-$786	-$761	-$661	-$736	85.8%

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
CAR PARTS BASELINE WITH 25% TRUCK TARIFF INCREASE												
Mannheim	Chicago	$4,425	$4,465	$4,518	$4,469	$4,706	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,385	$4,425	$4,478	$4,429	$4,640	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,316	$5,452	$5,452	$5,407	$5,407	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,878	$4,930	$4,882	$4,996	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,822	$4,909	$4,982	$4,904	$5,144	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,227	$4,267	$4,401	$4,298	$4,596	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,187	$4,227	$4,361	$4,258	$4,547	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,165	$5,634	$5,724	$5,508	$5,508	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,640	$4,680	$4,792	$4,704	$4,853	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,648	$4,785	$4,825	$4,752	$5,002	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,649	$4,689	$4,738	$4,692	$4,855	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,609	$4,649	$4,698	$4,652	$4,790	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,417	$5,493	$5,493	$5,468	$5,468	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,102	$5,114	$5,092	$5,145	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,985	$5,051	$5,206	$5,081	$5,291	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,973	$5,046	$5,213	$5,077	$5,520	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,933	$5,006	$5,173	$5,037	$5,454	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,371	$6,401	$6,401	$6,391	$6,391	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,386	$5,459	$5,559	$5,468	$5,802	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,531	$5,595	$5,604	$5,576	$5,941	Rotterdam	Rotterdam	Antwerp	Montreal	Norfolk	Montreal

MAERSK | HAPAG-LLOYD | MSC | RAIL | ROAD | BARGE

CAR PARTS DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,017	$4,142	$4,154	$4,104	$4,469	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,626	$3,751	$4,015	$3,797	$4,429	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,634	$4,759	$4,771	$4,721	$5,407	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,587	$3,712	$3,812	$3,704	$4,882	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,932	$3,957	$4,057	$3,982	$4,904	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,842	$3,967	$3,980	$3,930	$4,298	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,452	$3,577	$3,840	$3,623	$4,258	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,459	$4,584	$4,597	$4,547	$5,508	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,413	$3,538	$3,638	$3,529	$4,704	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,757	$3,782	$3,882	$3,807	$4,752	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,179	$4,304	$4,317	$4,267	$4,692	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,788	$3,913	$4,177	$3,960	$4,652	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,796	$4,921	$4,934	$4,884	$5,468	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,749	$3,874	$3,974	$3,866	$5,092	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,094	$4,119	$4,219	$4,144	$5,081	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,821	$4,946	$4,958	$4,908	$5,077	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,430	$4,555	$4,818	$4,601	$5,037	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,438	$5,563	$5,575	$5,525	$6,391	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,391	$4,516	$4,616	$4,508	$5,468	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,736	$4,761	$4,861	$4,786	$5,576	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 25% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$408	-$283	-$271	-$321	91.8%
Mannheim	**Detroit**	-$759	-$634	-$370	-$588	85.7%
Mannheim	**Minneapolis**	-$682	-$557	-$545	-$595	87.3%
Mannheim	**Cleveland**	-$1,250	-$1,125	-$1,025	-$1,134	75.9%
Mannheim	**Columbus**	-$890	-$865	-$765	-$840	81.2%
Duisburg	**Chicago**	-$385	-$260	-$247	-$297	91.4%
Duisburg	**Detroit**	-$735	-$610	-$347	-$564	85.1%
Duisburg	**Minneapolis**	-$706	-$581	-$568	-$618	82.6%
Duisburg	**Cleveland**	-$1,227	-$1,102	-$1,002	-$1,110	75.0%
Duisburg	**Columbus**	-$890	-$865	-$765	-$840	80.1%
Stuttgart	**Chicago**	-$470	-$345	-$332	-$382	90.9%
Stuttgart	**Detroit**	-$821	-$696	-$432	-$649	85.1%
Stuttgart	**Minneapolis**	-$621	-$496	-$483	-$533	89.3%
Stuttgart	**Cleveland**	-$1,312	-$1,187	-$1,087	-$1,195	75.9%
Stuttgart	**Columbus**	-$890	-$865	-$765	-$840	81.6%
Basel	**Chicago**	-$152	-$27	-$15	-$65	96.7%
Basel	**Detroit**	-$503	-$378	-$115	-$332	91.3%
Basel	**Minneapolis**	-$933	-$808	-$796	-$846	86.5%
Basel	**Cleveland**	-$995	-$870	-$770	-$878	82.4%
Basel	**Columbus**	-$795	-$770	-$670	-$745	85.8%

CAR PARTS BASELINE WITH 30% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,435	$4,475	$4,528	$4,479	$4,718	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,395	$4,435	$4,488	$4,439	$4,650	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,328	$5,463	$5,463	$5,418	$5,418	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,866	$4,906	$4,958	$4,910	$5,018	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,830	$4,917	$5,016	$4,921	$5,165	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Duisburg	Chicago	$4,237	$4,277	$4,411	$4,308	$4,608	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,197	$4,237	$4,371	$4,268	$4,556	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,177	$5,646	$5,735	$5,519	$5,519	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,668	$4,708	$4,803	$4,726	$4,872	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Norfolk
Duisburg	Columbus	$4,656	$4,818	$4,857	$4,777	$5,022	Antwerp	Antwerp	Antwerp	Norfolk	Montreal	Norfolk
Stuttgart	Chicago	$4,659	$4,699	$4,748	$4,702	$4,867	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,619	$4,659	$4,708	$4,662	$4,799	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,428	$5,505	$5,505	$5,479	$5,479	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,090	$5,130	$5,136	$5,119	$5,168	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,993	$5,059	$5,240	$5,097	$5,314	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,983	$5,056	$5,223	$5,087	$5,531	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,943	$5,016	$5,183	$5,047	$5,463	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,382	$6,412	$6,412	$6,402	$6,402	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,414	$5,487	$5,564	$5,488	$5,822	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
Basel	Columbus	$5,564	$5,603	$5,621	$5,596	$5,962	Rotterdam	Rotterdam	Rotterdam	Montreal	Norfolk	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CAR PARTS DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,032	$4,157	$4,169	$4,119	$4,479	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,638	$3,763	$4,043	$3,814	$4,439	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,649	$4,774	$4,786	$4,736	$5,418	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,602	$3,727	$3,831	$3,720	$4,910	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,957	$3,982	$4,082	$4,007	$4,921	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,858	$3,983	$3,995	$3,945	$4,308	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,463	$3,588	$3,868	$3,640	$4,268	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,475	$4,600	$4,612	$4,562	$5,519	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,428	$3,553	$3,657	$3,546	$4,726	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,782	$3,807	$3,907	$3,832	$4,777	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,194	$4,319	$4,332	$4,282	$4,702	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,800	$3,925	$4,205	$3,977	$4,662	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,811	$4,936	$4,949	$4,899	$5,479	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,765	$3,890	$3,993	$3,882	$5,119	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$4,119	$4,144	$4,244	$4,169	$5,097	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,836	$4,961	$4,973	$4,923	$5,087	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,441	$4,566	$4,847	$4,618	$5,047	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,453	$5,578	$5,590	$5,540	$6,402	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,406	$4,531	$4,635	$4,524	$5,488	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,761	$4,786	$4,886	$4,811	$5,596	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 30% TRUCK TARIFF INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$403	-$278	-$266	-$315	92.0%
Mannheim	**Detroit**	-$757	-$632	-$352	-$581	85.9%
Mannheim	**Minneapolis**	-$679	-$554	-$541	-$591	87.4%
Mannheim	**Cleveland**	-$1,263	-$1,138	-$1,034	-$1,145	75.8%
Mannheim	**Columbus**	-$874	-$849	-$749	-$824	81.4%
Duisburg	**Chicago**	-$380	-$255	-$242	-$292	91.6%
Duisburg	**Detroit**	-$734	-$609	-$329	-$557	85.3%
Duisburg	**Minneapolis**	-$702	-$577	-$565	-$615	82.7%
Duisburg	**Cleveland**	-$1,240	-$1,115	-$1,011	-$1,122	75.0%
Duisburg	**Columbus**	-$874	-$849	-$749	-$824	80.2%
Stuttgart	**Chicago**	-$465	-$340	-$327	-$377	91.1%
Stuttgart	**Detroit**	-$819	-$694	-$414	-$642	85.3%
Stuttgart	**Minneapolis**	-$617	-$492	-$480	-$530	89.4%
Stuttgart	**Cleveland**	-$1,325	-$1,200	-$1,096	-$1,207	75.9%
Stuttgart	**Columbus**	-$874	-$849	-$749	-$824	81.8%
Basel	**Chicago**	-$147	-$22	-$10	-$60	96.8%
Basel	**Detroit**	-$502	-$377	-$96	-$325	91.5%
Basel	**Minneapolis**	-$930	-$805	-$792	-$842	86.5%
Basel	**Cleveland**	-$1,008	-$883	-$779	-$890	82.4%
Basel	**Columbus**	-$804	-$779	-$679	-$754	86.0%

APPENDIX F:

Rail Tariff Increase (5.2.3.3)

MAERSK

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$87.30	X	$103.30	$116.30
Detroit	$80.40	X	$108.80	$137.80
Minneapolis	X	X	X	X
Cleveland	$80.40	X	$121.30	$132.80
Columbus	$80.40	X	$108.30	$118.30

Hapag Lloyd

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$88.90	$83.80	$98.30	$93.60
Detroit	$77.80	$83.80	$109.50	$102.10
Minneapolis	$128.10	$83.80	$184.00	$173.80
Cleveland	$77.80	$83.80	$106.60	$93.70
Columbus	$77.80	$97.30	$112.20	$94.90

MSC

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$88.10	X	$100.80	$104.95
Detroit	$79.10	X	$109.15	$119.95
Minneapolis	X	X	X	X
Cleveland	$79.10	X	$113.95	$113.25
Columbus	$79.10	X	$110.25	$106.60

CHEMICALS BASELINE WITH 10% RAIL PREMIUM WINTER/10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,977	$4,049	$4,059	$4,029	$4,132	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,901	$3,903	$3,912	$3,906	$4,007	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,527	$4,626	$4,646	$4,600	$4,600	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,182	$4,217	$4,226	$4,209	$4,269	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,266	$4,295	$4,325	$4,296	$4,377	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,816	$3,863	$3,895	$3,858	$3,995	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,739	$3,741	$3,756	$3,745	$3,928	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,366	$4,983	$5,115	$4,821	$4,821	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,022	$4,053	$4,103	$4,059	$4,151	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,106	$4,122	$4,152	$4,126	$4,214	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,087	$4,117	$4,209	$4,138	$4,243	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,931	$3,986	$4,041	$3,986	$4,123	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,596	$4,732	$4,752	$4,693	$4,693	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,245	$4,252	$4,388	$4,295	$4,384	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,406	$4,414	$4,443	$4,421	$4,483	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,655	$4,744	$4,795	$4,731	$4,862	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,580	$4,639	$4,668	$4,629	$4,742	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,297	$5,375	$5,395	$5,355	$5,355	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,942	$4,952	$4,953	$4,949	$4,999	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$4,945	$5,033	$5,054	$5,010	$5,114	Rotterdam	Antwerp	Antwerp	NYNJ	NYNJ	Norfolk

