Optimizing the Great Lakes-St. Lawrence Seaway Transportation System

An exploratory research on the key opportunities & barriers to container shipping on an underutilized waterway

Supervisor	Dr. B. Kuipers
2nd Supervisor	Mr. Dr. P.A. van Reeven
Student	S.J.A. Haazen

2012 Master's Thesis

ERASMUS UNIVERSITEIT ROTTERDAM

Table of contents

ACKNOWLEDGEMENTS 7

EXECUTIVE SUMMARY 8

CHAPTER 1 – INTRODUCTION 10

1.1 Introduction 10
1.2 Problem statement 14
1.3 Research objective 17

CHAPTER 2 – RESEARCH SETUP 18

2.1 Introduction 18
2.2 Research questions 19
2.3 Research strategy 20
2.4 Practical and academic relevance 22
2.5 Scope of research 23
2.6 Research framework 24

CHAPTER 3 – GLOBAL ECONOMIC DEVELOPMENTS AND THE ROLE OF TRANSPORT COSTS 25

3.1 Global economic developments and the maritime sector 25
3.2 Crisis effects on transportation 27
3.3 Implications for the GLSLS system 30
3.4 Conclusion 32

CHAPTER 4 – U.S. MIDWEST – NORTHWEST EUROPE KEY MARKETS AND GROWTH AREAS 33

4.1 Automotive sector 34
4.2 Chemicals sector 36
4.3 Conclusion 39

CHAPTER 5 – KEY GLSLS SYSTEM OPPORTUNITIES 40

5.1 Fuel efficiency 41
5.2 Corridor congestion 47
5.3 Transport and environmental sustainability 53
5.4 Safety and transportation 56
5.5 Conclusion 60

CHAPTER 6 – KEY PHYSICAL AND REGULATORY GLSLS SYSTEM BARRIERS 62

6.1 Seasonality aspect of the GLSLS system 63
6.2 U.S. Harbor Maintenance Tax 67
6.3 Cabotage regulation in North America 75
6.4 Pilotage in the GLSLS system 80
6.5 Non-tariff barriers to trade in the North America-Northwest Europe corridor 85
6.6 Conclusion 88

CHAPTER 7 – RECENT CONTAINER TRANSPORT UNDERTAKINGS IN THE GLSLS SYSTEM 91

7.1 Sea3 92
7.2 Great Lakes Feeder Lines 93
7.3 Conclusion 94

CHAPTER 8 – GLSLS SYSTEM IMPROVEMENT OPPORTUNITIES 95

8.1 Joining forces to facilitate Great Lakes container shipping practices 96
8.2 Perception of the Great Lakes and the role of eduction 102
8.3 Modernizing lock technologies 105
8.4 Conclusion 107

CHAPTER 9 – CONCLUSION 109

9.1 Conclusions qualitative part research 109
9.2 Limitations qualitative part research 117
9.3 Recommendations for future research following qualitative part research 118

LIST OF REFERENCES 119

Acknowledgements

This report was prepared as part of a collaborative research undertaking between Erasmus University Rotterdam and the Netherlands Consulate-General in Chicago. The author would like to thank fellow researcher and colleague Henri Verboon in respect of his efforts to make this research a success. Warm thanks go to Dr. Bart Kuipers for his supervision, extensive feedback, guidance and supply of information throughout the process of writing the findings presented in this report. Warm thanks go to Dr. Hans Heinsbroek for his feedback and support for this research. Warm thanks go to Dr. Bradley Hull for his feedback, his help to arrange interviews conducted during this research and provision of a solid basis from which to start this research. Warm thanks go to Mr. Arnie de la Porte for his support and help to arrange interviews conducted during this research. Warm thanks go to Mr. Dr. Peran van Reeven for his supervision.

Information supplied by several organizations contributed to this report, including:

- St. Lawrence Seaway Management Corporation
- St. Lawrence Seaway Development Corporation
- Cleveland-Cuyahoga County Port Authority
- Toledo-Lucas County Port Authority
- Port of Rotterdam Authority
- Melford International Terminal
- Midwest Terminals of Toledo
- International Longshoremen's Association
- Tata Steel
- World Shipping, Inc.
- International Transport Services
- U.S. Export Assistance Center

The author thanks all individuals affiliated with the above mentioned organizations for their contributions, as well as colleagues at the Netherlands Consulate-General Chicago, Richard Konik, and staff of John Carroll University.