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$2,995	$3,079	$3,157	$3,077	$4,029	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,906	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,674	$3,757	$3,836	$3,756	$4,600	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,209	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,296	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,834	$2,918	$2,997	$2,916	$3,858	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,745	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,513	$3,597	$3,675	$3,595	$4,821	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,059	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,126	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,213	$3,296	$3,375	$3,294	$4,138	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,799	$2,882	$3,113	$2,931	$3,986	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,891	$3,975	$4,053	$3,973	$4,693	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,751	$2,834	$2,948	$2,844	$4,295	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,047	$3,063	$3,130	$3,080	$4,421	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,736	$3,819	$3,898	$3,818	$4,731	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,629	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,415	$4,498	$4,577	$4,496	$5,355	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,949	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,010	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$982	-$899	-$820	-$900	76.4%
Mannheim	**Detroit**	-$1,320	-$1,236	-$1,006	-$1,187	69.5%
Mannheim	**Minneapolis**	-$853	-$769	-$691	-$771	81.7%
Mannheim	**Cleveland**	-$1,649	-$1,566	-$1,452	-$1,556	62.4%
Mannheim	**Columbus**	-$1,437	-$1,420	-$1,354	-$1,404	66.6%
Duisburg	**Chicago**	-$982	-$899	-$820	-$900	75.6%
Duisburg	**Detroit**	-$1,318	-$1,235	-$1,004	-$1,186	68.2%
Duisburg	**Minneapolis**	-$853	-$770	-$691	-$771	74.6%
Duisburg	**Cleveland**	-$1,649	-$1,566	-$1,452	-$1,556	60.8%
Duisburg	**Columbus**	-$1,437	-$1,420	-$1,354	-$1,404	65.5%
Stuttgart	**Chicago**	-$874	-$791	-$712	-$792	79.6%
Stuttgart	**Detroit**	-$1,132	-$1,049	-$818	-$999	73.5%
Stuttgart	**Minneapolis**	-$705	-$621	-$543	-$623	84.7%
Stuttgart	**Cleveland**	-$1,494	-$1,411	-$1,297	-$1,401	66.2%
Stuttgart	**Columbus**	-$1,359	-$1,343	-$1,276	-$1,326	69.7%
Basel	**Chicago**	-$920	-$836	-$758	-$838	80.7%
Basel	**Detroit**	-$1,257	-$1,174	-$943	-$1,125	74.6%
Basel	**Minneapolis**	-$882	-$799	-$720	-$800	84.0%
Basel	**Cleveland**	-$1,668	-$1,584	-$1,471	-$1,574	68.0%
Basel	**Columbus**	-$1,375	-$1,358	-$1,291	-$1,341	71.9%

MAERSK

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Chicago	$97.27	X	$110.80	$124.80
Detroit	$93.25	X	$116.80	$148.80
Minneapolis	X	X	X	X
Cleveland	$93.25	X	$130.80	$143.30
Columbus	$93.25	X	$116.30	$127.30

Hapag Lloyd

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Chicago	$97.70	$109.70	$106.70	$100.40
Detroit	$95.70	$114.50	$113.30	$113.00
Minneapolis	$152.20	$109.70	$194.60	$186.30
Cleveland	$95.70	$114.50	$116.70	$101.10
Columbus	$95.70	$114.50	$117.90	$104.30

MSC

Origin/Destination	Montreal	Halifax	NYNJ	Norfolk
Chicago	$97.48	X	$108.75	$112.60
Detroit	$94.48	X	$115.05	$130.90
Minneapolis	X	X	X	X
Cleveland	$94.48	X	$123.75	$122.20
Columbus	$94.48	X	$117.10	$115.80

HIGH VALUED GOODS BASELINE WITH 10% RAIL PREMIUM WINTER/10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,472	$4,513	$4,565	$4,517	$4,744	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,428	$4,469	$4,521	$4,473	$4,689	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,411	$5,547	$5,547	$5,501	$5,501	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,790	$4,831	$4,883	$4,835	$4,975	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,874	$4,906	$4,947	$4,909	$5,099	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,274	$4,315	$4,448	$4,346	$4,637	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,230	$4,271	$4,405	$4,302	$4,600	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,260	$5,729	$5,819	$5,602	$5,602	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,592	$4,633	$4,767	$4,664	$4,858	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,699	$4,708	$4,749	$4,719	$4,980	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,696	$4,736	$4,785	$4,739	$4,893	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,652	$4,692	$4,742	$4,696	$4,839	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,511	$5,588	$5,588	$5,563	$5,563	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,014	$5,054	$5,100	$5,056	$5,124	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,036	$5,102	$5,130	$5,089	$5,248	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$5,020	$5,093	$5,260	$5,125	$5,558	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,976	$5,049	$5,216	$5,081	$5,503	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,466	$6,496	$6,496	$6,486	$6,486	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,338	$5,411	$5,578	$5,443	$5,789	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,454	$5,527	$5,638	$5,540	$5,906	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CAR PARTS BASELINE WITH 10% RAIL PREMIUM WINTER/10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,472	$4,513	$4,565	$4,517	$4,747	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,428	$4,469	$4,521	$4,473	$4,692	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,411	$5,547	$5,547	$5,501	$5,501	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,790	$4,831	$4,883	$4,835	$4,978	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,897	$4,906	$4,947	$4,917	$5,105	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,274	$4,315	$4,448	$4,346	$4,640	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,230	$4,271	$4,405	$4,302	$4,603	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,260	$5,729	$5,819	$5,602	$5,602	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,592	$4,633	$4,767	$4,664	$4,866	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,708	$4,723	$4,749	$4,727	$4,988	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,696	$4,736	$4,785	$4,739	$4,896	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,652	$4,692	$4,742	$4,696	$4,841	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,511	$5,588	$5,588	$5,563	$5,563	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,014	$5,054	$5,100	$5,056	$5,127	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,059	$5,126	$5,130	$5,105	$5,254	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$5,020	$5,093	$5,260	$5,125	$5,560	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,976	$5,049	$5,216	$5,081	$5,505	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,466	$6,496	$6,496	$6,486	$6,486	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,338	$5,411	$5,578	$5,443	$5,791	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,454	$5,527	$5,662	$5,548	$5,914	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

HIGH VALUED GOODS DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,958	$4,083	$4,112	$4,051	$4,517	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,545	$3,670	$3,850	$3,688	$4,473	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,637	$4,762	$4,791	$4,730	$5,501	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,488	$3,613	$3,693	$3,598	$4,835	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,784	$3,809	$3,909	$3,834	$4,909	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,784	$3,909	$3,938	$3,877	$4,346	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,370	$3,495	$3,676	$3,514	$4,302	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,463	$4,588	$4,616	$4,555	$5,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,314	$3,439	$3,519	$3,424	$4,664	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,719	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,121	$4,246	$4,274	$4,213	$4,739	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,707	$3,832	$4,013	$3,850	$4,696	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,799	$4,924	$4,953	$4,892	$5,563	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,650	$3,775	$3,856	$3,760	$5,056	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,089	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,762	$4,887	$4,916	$4,855	$5,125	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,348	$4,473	$4,654	$4,492	$5,081	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,441	$5,566	$5,595	$5,534	$6,486	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,292	$4,417	$4,497	$4,402	$5,443	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,588	$4,613	$4,713	$4,638	$5,540	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$514	-$389	-$360	-$421	89.7%
Mannheim	Detroit	-$884	-$759	-$578	-$740	82.5%
Mannheim	Minneapolis	-$774	-$649	-$620	-$681	86.0%
Mannheim	Cleveland	-$1,302	-$1,177	-$1,097	-$1,192	74.4%
Mannheim	Columbus	-$1,089	-$1,064	-$964	-$1,039	78.1%
Duisburg	Chicago	-$490	-$365	-$337	-$398	89.2%
Duisburg	Detroit	-$860	-$735	-$554	-$717	81.7%
Duisburg	Minneapolis	-$797	-$672	-$644	-$704	81.3%
Duisburg	Cleveland	-$1,279	-$1,154	-$1,073	-$1,169	73.4%
Duisburg	Columbus	-$1,089	-$1,064	-$964	-$1,039	77.6%
Stuttgart	Chicago	-$576	-$451	-$422	-$483	88.9%
Stuttgart	Detroit	-$945	-$820	-$639	-$802	82.0%
Stuttgart	Minneapolis	-$712	-$587	-$558	-$619	87.9%
Stuttgart	Cleveland	-$1,364	-$1,239	-$1,158	-$1,254	74.4%
Stuttgart	Columbus	-$1,089	-$1,064	-$964	-$1,039	78.5%
Basel	Chicago	-$258	-$133	-$104	-$165	94.7%
Basel	Detroit	-$628	-$503	-$322	-$484	88.4%
Basel	Minneapolis	-$1,025	-$900	-$871	-$932	85.3%
Basel	Cleveland	-$1,046	-$921	-$841	-$936	80.9%
Basel	Columbus	-$866	-$841	-$741	-$816	83.7%

CAR PARTS DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,982	$4,107	$4,136	$4,075	$4,517	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,473	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,661	$4,786	$4,814	$4,753	$5,501	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,835	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,808	$3,833	$3,933	$3,858	$4,917	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,807	$3,932	$3,961	$3,900	$4,346	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,394	$3,519	$3,699	$3,537	$4,302	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,486	$4,611	$4,640	$4,579	$5,602	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,337	$3,462	$3,543	$3,447	$4,664	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,633	$3,658	$3,758	$3,683	$4,727	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,144	$4,269	$4,298	$4,237	$4,739	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,696	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,823	$4,948	$4,977	$4,916	$5,563	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,056	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,970	$3,995	$4,095	$4,020	$5,105	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,786	$4,911	$4,939	$4,879	$5,125	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,372	$4,497	$4,678	$4,516	$5,081	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,464	$5,589	$5,618	$5,557	$6,486	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,315	$4,440	$4,521	$4,426	$5,443	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,612	$4,637	$4,737	$4,662	$5,548	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 10% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$490	-$365	-$337	-$397	90.2%
Mannheim	**Detroit**	-$860	-$735	-$554	-$716	83.0%
Mannheim	**Minneapolis**	-$750	-$625	-$597	-$657	86.4%
Mannheim	**Cleveland**	-$1,279	-$1,154	-$1,073	-$1,168	74.9%
Mannheim	**Columbus**	-$1,089	-$1,064	-$964	-$1,039	78.5%
Duisburg	**Chicago**	-$467	-$342	-$313	-$374	89.7%
Duisburg	**Detroit**	-$837	-$712	-$531	-$693	82.2%
Duisburg	**Minneapolis**	-$774	-$649	-$620	-$681	81.7%
Duisburg	**Cleveland**	-$1,255	-$1,130	-$1,050	-$1,145	73.9%
Duisburg	**Columbus**	-$1,075	-$1,050	-$950	-$1,025	77.9%
Stuttgart	**Chicago**	-$552	-$427	-$398	-$459	89.4%
Stuttgart	**Detroit**	-$922	-$797	-$616	-$778	82.5%
Stuttgart	**Minneapolis**	-$689	-$564	-$535	-$596	88.4%
Stuttgart	**Cleveland**	-$1,340	-$1,215	-$1,135	-$1,230	74.8%
Stuttgart	**Columbus**	-$1,089	-$1,064	-$964	-$1,039	78.7%
Basel	**Chicago**	-$235	-$110	-$81	-$142	95.2%
Basel	**Detroit**	-$604	-$479	-$298	-$461	88.9%
Basel	**Minneapolis**	-$1,001	-$876	-$847	-$908	85.7%
Basel	**Cleveland**	-$1,023	-$898	-$817	-$913	81.3%
Basel	**Columbus**	-$843	-$818	-$718	-$793	84.0%