Executive summary

This report presents an analysis of the major opportunities and barriers to container shipping on the Great Lakes-St. Lawrence Seaway Transportation System in North America against the background of recent global economic developments, and is drawn up in conjunction with an economic analysis of the system's potentials by Verboon (2012). Despite plenty of transit capacity and access to major North American markets not a single container moves beyond the Welland Canal to be discharged at American Great Lakes port today.

The opportunities identified encompass the fuel efficiency advantage of the marine mode over competing modes – in particular evaluated as an opportunity against the background of rising fuel prices, congestion relief on roads and railroads in and between the economic centers of the U.S. Midwest, the potential of the marine mode to reduce air pollution if a larger fraction of transportation needs is captured, and lower safety risks of marine mode activities compared to its surface transportation counterparts.

Interviews with stakeholders in the Great Lakes area have led to the identification of several key barriers to enhanced system performance. To begin with, services in the system cannot be provided on a year-round basis, primarily because of maintenance requirements. Additionally, an ad-valorem tax levied on goods imported into the U.S. through U.S. ports creates a cost disadvantage and a mental barrier to use of the marine mode, which is particularly relevant for the Great Lakes area given its proximity to Canadian ports and railroads where no tax is levied. Furthermore, U.S. and Canadian cabotage regulation limits competition for maritime transport services and flexibility of the system, which leads to higher prices paid by shippers and consumers. Pilotage requirements in the system drive up prices further because of costly pilotage activities. Although there are options to get an exemption, for cross-Atlantic trade it generally holds that the payments are made. Finally, perception of the Great Lakes as suitable for recreation activities rather commercial activities causes authorities, shippers, and the financial sector to be insufficiently aware of the system's potentials.

Two sectors in the U.S. Midwest are identified as having the potential to reap the benefits from container movements on the Great Lakes in particular; the automotive sector and the chemicals sector. Both sectors are found to require transportation services for cargo volumes that are large enough for a new service to accommodate and are very well represented in the proximity of American Great Lakes ports. For these sectors, it holds that non-tariff barriers account for price increases that could be reduced significantly.

To gain insights into the likelihood of a new service being successful, previous container shipping initiatives on the Great Lakes have been evaluated which has led to the conclusion that the timing aspect of launching a new service and appropriate government support are crucial factors contributing to the success of new services. Compared to these initiatives, new service providers are advised to consider operations over longer distances and with larger ships to fully exploit economies of scale.

For the system to thrive a number of key system improvement opportunities are found. There seems to be significant potential for Canadian and American authorities to collaborate on efforts to improve the ease by which business can be done in the system. In this respect, evaluation of alternatives to current cost recovery practices of maintenance activities, integration of cabotage regulation,

education of authorities and businesses domestically and overseas, and the implementation of intelligent technologies are key components of strategies that aim to explore the benefits of intensified use of the marine mode in the Great Lakes area.

Based on these findings policy makers are recommended to take a proactive role in the development of container shipping in the Great Lakes-St. Lawrence Seaway Transportation System. In particular, the current structure of the ad-valorem tax needs to be redefined, the legal frameworks between Canada and the U.S. need to be streamlined, and promotional efforts should be installed to make stakeholders familiar with the commercial potentials of the system.

A good start for the shipping industry would be to conduct a study in which potential cargo diversion as a result of the ad-valorem tax for the Great Lakes area specifically is researched. In addition, a North American common framework for cabotage regulation can be drawn up – perhaps based on the European Union model – and technologies can be installed to relieve the administrative burden to shipping in bi-national waters. Lastly, stakeholders can join forces to promote the system in the domestic setting as well as in Europe. Matching perception of the lakes with reality and transport needs with services available can provide the basis from which the Great Lakes-St. Lawrence Seaway Transportation System can contribute to the development of profitable and sustainable transport services.

1 Introduction

1.1 Introduction

1.1.1. Research origin

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 looking for ways in which trade between the U.S. Midwest and North West Europe can be facilitated in order to spur growth in local business sectors.

In order to conduct this research on a sufficiently large scale we examine the topic by means of two complementary parts, each serving as a Masters' thesis in the trajectory of the programme '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 in an assessment of the economical aspects of shipping on the Great Lakes, under the assumptions of a direct service from/to Northwest Europe as well as a feeder service involving port calls in Montreal and/or Halifax.[1] 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 their cost 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.

Once the findings of both the analyses are combined, recommendations are provided that aim to assist Great Lakes transportation system optimization for the Northwest Europe – North America corridor. Our goal is to create insights for policymakers, port authorities and shipping lines on the question whether or not increasing the competitiveness of the Great Lakes holds the key to better serve the needs of consumers, shippers, and society.

The primal focus of our research centers around the view that major cost and regulatory barriers limit the development of the GLSLS system and considers the potential gains that can be identified provided that these barriers are reduced. If proven significant, our findings facilitate 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] For any questions or remarks please consult S.J.A. Haazen, BSc. for the first part and H.M. Verboon, BSc. for the second part.

1.1.2. 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 has 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 of 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 continue to be explored 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 that the infrastructure and superstructure of many ports are inadequate to accommodate the inbound and outbound flow of cargo between ports and their hinterlands. 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 costs is 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 both container and bulk transport it holds that 4 ports dominate the market in the Hamburg-Le Havre range; Rotterdam, Hamburg, Antwerp and Bremen. 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. Interestingly, the port of Rotterdam is located farthest from Austria compared to all other ports in the range. The competition between ports in the Hamburg-Le Havre range is further illustrated by Notteboom (see figure 1), who shows how large the hinterland covered by these ports actually is; i.e. stretching from Northwest Europe to France, Italy and East Europe.