MAERSK

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$130.95	X	$154.95	$174.45
Detroit	$120.60	X	$163.20	$206.70
Minneapolis	X	X	X	X
Cleveland	$120.60	X	$181.95	$199.20
Columbus	$120.60	X	$162.45	$177.45

Hapag Lloyd

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$133.35	$125.70	$147.45	$140.40
Detroit	$116.70	$125.70	$164.25	$153.15
Minneapolis	$192.15	$125.70	$276.00	$260.70
Cleveland	$116.70	$125.70	$159.90	$140.55
Columbus	$116.70	$145.95	$168.30	$142.35

MSC

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$132.15	X	$151.20	$157.43
Detroit	$118.65	X	$163.73	$179.93
Minneapolis	X	X	X	X
Cleveland	$118.65	X	$170.93	$169.88
Columbus	$118.65	X	$165.38	$159.90

CHEMICALS BASELINE WITH 15% RAIL PREMIUM WINTER/15% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,021	$4,093	$4,103	$4,072	$4,178	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,942	$3,942	$3,952	$3,945	$4,048	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,591	$4,690	$4,710	$4,664	$4,664	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,221	$4,256	$4,266	$4,248	$4,313	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,321	$4,349	$4,380	$4,350	$4,426	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,860	$3,907	$3,939	$3,902	$4,042	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,779	$3,781	$3,795	$3,785	$3,972	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,430	$5,047	$5,179	$4,885	$4,885	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,061	$4,093	$4,143	$4,099	$4,197	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,160	$4,175	$4,207	$4,181	$4,262	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,131	$4,161	$4,253	$4,181	$4,289	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,970	$4,025	$4,081	$4,025	$4,164	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,660	$4,796	$4,816	$4,757	$4,757	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,284	$4,291	$4,426	$4,334	$4,428	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,460	$4,467	$4,490	$4,472	$4,531	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,699	$4,787	$4,839	$4,775	$4,909	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,620	$4,678	$4,708	$4,669	$4,783	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,361	$5,439	$5,459	$5,419	$5,419	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,982	$4,991	$4,992	$4,989	$5,043	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$4,999	$5,087	$5,098	$5,061	$5,163	Rotterdam	Antwerp	Rotterdam	NYNJ	NYNJ	Montreal

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE												
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$3,016	$3,099	$3,186	$3,100	$4,072	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,945	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,725	$3,808	$3,895	$3,810	$4,664	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,248	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,350	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,855	$2,938	$3,025	$2,939	$3,902	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,785	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,564	$3,648	$3,734	$3,649	$4,885	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,099	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,181	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,233	$3,316	$3,403	$3,317	$4,181	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,799	$2,882	$3,113	$2,931	$4,025	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,942	$4,026	$4,112	$4,027	$4,757	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,751	$2,834	$2,948	$2,844	$4,334	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,047	$3,063	$3,130	$3,080	$4,472	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,756	$3,839	$3,926	$3,841	$4,775	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,669	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,466	$4,549	$4,636	$4,550	$5,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,989	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,061	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	**Chicago**	-$1,005	-$922	-$835	-$921	76.1%
Mannheim	**Detroit**	-$1,360	-$1,277	-$1,046	-$1,227	68.8%
Mannheim	**Minneapolis**	-$866	-$782	-$695	-$781	81.7%
Mannheim	**Cleveland**	-$1,688	-$1,605	-$1,491	-$1,594	61.8%
Mannheim	**Columbus**	-$1,491	-$1,474	-$1,408	-$1,458	65.8%
Duisburg	**Chicago**	-$1,005	-$922	-$835	-$921	75.3%
Duisburg	**Detroit**	-$1,358	-$1,275	-$1,044	-$1,225	67.5%
Duisburg	**Minneapolis**	-$866	-$782	-$696	-$781	74.7%
Duisburg	**Cleveland**	-$1,688	-$1,605	-$1,491	-$1,595	60.2%
Duisburg	**Columbus**	-$1,491	-$1,474	-$1,408	-$1,458	64.6%
Stuttgart	**Chicago**	-$898	-$815	-$728	-$814	79.3%
Stuttgart	**Detroit**	-$1,172	-$1,088	-$857	-$1,039	72.8%
Stuttgart	**Minneapolis**	-$718	-$634	-$548	-$633	84.6%
Stuttgart	**Cleveland**	-$1,534	-$1,450	-$1,337	-$1,440	65.6%
Stuttgart	**Columbus**	-$1,413	-$1,397	-$1,330	-$1,380	68.9%
Basel	**Chicago**	-$943	-$860	-$773	-$859	80.4%
Basel	**Detroit**	-$1,298	-$1,214	-$984	-$1,165	74.0%
Basel	**Minneapolis**	-$895	-$812	-$725	-$811	84.0%
Basel	**Cleveland**	-$1,708	-$1,625	-$1,511	-$1,614	67.5%
Basel	**Columbus**	-$1,429	-$1,412	-$1,345	-$1,395	71.2%

MAERSK

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$145.90	X	$166.20	$187.20
Detroit	$139.88	X	$175.20	$223.20
Minneapolis	X	X	X	X
Cleveland	$139.88	X	$196.20	$214.95
Columbus	$139.88	X	$174.45	$190.95

Hapag Lloyd

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$146.55	$164.55	$160.05	$150.60
Detroit	$143.55	$171.75	$169.95	$169.50
Minneapolis	$228.30	$164.55	$291.90	$279.45
Cleveland	$143.55	$171.75	$175.05	$151.65
Columbus	$143.55	$171.75	$176.85	$156.45

MSC

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$146.22	X	$163.13	$168.90
Detroit	$141.71	X	$172.58	$196.35
Minneapolis	X	X	X	X
Cleveland	$141.71	X	$185.63	$183.30
Columbus	$141.71	X	$175.65	$173.70

HIGH VALUED GOODS BASELINE WITH 15% RAIL PREMIUM WINTER/15% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,521	$4,561	$4,614	$4,565	$4,794	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,475	$4,515	$4,568	$4,519	$4,739	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,487	$5,623	$5,623	$5,577	$5,577	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,877	$4,930	$4,881	$5,024	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,931	$4,953	$4,993	$4,959	$5,149	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,323	$4,363	$4,497	$4,394	$4,688	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,277	$4,317	$4,453	$4,349	$4,651	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,336	$5,805	$5,895	$5,679	$5,679	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,639	$4,679	$4,815	$4,711	$4,912	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,755	$4,757	$4,795	$4,769	$5,033	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,745	$4,785	$4,834	$4,788	$4,943	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,699	$4,739	$4,789	$4,742	$4,888	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,588	$5,664	$5,664	$5,639	$5,639	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,101	$5,148	$5,103	$5,173	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,094	$5,160	$5,177	$5,144	$5,298	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$5,069	$5,142	$5,309	$5,173	$5,607	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$5,023	$5,096	$5,263	$5,127	$5,552	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,542	$6,572	$6,572	$6,562	$6,562	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,385	$5,458	$5,625	$5,489	$5,837	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,501	$5,574	$5,696	$5,590	$5,957	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CAR PARTS BASELINE WITH 15% RAIL PREMIUM WINTER/15% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,521	$4,561	$4,614	$4,565	$4,797	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,475	$4,515	$4,568	$4,519	$4,741	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,487	$5,623	$5,623	$5,577	$5,577	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,837	$4,877	$4,930	$4,881	$5,027	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,953	$4,955	$4,993	$4,967	$5,154	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Duisburg	Chicago	$4,323	$4,363	$4,497	$4,394	$4,691	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,277	$4,317	$4,453	$4,349	$4,654	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,336	$5,805	$5,895	$5,679	$5,679	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,639	$4,679	$4,815	$4,711	$4,920	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,755	$4,781	$4,795	$4,777	$5,041	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,745	$4,785	$4,834	$4,788	$4,946	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,699	$4,739	$4,789	$4,742	$4,890	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,588	$5,664	$5,664	$5,639	$5,639	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,061	$5,101	$5,148	$5,103	$5,176	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,117	$5,177	$5,184	$5,159	$5,303	Antwerp	Antwerp	Bremen	Norfolk	Montreal	Norfolk
Basel	Chicago	$5,069	$5,142	$5,309	$5,173	$5,610	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$5,023	$5,096	$5,263	$5,127	$5,555	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,542	$6,572	$6,572	$6,562	$6,562	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,385	$5,458	$5,625	$5,489	$5,840	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,501	$5,574	$5,720	$5,598	$5,965	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