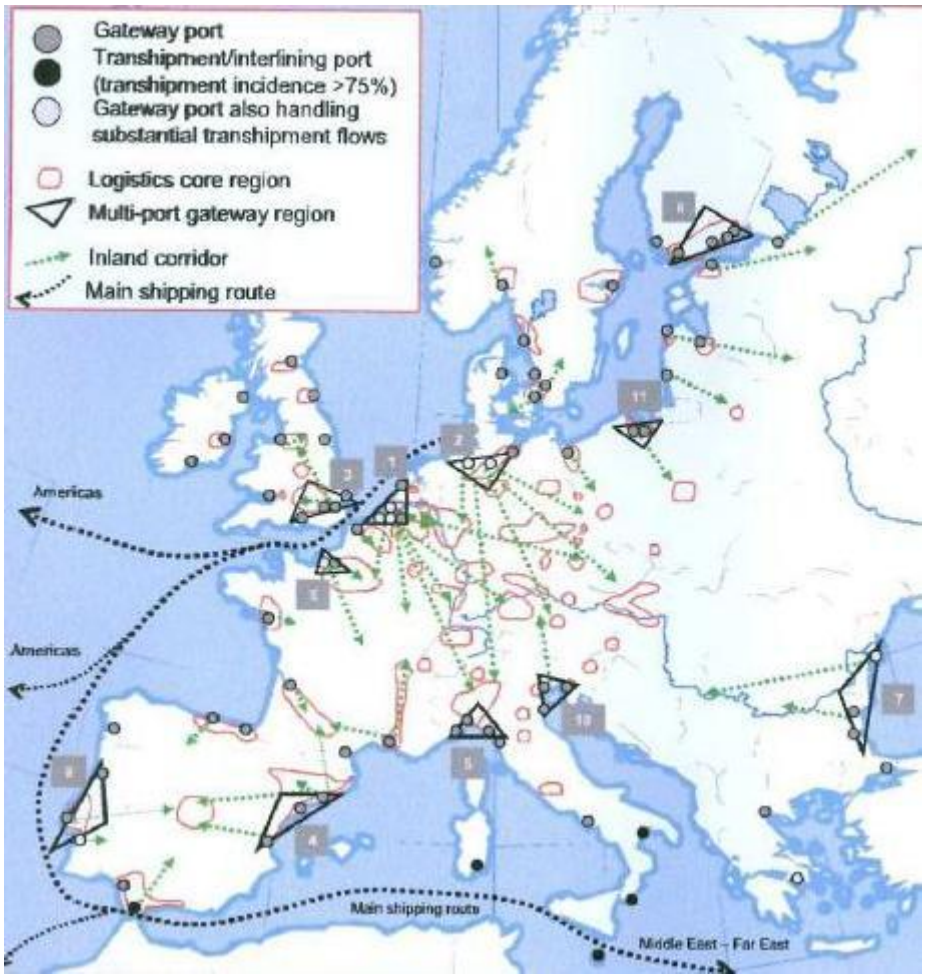

Figure 1 – The European container port system and logistics core regions in the hinterlands – From: Notteboom (2009)

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 its throughput volumes have been significantly lower since. The reasons that lie 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 against a background of increasing congestion, rising fuel prices, and concerns about the impact of transport on the environment.

1.1.3. Introduction to the area of focus

The Great Lakes is the world's largest reserve of fresh water and is considered the North coast of the United States of America. The ports along the St. Lawrence Seaway and the Great Lakes contain a big hinterland; 150 million people live within an 8 hour drive of a major port in the system, accounting for roughly 60% of the entire Canadian and American population. Moreover, in terms of economic activity, the region represents about 26% of U.S. industrial activities, whereas for Canada this percentage is up to 60 (TEMS Inc./RAND Corporation, 2007).[2] Despite the fact that the Great Lakes are geographically closest to Northwest Europe and that the system encompasses ports that lie in the proximity of major markets (see figure 2), these ports do not receive a regular scheduled container service to and from Europe.

Figure 2 – Major ports in the Great Lakes-St. Lawrence Seaway System – From: Great Lakes Seaway Review (2012)

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, 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). One would expect that cargo transported by rail to and from the Midwest is loaded/unloaded at intermodal facilities close to the origin or destination. However, despite the relatively large distance, next to these rail connections trucking services are still used to a significant extent on the entire routes.

[2] HWYH_2O GLSLS System Presentation, St. Catharines, Canada - November 7, 2011

1.2 Problem Statement

1.2.1. Developments in the U.S. trucking industry

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, costs, and environmental footprint of cargo delivery. 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, given the large consumption base resulting from high population density in the Eastern part of the U.S. Namely, trucks heading to the Midwestern states with an East Coast port as their origin will need to bypass many miles of congested highways that are used also 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 be facing higher costs for 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, truck drivers will be able to drive up the prices and select the highest bid from the many different businesses that will try to transport their cargo.

1.2.2. Developments in the North American rail industry

Although there is not as much of a difference as between the trucking mode and the marine alternative; 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 cost-efficiency 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 and 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 project 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.

1.2.3. The Great Lakes alternative

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 would deploy economies of scale advantages 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 cross Atlantic container shipping from a cost-efficiency perspective, provided that an alternative for the seasonality barrier can be offered as currently proven by several bulk-focused shippers. Namely, the locks through which ocean going ships have to navigate are closed because of ice formations and for the benefit of maintenance operations during the low season shipping in winter. 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 way of moving freight between both areas, many parties can reap the benefits. If cross Atlantic transportation can be offered at cheaper prices than is currently the case, more companies in both regions will be able to afford shipping costs. 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 market as long as no cheaper alternative to road and rail transportation is offered. With less access to foreign markets local businesses will miss the potential revenues gained from foreign trade, which could be a significant amount for niche players in the market.

The reasoning behind our decision to focus on container transport solely stems from the fact that current practices show that non-container shipping services between U.S. Great Lakes ports and Northwest European ports can 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 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 cost-efficiency and 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.

1.3 Research objective

The problem statement described above leads us to the following objective for our research:

"Combine findings from analyses of the institutional and economical aspects of the opportunities and barriers to container shipping in the Great Lakes basin, in order to facilitate discussion as to how the Great Lakes/St. Lawrence Seaway maritime transportation system can be optimized for trade between key markets in Northwest Europe and the U.S. Midwest."

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 determined. If such potential is proven significant, authorities on both sides of the North American border are recommended to further investigate the feasibility of exploiting opportunities and reducing barriers such that the American and European consumer can profit from lower transport costs associated with imports and exports in this corridor.

2 Research Setup

2.1 Introduction

The following paragraphs 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, we present a research framework 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 Research questions

2.2.1 Main research question

As discussed in chapter 1.3 we examine the institutional and economical aspects of opportunities and barriers to container shipping in the GLSLS maritime transportation system such that transport costs in the Northwest Europe – North America corridor are minimized and trade intensification is facilitated. Our main research question 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 existence of sustainable container transport services between U.S. Midwest ports along the Great Lakes coasts and ports in the Hamburg-Le Havre range in Northwest Europe?"

2.2.2 Sub-research questions

In order to answer our 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 of intensified use of the marine mode in the Great Lakes area can be identified to facilitate 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 to intensified use of the marine mode in the Great Lakes area can be identified that limit 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. *"What are the economic potentials of a direct or feeder service of Europe bound containerized cargo on the Great Lakes basin and which U.S. Great Lakes ports are most suitable to facilitate such a service?"*

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 researchers with 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 cost 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 US Midwest have been chosen, based on their position as economic and manufacturing centres in the US Midwest; Chicago, Detroit, Cleveland, Minneapolis and Columbus. Part 2 of our research will thoroughly discuss the reasoning behind the regions chosen in this model.

A problem encountered in the data collection procedure is that data for the transport rate-model is much diversified. However, we do find one common assumption which is that numbers are based on the usage of a 40" (FEU) container. For hinterland transportation, publicly available price quotes by the three largest European shipping lines on the transatlantic route, i.e. MSC, Hapag Lloyd and Maersk Line, are 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 various 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 is used. Finally, for the input of road transportation times, Google maps route planner is used. This source of data is also used for the final delivery, if the origin/destination does not have direct access to either rail or barge 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 ocean-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 US Midwest in a quantitative way.

2.4 Practical and academic relevance

Since our 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. (2000) 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. Shipping to these ports 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 cost and time efficiency, the effect is likely that shipping rates decrease for importers and exporters on both sides of the Atlantic, 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 costs 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 short sea shipping services from Halifax and Montreal to suited U.S. Great Lakes ports, we aim to contribute to the insights that have been drawn up to date. 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 our research 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 we only focus on three major institutional bodies – those of Canada, the U.S.A., and the European Union –, on four key barriers to overcome, on two key industries identified as ideally suited to spur the system's development, and an economic model based on the factors cost and time. The use of 40" containers as a standard and the limited input from truck and rail service providers further narrows down our scope.

2.6 Research framework

In this paragraph we outline the research setup and 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 feeder service into the Great Lakes from Montreal, Canada or Halifax, Canada. By applying theories from the field of port 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 costs 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.

3 Global Economic Developments and the role of transport costs

3.1 Global economic developments and the maritime sector

When the role of container shipping on the Great Lakes is evaluated in search of potentials to facilitate trade between the U.S. Midwest and Northwest Europe, one cannot ignore the macroeconomic developments that North American and European economies are dealing with in today's globalized world. The motivation for doing so is twofold. Not only is economic volatility reflected directly in cargo volumes and thus shipping activity; developments in the shipping industry also have their effects on economies. Investors assign significant importance to the debt paying ability of businesses in the shipping industry, based on the fact that it is capital-intensive and characterized by high debt ratios, high financial risks, unstable income, and oil price-dependency (Samaras and Papadopoulou, 2010). Governments on both sides of the Atlantic thus have every incentive to strengthen the maritime sector as a means to spur economic growth.

3.1.1 Financial crisis not overcome yet

Many economies in the corridor however still face the aftermath of a financial crisis to the extent that economic growth rates remain of a decreasing fashion if not negative at all. Of the 17 countries that use the euro, already three have received financial assistance from the European Central Bank and the International Monetary Fund; Greece, Ireland and Portugal. Other euro countries such as Spain and Italy, although they have not yet needed assistance, have borrowed and spent beyond their repayment capabilities as well and increasingly encounter economic troubles. If European banks are to cover up the billions that these countries are in debt without the nations being able to repay the funds, huge losses for the banks could be the outcome. The result could be that the crisis as severe as in Europe - a continent with a large manufacturing and consumer base intensely present in today's international trade - spreads out to other economies that are considered stable which in turn puts the global economy and living standards under pressure.