HIGH VALUED GOODS DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE												
					Average	Average	EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	1-3 choice	1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,979	$4,104	$4,140	$4,074	$4,565	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,545	$3,670	$3,850	$3,688	$4,519	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,688	$4,813	$4,850	$4,784	$5,577	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,488	$3,613	$3,693	$3,598	$4,881	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,784	$3,809	$3,909	$3,834	$4,959	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,804	$3,929	$3,966	$3,900	$4,394	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,370	$3,495	$3,676	$3,514	$4,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,514	$4,639	$4,675	$4,609	$5,679	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,314	$3,439	$3,519	$3,424	$4,711	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,769	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,141	$4,266	$4,303	$4,236	$4,788	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,707	$3,832	$4,013	$3,850	$4,742	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,850	$4,975	$5,012	$4,946	$5,639	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,650	$3,775	$3,856	$3,760	$5,103	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,144	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,782	$4,907	$4,944	$4,878	$5,173	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,348	$4,473	$4,654	$4,492	$5,127	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,492	$5,617	$5,654	$5,588	$6,562	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,292	$4,417	$4,497	$4,402	$5,489	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,588	$4,613	$4,713	$4,638	$5,590	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$542	-$417	-$381	-$447	89.2%
Mannheim	**Detroit**	-$930	-$805	-$624	-$787	81.6%
Mannheim	**Minneapolis**	-$799	-$674	-$637	-$703	85.8%
Mannheim	**Cleveland**	-$1,349	-$1,224	-$1,143	-$1,239	73.7%
Mannheim	**Columbus**	-$1,147	-$1,122	-$1,022	-$1,097	77.3%
Duisburg	**Chicago**	-$519	-$394	-$357	-$423	88.7%
Duisburg	**Detroit**	-$907	-$782	-$601	-$763	80.8%
Duisburg	**Minneapolis**	-$822	-$697	-$660	-$727	81.2%
Duisburg	**Cleveland**	-$1,325	-$1,200	-$1,120	-$1,215	72.7%
Duisburg	**Columbus**	-$1,145	-$1,120	-$1,020	-$1,095	76.7%
Stuttgart	**Chicago**	-$604	-$479	-$442	-$508	88.5%
Stuttgart	**Detroit**	-$992	-$867	-$686	-$848	81.2%
Stuttgart	**Minneapolis**	-$737	-$612	-$575	-$642	87.7%
Stuttgart	**Cleveland**	-$1,410	-$1,285	-$1,205	-$1,300	73.7%
Stuttgart	**Columbus**	-$1,147	-$1,122	-$1,022	-$1,097	77.7%
Basel	**Chicago**	-$287	-$162	-$125	-$191	94.3%
Basel	**Detroit**	-$674	-$549	-$369	-$531	87.6%
Basel	**Minneapolis**	-$1,050	-$925	-$888	-$954	85.2%
Basel	**Cleveland**	-$1,093	-$968	-$888	-$983	80.2%
Basel	**Columbus**	-$913	-$888	-$788	-$863	83.0%

CAR PARTS DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,002	$4,127	$4,164	$4,098	$4,565	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,519	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,712	$4,837	$4,873	$4,807	$5,577	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,881	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,808	$3,833	$3,933	$3,858	$4,967	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,828	$3,953	$3,989	$3,923	$4,394	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,394	$3,519	$3,699	$3,537	$4,349	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,537	$4,662	$4,699	$4,633	$5,679	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,337	$3,462	$3,543	$3,447	$4,711	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,633	$3,658	$3,758	$3,683	$4,777	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,164	$4,289	$4,326	$4,260	$4,788	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,742	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,874	$4,999	$5,036	$4,970	$5,639	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,103	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,970	$3,995	$4,095	$4,020	$5,159	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,806	$4,931	$4,968	$4,902	$5,173	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,372	$4,497	$4,678	$4,516	$5,127	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,515	$5,640	$5,677	$5,611	$6,562	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,315	$4,440	$4,521	$4,426	$5,489	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,612	$4,637	$4,737	$4,662	$5,598	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 15% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$519	-$394	-$357	-$423	89.8%
Mannheim	Detroit	-$907	-$782	-$601	-$763	82.1%
Mannheim	Minneapolis	-$775	-$650	-$613	-$680	86.2%
Mannheim	Cleveland	-$1,325	-$1,200	-$1,120	-$1,215	74.2%
Mannheim	Columbus	-$1,145	-$1,120	-$1,020	-$1,095	77.7%
Duisburg	Chicago	-$495	-$370	-$333	-$400	89.3%
Duisburg	Detroit	-$883	-$758	-$577	-$740	81.3%
Duisburg	Minneapolis	-$799	-$674	-$637	-$703	81.6%
Duisburg	Cleveland	-$1,302	-$1,177	-$1,096	-$1,192	73.2%
Duisburg	Columbus	-$1,122	-$1,097	-$997	-$1,072	77.1%
Stuttgart	Chicago	-$580	-$455	-$419	-$485	89.0%
Stuttgart	Detroit	-$968	-$843	-$663	-$825	81.7%
Stuttgart	Minneapolis	-$714	-$589	-$552	-$618	88.1%
Stuttgart	Cleveland	-$1,387	-$1,262	-$1,181	-$1,277	74.1%
Stuttgart	Columbus	-$1,147	-$1,122	-$1,022	-$1,097	77.9%
Basel	Chicago	-$263	-$138	-$101	-$167	94.7%
Basel	Detroit	-$651	-$526	-$345	-$507	88.1%
Basel	Minneapolis	-$1,026	-$901	-$864	-$931	85.5%
Basel	Cleveland	-$1,069	-$944	-$864	-$959	80.6%
Basel	Columbus	-$889	-$864	-$764	-$839	83.3%

MAERSK

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$174.60	X	$206.60	$232.60
Detroit	$160.80	X	$217.60	$275.60
Minneapolis	X	X	X	X
Cleveland	$160.80	X	$242.60	$265.60
Columbus	$160.80	X	$216.60	$236.60

Hapag Lloyd

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$177.80	$167.60	$196.60	$187.20
Detroit	$155.60	$167.60	$219.00	$204.20
Minneapolis	$256.20	$167.60	$368.00	$347.60
Cleveland	$155.60	$167.60	$213.20	$187.40
Columbus	$155.60	$194.60	$224.40	$189.80

MSC

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$176.20	X	$201.60	$209.90
Detroit	$158.20	X	$218.30	$239.90
Minneapolis	X	X	X	X
Cleveland	$158.20	X	$227.90	$226.50
Columbus	$158.20	X	$220.50	$213.20

CHEMICALS BASELINE WITH 20% RAIL PREMIUM WINTER/20% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,064	$4,137	$4,147	$4,116	$4,225	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,982	$3,982	$3,992	$3,985	$4,089	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,655	$4,754	$4,774	$4,728	$4,728	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,260	$4,296	$4,306	$4,287	$4,357	Antwerp	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,375	$4,402	$4,435	$4,404	$4,476	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,904	$3,951	$3,983	$3,946	$4,088	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,818	$3,821	$3,834	$3,824	$4,015	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,494	$5,111	$5,243	$4,949	$4,949	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,100	$4,132	$4,183	$4,138	$4,243	Antwerp	Antwerp	Rotterdam	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,214	$4,229	$4,261	$4,235	$4,310	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$4,175	$4,204	$4,297	$4,225	$4,335	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,010	$4,064	$4,121	$4,065	$4,205	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,724	$4,860	$4,880	$4,821	$4,821	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,324	$4,330	$4,465	$4,373	$4,472	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,514	$4,520	$4,529	$4,521	$4,578	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,743	$4,831	$4,883	$4,819	$4,955	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,660	$4,718	$4,748	$4,709	$4,824	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,425	$5,503	$5,523	$5,483	$5,483	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$5,022	$5,030	$5,032	$5,028	$5,087	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Columbus	$5,053	$5,138	$5,141	$5,111	$5,213	Rotterdam	Antwerp	Rotterdam	NYNJ	NYNJ	Montreal

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE												
					Average	Average	EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	1-3 choice	1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,036	$3,119	$3,214	$3,123	$4,116	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,985	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,776	$3,859	$3,954	$3,863	$4,728	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,287	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,404	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,875	$2,958	$3,053	$2,962	$3,946	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,824	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,615	$3,699	$3,794	$3,703	$4,949	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$4,138	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,235	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,253	$3,336	$3,431	$3,340	$4,225	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,799	$2,882	$3,113	$2,931	$4,065	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,993	$4,077	$4,172	$4,081	$4,821	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,751	$2,834	$2,948	$2,844	$4,373	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,047	$3,063	$3,130	$3,080	$4,521	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,776	$3,860	$3,955	$3,863	$4,819	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,709	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,517	$4,600	$4,695	$4,604	$5,483	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$5,028	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$5,111	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	Chicago	-$1,029	-$945	-$850	-$942	75.9%
Mannheim	Detroit	-$1,400	-$1,317	-$1,086	-$1,268	68.1%
Mannheim	Minneapolis	-$879	-$795	-$700	-$791	81.7%
Mannheim	Cleveland	-$1,727	-$1,643	-$1,530	-$1,633	61.3%
Mannheim	Columbus	-$1,545	-$1,529	-$1,462	-$1,512	65.0%
Duisburg	Chicago	-$1,029	-$945	-$850	-$942	75.1%
Duisburg	Detroit	-$1,398	-$1,314	-$1,083	-$1,265	66.8%
Duisburg	Minneapolis	-$879	-$795	-$701	-$792	74.8%
Duisburg	Cleveland	-$1,727	-$1,644	-$1,530	-$1,634	59.6%
Duisburg	Columbus	-$1,545	-$1,529	-$1,462	-$1,512	63.8%
Stuttgart	Chicago	-$922	-$839	-$744	-$835	79.1%
Stuttgart	Detroit	-$1,211	-$1,128	-$897	-$1,079	72.1%
Stuttgart	Minneapolis	-$731	-$647	-$552	-$644	84.6%
Stuttgart	Cleveland	-$1,573	-$1,490	-$1,376	-$1,480	65.0%
Stuttgart	Columbus	-$1,468	-$1,451	-$1,384	-$1,434	68.1%
Basel	Chicago	-$966	-$883	-$788	-$879	80.2%
Basel	Detroit	-$1,338	-$1,255	-$1,024	-$1,205	73.4%
Basel	Minneapolis	-$908	-$825	-$730	-$821	84.0%
Basel	Cleveland	-$1,748	-$1,665	-$1,551	-$1,655	67.0%
Basel	Columbus	-$1,483	-$1,466	-$1,400	-$1,450	70.5%

MAERSK

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$194.53	X	$221.60	$249.60
Detroit	$186.50	X	$233.60	$297.60
Minneapolis	X	X	X	X
Cleveland	$186.50	X	$261.60	$286.60
Columbus	$186.50	X	$232.60	$254.60

Hapag Lloyd

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$195.40	$219.40	$213.40	$200.80
Detroit	$191.40	$229.00	$226.60	$226.00
Minneapolis	$304.40	$219.40	$389.20	$372.60
Cleveland	$191.40	$229.00	$233.40	$202.20
Columbus	$191.40	$229.00	$235.80	$208.60

MSC

Origin/Destination

	Montreal	Halifax	NYNJ	Norfolk
Chicago	$194.97	X	$217.50	$225.20
Detroit	$188.95	X	$230.10	$261.80
Minneapolis	X	X	X	X
Cleveland	$188.95	X	$247.50	$244.40
Columbus	$188.95	X	$234.20	$231.60