3.1.2 Conflicting interests of economics and politics

Despite optimism about the future, unemployment levels keep rising in those countries that are hit hardest such as Greece and Ireland, but also the U.S., the Netherlands, Belgium, and Denmark have seen their unemployment rates increase between 2009 and 2010 and even more significantly since the beginning of the millennium. Canada, Germany, and France meanwhile show very little growth in their respective employments rates (OECD, 2012). Developments in the European financial sector are thus followed closely by leaders all over the world while European authorities try to limit the crisis' impacts on its nations' economic sustainability and employment levels. Both in North America and Europe leaders are intensely discussing the means to tackle these issues stretching as far as whether or not the euro as a currency should be held on to in its current form. Following these discussions an increasingly heard argument is that politicians often do not act in line with what economists find necessary but rather that they take measures inspired by what they expect to be beneficial for the political prosperity for themselves and the parties they represent (Krugman, 2011). The topicality of this discussion emphasizes the importance of the political aspect of economic crisis management for

the future of cross-Atlantic trade patterns, yet due to the limited scope of this research our focus will be on the implications the crisis has on transportation in general, and to what opportunities and threats it leads for the Great Lakes-St. Lawrence Seaway System in particular.

3.2 Crisis effects on transportation

3.2.1 Expert expectations

Economists argue that there are three scenarios that the Western world could be facing following the crisis (OECD-ITF, 2009). Firstly, the crisis as we experience it today could become more severe and turn into a longer-term recession in which negative growth rates are observed on a wider scale. Secondly, governments may decide for a continuation of the heavy borrowing of nations which seems to lie at the very core of the troubles currently faced. It can be expected that in such case the effects of the crisis are simply postponed – if not worsened – to some future date. Thirdly, a period of growth may be experienced in which both savings and spending is increased leading to more capital for businesses to further spur economic development. In terms of cross-Atlantic transport, in the second and third scenario it is likely that the amounts of cargo shipped across the ocean will grow, at least in the short term.

3.2.2 Scenario implications and prospects for the GLSLS maritime transportation system

As emphasized by several parties that were interviewed, we should note that the expansion of the Panama Canal – which is set to be completed by 2014 – may lead to more ships from Asia entering U.S. ports on the East Coast. As such, these developments may be beneficial for the GLSLS system in the sense that ports on the American East Coast could become saturated. An economically feasible shipping network on the Great Lakes could therefore provide potentials for U.S. Midwest-bound cargo from Europe to avoid congested areas in the east. On the contrary, should the first scenario become the reality for American and European economies, this would most likely imply a downgrading of trade intensity and thus shipping as consumers have less to spend. A decrease in cargo volumes however does not necessarily mean that the GLSLS system is out of the picture since along with economic distress other factors come into play. The cost aspect of transport is in that case likely to become more important as opposed to timeliness of delivery. Issues such as capital intensive infrastructure maintenance and fuel efficiency are then set to become more dominant; on these aspects waterborne shipping has a comparative advantage over other modes of transport. For more information on how maritime shipping compares to competing modes in terms of fuel efficiency, reference is made to chapter 5 of this report.

Although relatively high risk – and therefore high costs of capital – puts the marine mode at a disadvantage in economic uncertain times when compared to other modes, especially in the start-up phase; in times of fluctuation in an economy and thus of demand for transport, the marine alternative can to some extent limit the effects for employment levels. Namely, for the transport of a container by truck a truck driver is employed, whereas on a ship the ratio of containers per crew member is much higher. In times of economic downturn and relatively low demand for transport, the risk that unemployment rises among truck drivers therefore increases more significantly than among shipping crews.

3.2.3 Crisis effects on the shipping industry

In concurrence with the above stated Samaras and Papadopoulou (2010) state that the effects of the financial crisis are both negative and positive for the shipping industry. The most obvious negative effect is that consumers have fewer funds to spend and that demand for goods decreases. As a result, the shipping industry is faced with a situation of severe overcapacity, leading to changes in schedules, routes and vessel usage. Namely, changes in cargo volume bound for specific destinations lead to a reconsideration of the means to get goods delivered optimally.