HIGH VALUED GOODS BASELINE WITH 20% RAIL PREMIUM WINTER/20% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,569	$4,610	$4,662	$4,614	$4,844	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,521	$4,562	$4,614	$4,566	$4,788	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,563	$5,699	$5,699	$5,653	$5,653	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,883	$4,924	$4,976	$4,928	$5,073	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,989	$4,999	$5,040	$5,010	$5,199	Antwerp	Antwerp	Rotterdam	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,372	$4,412	$4,546	$4,443	$4,739	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,324	$4,364	$4,500	$4,396	$4,703	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,412	$5,881	$5,971	$5,755	$5,755	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,686	$4,726	$4,862	$4,758	$4,967	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,802	$4,815	$4,842	$4,819	$5,086	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,793	$4,834	$4,883	$4,837	$4,993	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,745	$4,786	$4,837	$4,789	$4,937	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,664	$5,740	$5,740	$5,715	$5,715	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,107	$5,148	$5,196	$5,150	$5,222	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,152	$5,218	$5,223	$5,198	$5,348	Antwerp	Bremen	Antwerp	Norfolk	Norfolk	Montreal
Basel	Chicago	$5,118	$5,191	$5,357	$5,222	$5,657	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$5,070	$5,143	$5,309	$5,174	$5,601	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,618	$6,648	$6,648	$6,638	$6,638	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,432	$5,505	$5,671	$5,536	$5,886	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,548	$5,621	$5,755	$5,641	$6,008	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CAR PARTS BASELINE WITH 20% RAIL PREMIUM WINTER/20% GENERAL RAIL RATE INCREASE

EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	EU 1st Choice	EU 2nd Choice	EU 3rd Choice	NA 1st Choice	NA 2nd Choice	NA 3rd Choice
Mannheim	Chicago	$4,569	$4,610	$4,662	$4,614	$4,846	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,521	$4,562	$4,614	$4,566	$4,791	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,563	$5,699	$5,699	$5,653	$5,653	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,883	$4,924	$4,976	$4,928	$5,075	Antwerp	Rotterdam	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,999	$5,013	$5,040	$5,017	$5,204	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Duisburg	Chicago	$4,372	$4,412	$4,546	$4,443	$4,742	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,324	$4,364	$4,500	$4,396	$4,705	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,412	$5,881	$5,971	$5,755	$5,755	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,686	$4,726	$4,862	$4,758	$4,974	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,802	$4,838	$4,842	$4,827	$5,094	Antwerp	Antwerp	Rotterdam	Montreal	Norfolk	Montreal
Stuttgart	Chicago	$4,793	$4,834	$4,883	$4,837	$4,995	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,745	$4,786	$4,837	$4,789	$4,940	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,664	$5,740	$5,740	$5,715	$5,715	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$5,107	$5,148	$5,196	$5,150	$5,225	Antwerp	Rotterdam	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$5,175	$5,223	$5,242	$5,213	$5,353	Antwerp	Antwerp	Bremen	Norfolk	Montreal	Norfolk
Basel	Chicago	$5,118	$5,191	$5,357	$5,222	$5,659	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$5,070	$5,143	$5,309	$5,174	$5,604	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,618	$6,648	$6,648	$6,638	$6,638	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,432	$5,505	$5,671	$5,536	$5,889	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,548	$5,621	$5,778	$5,649	$6,016	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

HIGH VALUED GOODS DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,999	$4,124	$4,169	$4,097	$4,614	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,545	$3,670	$3,850	$3,688	$4,566	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,739	$4,864	$4,909	$4,837	$5,653	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,488	$3,613	$3,693	$3,598	$4,928	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,784	$3,809	$3,909	$3,834	$5,010	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,824	$3,949	$3,994	$3,923	$4,443	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,370	$3,495	$3,676	$3,514	$4,396	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,565	$4,690	$4,735	$4,663	$5,755	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,314	$3,439	$3,519	$3,424	$4,758	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,819	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,161	$4,286	$4,331	$4,259	$4,837	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,707	$3,832	$4,013	$3,850	$4,789	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,901	$5,026	$5,071	$5,000	$5,715	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,650	$3,775	$3,856	$3,760	$5,150	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,198	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,803	$4,928	$4,973	$4,901	$5,222	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,348	$4,473	$4,654	$4,492	$5,174	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,543	$5,668	$5,713	$5,641	$6,638	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,292	$4,417	$4,497	$4,402	$5,536	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,588	$4,613	$4,713	$4,638	$5,641	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$571	-$446	-$401	-$472	88.8%
Mannheim	**Detroit**	-$977	-$852	-$671	-$833	80.8%
Mannheim	**Minneapolis**	-$824	-$699	-$654	-$726	85.6%
Mannheim	**Cleveland**	-$1,395	-$1,270	-$1,190	-$1,285	73.0%
Mannheim	**Columbus**	-$1,205	-$1,180	-$1,080	-$1,155	76.5%
Duisburg	**Chicago**	-$547	-$422	-$377	-$449	88.3%
Duisburg	**Detroit**	-$953	-$828	-$648	-$810	79.9%
Duisburg	**Minneapolis**	-$847	-$722	-$677	-$749	81.0%
Duisburg	**Cleveland**	-$1,372	-$1,247	-$1,167	-$1,262	72.0%
Duisburg	**Columbus**	-$1,192	-$1,167	-$1,067	-$1,142	75.9%
Stuttgart	**Chicago**	-$632	-$507	-$462	-$534	88.1%
Stuttgart	**Detroit**	-$1,039	-$914	-$733	-$895	80.4%
Stuttgart	**Minneapolis**	-$762	-$637	-$592	-$664	87.5%
Stuttgart	**Cleveland**	-$1,457	-$1,332	-$1,252	-$1,347	73.0%
Stuttgart	**Columbus**	-$1,205	-$1,180	-$1,080	-$1,155	76.9%
Basel	**Chicago**	-$315	-$190	-$145	-$217	93.9%
Basel	**Detroit**	-$721	-$596	-$415	-$577	86.8%
Basel	**Minneapolis**	-$1,075	-$950	-$905	-$976	85.0%
Basel	**Cleveland**	-$1,140	-$1,015	-$934	-$1,030	79.5%
Basel	**Columbus**	-$959	-$934	-$834	-$909	82.2%

CAR PARTS DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,022	$4,147	$4,192	$4,121	$4,614	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,566	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,763	$4,888	$4,933	$4,861	$5,653	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,928	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,808	$3,833	$3,933	$3,858	$5,017	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,848	$3,973	$4,018	$3,946	$4,443	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,394	$3,519	$3,699	$3,537	$4,396	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,588	$4,713	$4,758	$4,687	$5,755	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,337	$3,462	$3,543	$3,447	$4,758	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,633	$3,658	$3,758	$3,683	$4,827	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,185	$4,310	$4,355	$4,283	$4,837	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,789	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,925	$5,050	$5,095	$5,023	$5,715	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$5,150	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,970	$3,995	$4,095	$4,020	$5,213	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,826	$4,951	$4,996	$4,925	$5,222	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,372	$4,497	$4,678	$4,516	$5,174	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,567	$5,692	$5,737	$5,665	$6,638	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,315	$4,440	$4,521	$4,426	$5,536	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,612	$4,637	$4,737	$4,662	$5,649	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CAR PARTS BASELINE+DIRECT SERVICE WITH 20% GENERAL RAIL RATE INCREASE						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$547	-$422	-$377	-$449	89.3%
Mannheim	**Detroit**	-$953	-$828	-$648	-$810	81.3%
Mannheim	**Minneapolis**	-$800	-$675	-$630	-$702	86.0%
Mannheim	**Cleveland**	-$1,372	-$1,247	-$1,166	-$1,262	73.5%
Mannheim	**Columbus**	-$1,192	-$1,167	-$1,067	-$1,142	76.9%
Duisburg	**Chicago**	-$524	-$399	-$354	-$425	88.8%
Duisburg	**Detroit**	-$930	-$805	-$624	-$786	80.5%
Duisburg	**Minneapolis**	-$824	-$699	-$654	-$725	81.4%
Duisburg	**Cleveland**	-$1,348	-$1,223	-$1,143	-$1,238	72.5%
Duisburg	**Columbus**	-$1,168	-$1,143	-$1,043	-$1,118	76.3%
Stuttgart	**Chicago**	-$609	-$484	-$439	-$510	88.6%
Stuttgart	**Detroit**	-$1,015	-$890	-$709	-$871	80.9%
Stuttgart	**Minneapolis**	-$739	-$614	-$569	-$640	87.9%
Stuttgart	**Cleveland**	-$1,434	-$1,309	-$1,228	-$1,323	73.5%
Stuttgart	**Columbus**	-$1,205	-$1,180	-$1,080	-$1,155	77.1%
Basel	**Chicago**	-$291	-$166	-$121	-$193	94.3%
Basel	**Detroit**	-$698	-$573	-$392	-$554	87.3%
Basel	**Minneapolis**	-$1,051	-$926	-$881	-$953	85.3%
Basel	**Cleveland**	-$1,116	-$991	-$911	-$1,006	79.9%
Basel	**Columbus**	-$936	-$911	-$811	-$886	82.5%

FEASIBILITY OF A DIRECT SERVICE INTO THE GREAT LAKES AFTER APPLYING A RAIL PREMIUM DURING THE WINTER CLOSURE FOR 20"ISO TANK CHEMICAL CONTAINERS					
		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Mannheim	Chicago	76.9%	78.6%	79.4%	80.2%
Mannheim	Detroit	70.9%	72.4%	73.1%	73.8%
Mannheim	Minneapolis	81.6%	83.9%	84.9%	86.0%
Mannheim	Cleveland	63.6%	64.8%	65.4%	65.9%
Mannheim	Columbus	68.4%	70.1%	70.9%	71.7%
Duisburg	Chicago	76.1%	77.8%	78.7%	79.5%
Duisburg	Detroit	69.6%	71.1%	71.8%	72.5%
Duisburg	Minneapolis	74.3%	76.3%	77.2%	78.2%
Duisburg	Cleveland	62.0%	63.3%	63.9%	64.4%
Duisburg	Columbus	67.2%	69.0%	69.9%	70.7%
Stuttgart	Chicago	80.2%	81.9%	82.7%	83.5%
Stuttgart	Detroit	75.0%	76.5%	77.2%	78.0%
Stuttgart	Minneapolis	84.7%	87.0%	88.1%	89.2%
Stuttgart	Cleveland	67.5%	68.7%	69.3%	69.9%
Stuttgart	Columbus	71.4%	73.2%	74.0%	74.7%
Basel	Chicago	81.3%	83.0%	83.7%	84.4%
Basel	Detroit	75.9%	77.3%	77.9%	78.5%
Basel	Minneapolis	84.0%	86.0%	86.9%	87.9%
Basel	Cleveland	69.3%	70.5%	71.0%	71.5%
Basel	Columbus	73.5%	75.1%	75.8%	76.5%

FEASIBILITY OF A DIRECT SERVICE INTO THE GREAT LAKES AFTER APPLYING A RAIL PREMIUM DURING THE WINTER CLOSURE FOR 40"C ONTAINERS WITH HIGH VALUED GOODS					
		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Mannheim	Chicago	90.6%	92.6%	93.5%	94.5%
Mannheim	Detroit	84.2%	86.0%	86.8%	87.7%
Mannheim	Minneapolis	86.4%	88.8%	89.9%	91.1%
Mannheim	Cleveland	75.9%	77.4%	78.1%	78.8%
Mannheim	Columbus	79.8%	81.5%	82.3%	83.1%
Duisburg	Chicago	90.2%	92.2%	93.2%	94.1%
Duisburg	Detroit	83.5%	85.3%	86.2%	87.1%
Duisburg	Minneapolis	81.6%	83.8%	84.9%	85.9%
Duisburg	Cleveland	74.9%	76.4%	77.1%	77.9%
Duisburg	Columbus	79.3%	80.9%	81.8%	82.6%
Stuttgart	Chicago	89.8%	91.6%	92.5%	93.4%
Stuttgart	Detroit	83.7%	85.3%	86.2%	86.9%
Stuttgart	Minneapolis	88.4%	90.9%	92.0%	93.1%
Stuttgart	Cleveland	75.8%	77.2%	77.9%	78.6%
Stuttgart	Columbus	80.2%	81.9%	82.8%	83.6%
Basel	Chicago	95.7%	97.5%	98.4%	99.2%
Basel	Detroit	90.1%	91.7%	92.5%	93.3%
Basel	Minneapolis	85.7%	87.7%	88.7%	89.6%
Basel	Cleveland	82.3%	83.7%	84.4%	85.1%
Basel	Columbus	85.3%	86.8%	87.6%	88.3%

FEASIBILITY OF A DIRECT SERVICE INTO THE GREAT LAKES AFTER APPLYING A RAIL PREMIUM DURING THE WINTER CLOSURE FOR 40"C ONTAINERS WITH CAR PARTS					
		Baseline	10% Rail Premium Winter	15% Rail Premium Winter	20% Rail Premium Winter
Mannheim	Chicago	91.2%	93.7%	94.6%	95.5%
Mannheim	Detroit	84.8%	87.1%	87.9%	88.7%
Mannheim	Minneapolis	86.9%	89.7%	90.8%	91.9%
Mannheim	Cleveland	76.4%	78.3%	79.1%	79.8%
Mannheim	Columbus	80.1%	82.1%	82.9%	83.7%
Duisburg	Chicago	90.7%	93.3%	94.3%	95.2%
Duisburg	Detroit	84.1%	86.4%	87.3%	88.2%
Duisburg	Minneapolis	82.0%	84.7%	85.8%	86.8%
Duisburg	Cleveland	75.4%	77.4%	78.2%	78.9%
Duisburg	Columbus	79.6%	81.7%	82.5%	83.3%
Stuttgart	Chicago	90.3%	92.6%	93.5%	94.4%
Stuttgart	Detroit	84.2%	86.4%	87.2%	88.0%
Stuttgart	Minneapolis	88.9%	91.7%	92.9%	94.0%
Stuttgart	Cleveland	76.3%	78.1%	78.8%	79.5%
Stuttgart	Columbus	80.5%	82.4%	83.2%	84.0%
Basel	Chicago	96.1%	98.4%	99.3%	100.2%
Basel	Detroit	90.5%	92.7%	93.5%	94.3%
Basel	Minneapolis	86.0%	88.4%	89.4%	90.3%
Basel	Cleveland	82.7%	84.6%	85.3%	85.9%
Basel	Columbus	85.6%	87.4%	88.2%	88.9%

APPENDIX G:

Terminal Handling Charges (5.2.3.4)

CHEMICALS BASELINE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,870	$3,919	$3,955	$3,915	$4,034	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Detroit	$3,801	$3,850	$3,865	$3,839	$3,941	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$4,425	$4,498	$4,518	$4,480	$4,480	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,131	$4,154	$4,163	$4,149	$4,206	Antwerp	Rotterdam	Rotterdam	Montreal	NYNJ	Montreal
Mannheim	Columbus	$4,139	$4,228	$4,254	$4,207	$4,286	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Duisburg	Chicago	$3,710	$3,782	$3,802	$3,764	$3,903	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$3,641	$3,704	$3,713	$3,686	$3,850	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$4,264	$4,855	$4,986	$4,702	$4,702	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$3,970	$3,993	$4,003	$3,989	$4,072	Antwerp	Rotterdam	Rotterdam	Montreal	NYNJ	Montreal
Duisburg	Columbus	$3,978	$4,054	$4,070	$4,034	$4,127	Rotterdam	Antwerp	Antwerp	NYNJ	Norfolk	NYNJ
Stuttgart	Chicago	$3,947	$4,030	$4,102	$4,026	$4,137	Bremen	Bremen	Rotterdam	Montreal	Montreal	Montreal
Stuttgart	Detroit	$3,878	$3,934	$3,961	$3,924	$4,053	Bremen	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$4,494	$4,604	$4,624	$4,574	$4,574	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,200	$4,240	$4,310	$4,250	$4,313	Antwerp	Bremen	Bremen	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,298	$4,307	$4,333	$4,313	$4,383	Bremen	Bremen	Bremen	NYNJ	Norfolk	NYNJ
Basel	Chicago	$4,549	$4,655	$4,668	$4,624	$4,766	Rotterdam	Bremen	Rotterdam	Montreal	Montreal	Norfolk
Basel	Detroit	$4,480	$4,586	$4,613	$4,560	$4,676	Rotterdam	Bremen	Antwerp	Montreal	Montreal	Montreal
Basel	Minneapolis	$5,195	$5,247	$5,267	$5,236	$5,236	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Basel	Cleveland	$4,832	$4,842	$4,901	$4,858	$4,936	Rotterdam	Rotterdam	Antwerp	NYNJ	Montreal	Montreal
Basel	Columbus	$4,817	$4,933	$4,951	$4,900	$5,023	Rotterdam	Rotterdam	Antwerp	NYNJ	Norfolk	NYNJ

MAERSK	HAPAG-LLOYD	MSC	RAIL	ROAD	BARGE

CHEMICALS DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$2,955	$3,038	$3,101	$3,031	$3,915	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$2,582	$2,665	$2,896	$2,714	$3,839	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$3,572	$3,655	$3,718	$3,648	$4,480	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$2,533	$2,617	$2,730	$2,627	$4,149	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$2,830	$2,846	$2,913	$2,863	$4,207	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$2,794	$2,877	$2,940	$2,870	$3,764	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$2,421	$2,504	$2,735	$2,553	$3,686	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$3,411	$3,494	$3,557	$3,487	$4,702	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$2,373	$2,456	$2,570	$2,466	$3,989	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$2,669	$2,685	$2,752	$2,702	$4,034	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$3,172	$3,255	$3,318	$3,248	$4,026	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$2,799	$2,882	$3,113	$2,931	$3,924	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$3,789	$3,872	$3,935	$3,865	$4,574	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$2,751	$2,834	$2,948	$2,844	$4,250	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,047	$3,063	$3,130	$3,080	$4,313	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$3,695	$3,779	$3,841	$3,772	$4,624	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$3,322	$3,405	$3,636	$3,455	$4,560	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$4,312	$4,396	$4,458	$4,389	$5,236	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$3,274	$3,357	$3,471	$3,367	$4,858	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$3,570	$3,587	$3,653	$3,603	$4,900	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

CHEMICALS BASELINE+DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 20"	Percentage Direct / Existing
Mannheim	Chicago	-$916	-$832	-$770	-$839	77.4%
Mannheim	Detroit	-$1,220	-$1,137	-$906	-$1,087	70.7%
Mannheim	Minneapolis	-$853	-$769	-$707	-$776	81.4%
Mannheim	Cleveland	-$1,597	-$1,514	-$1,400	-$1,504	63.3%
Mannheim	Columbus	-$1,309	-$1,292	-$1,226	-$1,276	68.1%
Duisburg	Chicago	-$916	-$832	-$770	-$839	76.2%
Duisburg	Detroit	-$1,220	-$1,137	-$906	-$1,087	69.3%
Duisburg	Minneapolis	-$853	-$770	-$707	-$777	74.2%
Duisburg	Cleveland	-$1,597	-$1,514	-$1,400	-$1,504	61.8%
Duisburg	Columbus	-$1,309	-$1,292	-$1,226	-$1,276	67.0%
Stuttgart	Chicago	-$775	-$692	-$629	-$699	80.7%
Stuttgart	Detroit	-$1,079	-$996	-$765	-$947	74.7%
Stuttgart	Minneapolis	-$705	-$622	-$559	-$628	84.5%
Stuttgart	Cleveland	-$1,449	-$1,366	-$1,252	-$1,356	66.9%
Stuttgart	Columbus	-$1,251	-$1,234	-$1,168	-$1,218	71.4%
Basel	Chicago	-$853	-$770	-$708	-$777	81.6%
Basel	Detroit	-$1,158	-$1,074	-$843	-$1,025	75.8%
Basel	Minneapolis	-$882	-$799	-$736	-$806	83.8%
Basel	Cleveland	-$1,558	-$1,475	-$1,361	-$1,465	69.3%
Basel	Columbus	-$1,247	-$1,230	-$1,164	-$1,214	73.5%

HIGH VALUED GOODS BASELINE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,396	$4,401	$4,468	$4,421	$4,655	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,356	$4,361	$4,428	$4,381	$4,604	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,285	$5,394	$5,394	$5,358	$5,358	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,718	$4,723	$4,790	$4,743	$4,891	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,820	$4,834	$4,839	$4,831	$5,016	Antwerp	Rotterdam	Antwerp	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,198	$4,203	$4,377	$4,259	$4,543	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,158	$4,163	$4,337	$4,219	$4,505	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,134	$5,577	$5,666	$5,459	$5,459	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,520	$4,525	$4,699	$4,581	$4,768	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,636	$4,641	$4,646	$4,641	$4,893	Antwerp	Rotterdam	Antwerp	Norfolk	Montreal	Montreal
Stuttgart	Chicago	$4,620	$4,625	$4,711	$4,652	$4,808	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,580	$4,585	$4,671	$4,612	$4,754	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,385	$5,436	$5,436	$5,419	$5,419	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,942	$4,947	$5,030	$4,973	$5,040	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,983	$5,010	$5,058	$5,017	$5,165	Antwerp	Bremen	Rotterdam	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,904	$5,022	$5,163	$5,029	$5,472	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,864	$4,982	$5,123	$4,989	$5,418	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,339	$6,343	$6,343	$6,342	$6,342	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,226	$5,344	$5,485	$5,351	$5,704	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,342	$5,460	$5,526	$5,443	$5,821	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