Economic fluctuation can lead to a problem identified as the bullwhip effect. Because of fluctuating demand for products it is complicated to predict production levels that meet demand. As a result, the risk of stock surpluses increases leading to higher costs associated with stocking products. The further one moves up the supply chain away from consumer demand, the more variability in demand is often observed since each business involved attempts to solve the problem from its own perspective. Closer coordination and thorough communication between the different links in the supply chain can to some extent limit the bullwhip effect, as it allows businesses to find a closer match between consumer demand and their individual production levels (Fransoo and Wouters, 2000). The shipping sector is at the very end of the bullwhip effect and has therefore suffered most from recent decreases in demand. Until the economic downturn growth in global trade averaged about 15% on an annual basis, the economic crisis then decreased this percentage to about 0 (Jacoby, 2009). Shipping companies had not foreseen such dramatic decrease in volumes and had built up capacity leading to a significant percentage of today's container fleet put out of business. To remain competitive in the new market situation, shipping rates have in recent years undergone tremendous drops. Lower rates for transport services have as a result decreased the costs of doing business in an international setting, thereby keeping goods relatively affordable. Some argue that these effects can have a positive side effect in the sense that the shipping industry can eliminate inefficiencies by realigning its fleet capacity and routing with the services needed. Other positive side effects mentioned by Min et al. (2009) are the emergence of co-operations, efforts to promote fair competition, and intensification of information exchange.

3.2.4 Overcapacity into perspective

The overcapacity issue stems from the fact that the shipping industry has been investing to enlarge capacity levels based on the expectations that increases in container volumes would maintain to the extent that was the case in years prior to the crisis. For shippers, the overcapacity has had the effect that shipping rates are lowered because carriers are fighting for market share. The authors of a report by Supply Chain Digest, an online newsletter for professionals in the supply chain and logistics industry, suggest that in certain corridors in a matter of months the shipping rates dropped from $2800 to $700 following the crisis in 2008 (Supply Chain Digest, 2008). For a while such competitive rates can be maintained by carriers to remain operative instead of pricing themselves out of the market, yet in the long run they seem unsustainable and rates are likely to increase. Obviously, these developments will depend on where economies around the world are heading in the years to come. Pessimistic as well as optimistic scenarios as sketched previously have been suggested, but most experts seem to agree that real development will lie somewhat in between, depending on how leaders deal with the current distress encountered (Rothengatter, 2012).

3.2.5 Crises: is our economy as tidal as the ocean?

That the crisis creates room for a change of structures in economies as well as transport services has been observed before. In this respect, Rothengatter (2010) argues that technological improvements and innovation can pave the way for new stimuli to economic growth, based on evolutionary economic theory described by well-known economists as Kondratieff and Schumpeter. Kondratieff found that economies show long term cyclical patterns in which every 40-60 years new technologies lie at the basis of a new cycle where focus is on key developing sectors (Kondratieff, 1926). Schumpeter too believed that the transition from one state of the economy to the next is initiated by technological innovation. In this respect, a well-known concept brought up by Schumpeter is that of the ''creative destruction' of the market system. New products, new methods of production, new markets, new forms of industrial organization and other areas were practices undergo a process of renewal lie according to Schumpeter at the core of the fact that capitalist markets are ever "in motion"; market structures continuously evolve from within from old into new patterns and practices (Schumpeter, 1943). Schumpeter was convinced that crises are not phenomena standing on their own; rather do they represent fluctuations in market economies providing chances for renewal of routines, products and production processes.

3.2.6 Kondratieff 6 from a transportation perspective

Following the economic crisis both theories have undergone much attention as experts increasingly have doubts as to whether or not neoclassical economic theory upholds given that crises and cycles are observed throughout history once the industrial revolution had ignited the first. With a new, sixth Kondratieff cycle on the doorstep, Nefiodow (2006) comes to the conclusion that key developments will play a role in the areas of:

- Nano-technology
- Material compounds
- Robotics and Assistant Systems
- Energy technology
- Network clouds in information technology
- Health technology
- Knowledge economy