HIGH VALUED GOODS DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,918	$4,043	$4,055	$4,005	$4,421	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,545	$3,670	$3,850	$3,688	$4,381	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,535	$4,660	$4,672	$4,622	$5,358	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,488	$3,613	$3,693	$3,598	$4,743	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,784	$3,809	$3,909	$3,834	$4,823	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,743	$3,868	$3,881	$3,831	$4,259	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,370	$3,495	$3,676	$3,514	$4,219	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,360	$4,485	$4,498	$4,448	$5,459	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,314	$3,439	$3,519	$3,424	$4,581	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,610	$3,635	$3,735	$3,660	$4,633	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,080	$4,205	$4,218	$4,168	$4,652	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,707	$3,832	$4,013	$3,850	$4,612	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,697	$4,822	$4,835	$4,785	$5,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,650	$3,775	$3,856	$3,760	$4,973	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,947	$3,972	$4,072	$3,997	$5,001	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,722	$4,847	$4,859	$4,809	$5,029	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,348	$4,473	$4,654	$4,492	$4,989	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,339	$5,464	$5,476	$5,426	$6,342	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,292	$4,417	$4,497	$4,402	$5,351	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,588	$4,613	$4,713	$4,638	$5,435	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland

14 Knots Direct Cleveland	18 Knots Direct Cleveland	MAERSK	MSC	RAIL	ROAD	BARGE
14 Knots Direct Toledo	18 Knots Direct Toledo	HAPAG-LLOYD				

HIGH VALUED GOODS BASELINE+DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	Chicago	-$478	-$353	-$341	-$390	90.6%
Mannheim	Detroit	-$811	-$686	-$505	-$668	84.2%
Mannheim	Minneapolis	-$750	-$625	-$612	-$662	86.3%
Mannheim	Cleveland	-$1,230	-$1,105	-$1,024	-$1,120	75.9%
Mannheim	Columbus	-$1,013	-$988	-$888	-$963	79.5%
Duisburg	Chicago	-$455	-$330	-$317	-$367	89.9%
Duisburg	Detroit	-$788	-$663	-$482	-$644	83.3%
Duisburg	Minneapolis	-$773	-$648	-$636	-$686	81.5%
Duisburg	Cleveland	-$1,206	-$1,081	-$1,001	-$1,096	74.7%
Duisburg	Columbus	-$1,013	-$988	-$888	-$963	79.0%
Stuttgart	Chicago	-$540	-$415	-$402	-$452	89.6%
Stuttgart	Detroit	-$873	-$748	-$567	-$729	83.5%
Stuttgart	Minneapolis	-$688	-$563	-$551	-$601	88.3%
Stuttgart	Cleveland	-$1,291	-$1,166	-$1,086	-$1,181	75.6%
Stuttgart	Columbus	-$1,013	-$988	-$888	-$963	79.9%
Basel	Chicago	-$182	-$57	-$44	-$94	95.6%
Basel	Detroit	-$515	-$390	-$209	-$371	90.0%
Basel	Minneapolis	-$1,001	-$876	-$863	-$913	85.6%
Basel	Cleveland	-$934	-$809	-$728	-$824	82.3%
Basel	Columbus	-$753	-$728	-$628	-$703	85.3%

CAR PARTS BASELINE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM												
							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-9 choice	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$4,396	$4,401	$4,468	$4,421	$4,655	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Detroit	$4,356	$4,361	$4,428	$4,381	$4,604	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Minneapolis	$5,285	$5,394	$5,394	$5,358	$5,358	Antwerp	BREHA		Montreal	Montreal	Montreal
Mannheim	Cleveland	$4,718	$4,723	$4,790	$4,743	$4,891	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Mannheim	Columbus	$4,820	$4,834	$4,839	$4,831	$5,016	Antwerp	Rotterdam	Antwerp	Norfolk	Montreal	Montreal
Duisburg	Chicago	$4,198	$4,203	$4,377	$4,259	$4,543	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Detroit	$4,158	$4,163	$4,337	$4,219	$4,505	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Minneapolis	$5,134	$5,577	$5,666	$5,459	$5,459	Antwerp	Bremen	Hamburg	Montreal	Montreal	Montreal
Duisburg	Cleveland	$4,520	$4,525	$4,699	$4,581	$4,768	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Duisburg	Columbus	$4,636	$4,641	$4,646	$4,641	$4,893	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Norfolk
Stuttgart	Chicago	$4,620	$4,625	$4,711	$4,652	$4,808	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Detroit	$4,580	$4,585	$4,671	$4,612	$4,754	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Stuttgart	Minneapolis	$5,385	$5,436	$5,436	$5,419	$5,419	Antwerp	BREHA		Montreal	Montreal	Montreal
Stuttgart	Cleveland	$4,942	$4,947	$5,030	$4,973	$5,040	Rotterdam	Antwerp	Antwerp	Montreal	Montreal	Montreal
Stuttgart	Columbus	$4,983	$5,010	$5,058	$5,017	$5,165	Antwerp	Bremen	Rotterdam	Norfolk	Norfolk	Montreal
Basel	Chicago	$4,904	$5,022	$5,163	$5,029	$5,472	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Detroit	$4,864	$4,982	$5,123	$4,989	$5,418	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Minneapolis	$6,339	$6,343	$6,343	$6,342	$6,342	Antwerp	BREHA		Montreal	Montreal	Montreal
Basel	Cleveland	$5,226	$5,344	$5,485	$5,351	$5,704	Rotterdam	Antwerp	Bremen	Montreal	Montreal	Montreal
Basel	Columbus	$5,342	$5,460	$5,526	$5,443	$5,821	Rotterdam	Antwerp	Rotterdam	Montreal	Montreal	NYNJ
MAERSK		HAPAG-LLOYD			MSC		RAIL		ROAD		BARGE	

CAR PARTS DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM							EU			NA		
EU Origin	US Destination	1st Choice	2nd Choice	3rd Choice	Average 1-3 choice	Average 1-3 Existing	1st Choice	2nd Choice	3rd Choice	1st Choice	2nd Choice	3rd Choice
Mannheim	Chicago	$3,941	$4,066	$4,079	$4,029	$4,421	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Detroit	$3,568	$3,693	$3,874	$3,712	$4,381	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Minneapolis	$4,558	$4,683	$4,696	$4,646	$5,358	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Mannheim	Cleveland	$3,512	$3,637	$3,717	$3,622	$4,743	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Mannheim	Columbus	$3,808	$3,833	$3,933	$3,858	$4,831	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Duisburg	Chicago	$3,767	$3,892	$3,904	$3,854	$4,259	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Detroit	$3,394	$3,519	$3,699	$3,537	$4,219	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Minneapolis	$4,384	$4,509	$4,521	$4,471	$5,459	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Duisburg	Cleveland	$3,337	$3,462	$3,543	$3,447	$4,581	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Duisburg	Columbus	$3,633	$3,658	$3,758	$3,683	$4,641	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Stuttgart	Chicago	$4,104	$4,229	$4,241	$4,191	$4,652	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Detroit	$3,730	$3,855	$4,036	$3,874	$4,612	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Minneapolis	$4,721	$4,846	$4,858	$4,808	$5,419	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Stuttgart	Cleveland	$3,674	$3,799	$3,879	$3,784	$4,973	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Stuttgart	Columbus	$3,970	$3,995	$4,095	$4,020	$5,017	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
Basel	Chicago	$4,745	$4,870	$4,883	$4,833	$5,029	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Detroit	$4,372	$4,497	$4,678	$4,516	$4,989	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Minneapolis	$5,362	$5,487	$5,500	$5,450	$6,342	Rotterdam	Rotterdam	Rotterdam	Toledo	Toledo	Cleveland
Basel	Cleveland	$4,315	$4,440	$4,521	$4,426	$5,351	Rotterdam	Rotterdam	Rotterdam	Cleveland	Cleveland	Toledo
Basel	Columbus	$4,612	$4,637	$4,737	$4,662	$5,443	Rotterdam	Rotterdam	Rotterdam	Cleveland	Toledo	Cleveland
14 Knots Direct Cleveland		18 Knots Direct Cleveland			MAERSK	MSC	RAIL		ROAD		BARGE	
14 Knots Direct Toledo		18 Knots Direct Toledo			HAPAG-LLOYD							

CAR PARTS BASELINE+DIRECT SERVICE WITH TERMINAL HANDLING CHARGES ANT=RTM BRE=HAM						
		1st choice Direct vs. 1st choice Existing	2nd choice Direct vs. 1st choice Existing	3rd choice Direct vs. 1st choice Existing	Average benefit per 40"	Percentage Direct / Existing
Mannheim	**Chicago**	-$454	-$329	-$317	-$367	91.1%
Mannheim	**Detroit**	-$788	-$663	-$482	-$644	84.7%
Mannheim	**Minneapolis**	-$726	-$601	-$589	-$639	86.7%
Mannheim	**Cleveland**	-$1,206	-$1,081	-$1,001	-$1,096	76.4%
Mannheim	**Columbus**	-$1,013	-$988	-$888	-$963	79.9%
Duisburg	**Chicago**	-$431	-$306	-$293	-$343	90.5%
Duisburg	**Detroit**	-$764	-$639	-$458	-$621	83.8%
Duisburg	**Minneapolis**	-$750	-$625	-$612	-$662	81.9%
Duisburg	**Cleveland**	-$1,183	-$1,058	-$977	-$1,073	75.2%
Duisburg	**Columbus**	-$1,003	-$978	-$878	-$953	79.4%
Stuttgart	**Chicago**	-$516	-$391	-$379	-$429	90.1%
Stuttgart	**Detroit**	-$849	-$724	-$543	-$706	84.0%
Stuttgart	**Minneapolis**	-$665	-$540	-$527	-$577	88.7%
Stuttgart	**Cleveland**	-$1,268	-$1,143	-$1,062	-$1,158	76.1%
Stuttgart	**Columbus**	-$1,013	-$987	-$887	-$962	80.1%
Basel	**Chicago**	-$158	-$33	-$21	-$71	96.1%
Basel	**Detroit**	-$492	-$367	-$186	-$348	90.5%
Basel	**Minneapolis**	-$977	-$852	-$840	-$890	85.9%
Basel	**Cleveland**	-$910	-$785	-$705	-$800	82.7%
Basel	**Columbus**	-$730	-$705	-$605	-$680	85.7%

APPENDIX H:

Conclusion Transportation Rate Scenarios (5.2.3)

		DF	HMT			Trucking rate increase			Rail rate increase					
			0.09%	0.00% Feeder	0.00%	20%	25%	30%	10% Premium winter	15% Premium winter	20% Premium winter	10% General Increase	15% General Increase	20% General Increase
Chemicals														
Mannheim	Chicago	76.9%	76.7%	105.3%	76.1%	77.7%	77.8%	78.0%	78.6%	79.4%	80.2%	76.4%	76.1%	75.9%
Mannheim	Detroit	70.9%	70.7%	98.7%	70.1%	72.0%	72.2%	72.5%	72.3%	73.0%	73.7%	69.5%	68.8%	68.1%
Mannheim	Cleveland	63.6%	63.4%	90.4%	62.8%	64.0%	64.2%	64.4%	64.8%	65.4%	65.9%	62.4%	61.8%	61.3%
Mannheim	Columbus	68.4%	68.3%	96.0%	68.1%	70.0%	70.4%	70.9%	70.2%	71.0%	71.8%	66.6%	65.8%	65.0%
Duisburg	Chicago	76.1%	75.9%	105.3%	75.2%	76.9%	77.1%	77.3%	77.8%	78.6%	79.5%	75.6%	75.3%	75.1%
Duisburg	Detroit	69.6%	69.4%	98.1%	68.7%	70.8%	71.1%	71.3%	71.0%	71.7%	72.4%	68.2%	67.5%	66.8%
Duisburg	Cleveland	62.0%	61.8%	89.4%	61.3%	62.6%	62.8%	63.1%	63.2%	63.8%	64.4%	60.8%	60.2%	59.6%
Duisburg	Columbus	67.2%	67.2%	95.7%	67.0%	69.0%	69.4%	69.9%	68.9%	69.8%	70.6%	65.5%	64.6%	63.8%
Basel	Chicago	81.3%	81.2%	106.0%	80.8%	81.9%	82.1%	82.2%	82.9%	83.6%	84.3%	80.7%	80.4%	80.2%
Basel	Detroit	75.9%	75.7%	99.8%	75.2%	76.8%	77.0%	77.2%	77.2%	77.8%	78.4%	74.6%	74.0%	73.4%
Basel	Cleveland	69.3%	69.1%	92.5%	68.7%	69.6%	69.8%	70.0%	70.6%	71.1%	71.6%	68.0%	67.5%	67.0%
Basel	Columbus	73.5%	73.4%	96.8%	73.3%	74.9%	75.2%	75.5%	75.1%	75.8%	76.5%	71.9%	71.2%	70.5%
High Valued Goods														
Duisburg	Chicago	90.2%	88.3%	108.6%	83.4%	90.7%	90.9%	91.0%	92.2%	93.2%	94.1%	89.2%	88.7%	88.3%
Duisburg	Columbus	79.3%	78.0%	96.3%	76.2%	79.7%	79.8%	80.0%	80.9%	81.8%	82.6%	77.6%	76.7%	75.9%
Stuttgart	Chicago	89.8%	88.0%	108.1%	83.6%	90.3%	90.4%	90.6%	91.6%	92.5%	93.4%	88.9%	88.5%	88.1%
Stuttgart	Columbus	80.2%	79.5%	97.7%	78.2%	81.1%	81.4%	81.6%	81.9%	82.8%	83.6%	78.5%	77.7%	76.9%
Car Parts														
Mannheim	Detroit	84.8%	82.0%	101.4%	77.6%	85.5%	85.7%	85.9%	87.1%	87.9%	88.7%	83.0%	82.1%	81.3%
Mannheim	Cleveland	76.4%	73.6%	92.7%	71.1%	76.0%	75.9%	75.8%	78.3%	79.1%	79.8%	74.9%	74.2%	73.5%
Stuttgart	Detroit	84.2%	82.3%	100.9%	77.4%	84.9%	85.1%	85.3%	86.4%	87.2%	88.0%	82.5%	81.7%	80.9%
Stuttgart	Cleveland	76.3%	74.6%	92.6%	71.9%	76.0%	75.9%	75.9%	78.1%	78.8%	79.5%	74.8%	74.1%	73.5%

			HMT			Trucking rate increase			Rail rate increase					
		DF	0.09%	0.00% Feeder	0.00%	20%	25%	30%	10% Premium winter	15% Premium winter	20% Premium winter	10% General Increase	15% General Increase	20% General Increase
Chemicals														
Mannheim	Chicago	2	2	-2	2	2	2	2	2	2	2	2	2	2
Mannheim	Detroit	2	2	-1	2	2	2	2	2	2	2	2	2	2
Mannheim	Cleveland	2	2	1	2	2	2	2	2	2	2	2	2	2
Mannheim	Columbus	2	2	-1	2	2	2	2	2	2	2	2	2	2
Duisburg	Chicago	2	2	-2	2	2	2	2	2	2	2	2	2	2
Duisburg	Detroit	2	2	-1	2	2	2	2	2	2	2	2	2	2
Duisburg	Cleveland	2	2	2	2	2	2	2	2	2	2	2	2	2
Duisburg	Columbus	2	2	-1	2	2	2	2	2	2	2	2	2	2
Basel	Chicago	2	2	-2	2	2	2	2	2	2	2	2	2	2
Basel	Detroit	2	2	-1	2	2	2	2	2	2	2	2	2	2
Basel	Cleveland	2	2	1	2	2	2	2	2	2	2	2	2	2
Basel	Columbus	2	2	-1	2	2	2	2	2	2	2	2	2	2
AVERAGE		2.00	2.00	-0.84	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
High Valued Goods														
Duisburg	Chicago	-1	-1	-2	1	-1	-1	-2	-2	-2	-2	-1	-1	-1
Duisburg	Columbus	2	2	-2	2	2	2	2	2	1	1	2	2	2
Stuttgart	Chicago	-1	-1	2	1	-1	-1	-1	-2	-2	-2	-1	-1	-1
Stuttgart	Columbus	2	2	-2	2	1	1	1	1	1	1	2	2	2
AVERAGE		0.41	0.41	-1.64	1.23	0.21	0.21	0.00	-0.20	-0.41	-0.41	0.41	0.41	0.41
Car Parts														
Mannheim	Detroit	1	1	-2	2	1	1	1	-1	-1	-1	1	1	1
Mannheim	Cleveland	2	2	-2	2	2	2	2	2	2	2	2	2	2
Stuttgart	Detroit	1	1	-2	2	1	1	1	-1	-1	-1	1	1	2
Stuttgart	Cleveland	2	2	-2	2	2	2	2	2	2	2	2	2	2
AVERAGE		1.46	1.46	-2	2	1.46	1.46	1.46	0.38	0.38	0.38	1.46	1.46	1.73
Weighted Scores		1.45	1.45	-1.20	1.76	1.38	1.38	1.32	1.15	1.09	1.09	1.45	1.45	1.47

		DF	HMT 0.09%	HMT 0.00% Feeder	HMT 0.00%	Trucking rate increase 20%	Trucking rate increase 25%	Trucking rate increase 30%	Rail rate increase 10% Premium winter	Rail rate increase 15% Premium winter	Rail rate increase 20% Premium winter	Rail rate increase 10% General Increase	Rail rate increase 15% General Increase	Rail rate increase 20% General Increase
Chemicals														
Mannheim	Chicago	+++	+++	---	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Mannheim	Detroit	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Mannheim	Cleveland	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Mannheim	Columbus	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Duisburg	Chicago	+++	+++	---	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Duisburg	Detroit	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Duisburg	Cleveland	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Duisburg	Columbus	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Basel	Chicago	+++	+++	---	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Basel	Detroit	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Basel	Cleveland	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Basel	Columbus	+++	+++	--	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
AVERAGE		+++	+++	-	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
High Valued Goods														
Duisburg	Chicago	--	--	---	++	--	--	---	---	---	---	--	--	--
Duisburg	Columbus	+++	+++	---	+++	+++	+++	+++	+++	++	++	+++	+++	+++
Stuttgart	Chicago	--	--	---	++	--	--	--	---	---	---	--	--	--
Stuttgart	Columbus	+++	+++	---	+++	++	++	++	++	++	++	+++	+++	+++
AVERAGE		+-	+-	---	++	+-	+-	+-	+-	+-	+-	+-	+-	+-
Car Parts														
Mannheim	Detroit	++	++	---	+++	++	++	++	--	--	--	++	++	++
Mannheim	Cleveland	+++	+++	---	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Stuttgart	Detroit	++	++	---	+++	++	++	++	--	--	--	++	++	+++
Stuttgart	Cleveland	+++	+++	---	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
AVERAGE		++	++	---	+++	++	++	++	+-	+-	+-	++	++	+++
Weighted Scores		++	++	--	+++	++	++	++	++	++	++	++	++	++

APPENDIX I:

Assumptions Baseline Transit Time

Rail

Origin/Destination

	Duisburg	Mannheim	Stuttgart	Basel
Rotterdam	32,00	40,00	48,00	42,50
Antwerp	43,50	38,50	42,50	41,25
Hamburg	31,80	36,00	46,50	38,25
Bremerhafen	X	50,50	51,75	53,00

(In hours)

Truck

Origin/Destination

	Duisburg	Mannheim	Stuttgart	Basel
Rotterdam	3	6	7,25	9
Antwerp	2,5	5	6	7,5
Hamburg	4	6	7,5	9
Bremerhafen	3,75	6	7,5	9

(In hours)

Barge

Origin/Destination

	Duisburg	Mannheim	Stuttgart	Basel
Rotterdam	24	48	72	72
Antwerp	24	48	72	120
Hamburg	X	X	X	X
Bremerhafen	X	X	X	X

(In hours)

MAERSK

Origin/Destination	Halifax	Montreal	Newark	Norfolk
Rotterdam	459	339	193	228
Antwerp	376	256	305	340
Hamburg	X	X	X	X
Bremerhafen	424	304	208	269

(In hours)

HAPAG LLOYD

Origin/Destination	Halifax	Montreal	New York	Norfolk
Rotterdam	172	X	225	260
Antwerp	240	251	196	375
Hamburg	209	195	242	297
Bremerhafen	X	285	X	517

(In hours)

MSC

Origin/Destination	Halifax	Montreal	New York	Norfolk
Rotterdam	X	X	X	X
Antwerp	X	322	288	408
Hamburg	X	X	X	X
Bremerhafen	X	285	384	504

(In hours)

TOTAL CSX

	Cleveland	Toledo
Chicago	62,29	75,93
Detroit	65,69	79,33
Cleveland	54,00	79,88
Columbus	65,67	79,32

(In hours)

TOTAL NS

	Cleveland	Toledo
Chicago	68,43	79,07
Detroit	61,80	72,26
Cleveland	52,00	74,14
Columbus	61,79	75,52

(In hours)

APPENDIX J:

List of interviewed parties

St. Lawrence Seaway Management Corporation – Bruce Hodgson, Gina Delle Rose-Ash

St. Lawrence Seaway Development Corporation – Timothy Downey

Cleveland-Cuyahoga County Port Authority – Will Friedman, David Gutheil

Toledo-Lucas County Port Authority – Joe Cappel

Melford International Terminal – Richie Mann

Port of Amsterdam – Michael van Toledo, Micha Hes

European Container Terminals – Florian Vreeburg

Midwest Terminals of Toledo – Jason Lowery

International Longshoremen's Association – John Baker Sr., John Baker Jr.

Tata Steel – Stephen Wilkes

World Shipping – Doc Mahoney

New Port Tank Containers – Mary Joyce

International Transport Service – Mark Vinesky

Marinova – Jim Frost

The Maritime Academy of Toledo – Jim Hartung

Richard Konik

U.S. Export Assistance Center – Susan Whitney

Ninth Coast Guard District – Lorne Thomas, Keith Ropella