Combined with the assumptions that the current crisis leads to a stronger focus on the relevance of rising energy prices and climate change policies, Rothengatter (2010) concludes that these developments have a number of implications for the transportation sector. Firstly, several trends are expected to continue in the new cycle; i.e. shares of bulk cargo as opposed to containerized cargo decline, the percentage of GDP that originates in the services sector increases, and more relatively small, light products are manufactured with an increasing share of electronics and communication technology. Secondly, preferences will be on energy-efficient products, particularly in the automotive sector. Thirdly, considerations surrounding the production of parts and subassemblies will increasingly involve logistic requirements. Rothengatter continues by stating that these implications are expected to lead to some structural changes in the transportation industry. Amongst others, the frequency of consignments getting bundled to optimize the use of hub and spoke networks as opposed to direct routes increases, the share of container shipping on intermodal routes increases, and fourth party logistics contracts and collaborative logistics will be seen more often.

3.3 Implications for the GLSLS system

Should these developments become reality then policy-makers have to be supportive by providing regulatory frameworks and incentives that facilitate sectoral growth. More effective measures to internalize external costs such as those related to CO_2 emissions are but one of the steps that Rothengatter advises in universal scope. If we keep these expectations in mind upon analyzing the GLSLS system we can get more specific and several potentials can be identified.

3.3.1 Energy efficiency transport

First of all, with energy efficiency and emission cuts being among the most prominent areas of focus projected, a surge for intensified use of fuel efficient transportation can lead to waterborne transport service providers being able to capture a larger market share as opposed to other modes. If these areas will be the main focus of North American governments, trucking companies have to cover additional taxes on fossil fuels and emissions which are reflected in the transport rates for shippers. Moreover, shippers that use trucking operators in the U.S. face even higher increases of shipping costs if oil prices keep rising and if the projections on trucker shortages become reality. Rail and waterborne services obviously cannot deliver goods on the doorstep of companies like a truck, yet for longer distances these modes will see their comparative advantages get stronger. Cargo that is now transported by truck from and to the East Coast ports and the port of Montreal is more prone to be diverted to other modes.

3.3.2 Economies of scale opportunities

Furthermore, if American and Canadian policy-makers are able to create a setting in which the use of hub and spoke networks is stimulated, the rise of short sea shipping services may provide economic benefits. On the North American east coast the port of Halifax in Nova Scotia, Canada, is geographically closest to Northwest European ports and is able to handle container ships of significant size. With current plans to develop a second terminal that is set to be capable of handling ships that would provide even more economies of scale opportunities in the form of Melford; Nova Scotia could very well become a hub from which feeder ships serve U.S. markets on the East Coast, as well as Canadian and U.S. markets in the Great Lakes region.

3.3.3 Collaborative logistics

Another opportunity for the system arises from the trend that logistic activities are set to be arranged collaboratively and that fourth party logistics contracts will come into effect more often. Authorities that have an interest in stimulating economies that surround the Great Lakes and that are convinced of its container shipping potentials could join forces to establish a service operator that keeps track of transportation needs from and to specific regions and acts accordingly. One of the interviewed parties suggested that the GLSLS as a system could provide services which make it more attractive to ship cargo through the Seaway. The example mentioned was that free warehousing could be offered for shippers to tackle the seasonality issue of GLSLS transportation financed by both American and Canadian parties having an interest in Great Lakes shipping. In this respect however one could also think of an organization that provides contracting services. If the transportation needs of multiple parties are known on a central level these needs can be bundled easier and services can be assigned more efficiently. The costs that would be involved with installing and running such an

organization would obviously have to be weighed against the benefits, but with a trend towards more frequent use of waterborne transport such undertaking may become economically feasible. The bi-national characteristic of the Great Lakes region, which seems to limit development in its current form, could in essence become its comparative advantage if regulatory differences are eliminated. After all, on both sides of the border there are large markets that could be served by ships sailing the lakes. If bundling of cargo from and to these markets is facilitated by optimal legal frameworks, container shipments with multiple discharges become more feasible.

3.3.4 Innovative logistics and technological concepts

Additionally, if innovation is spurred and more thorough use of technology can provide potentials for transport services in terms of better matching intermodal needs with the supply side of transport services by software, the base from which to choose the services is enlarged. Should the American and Canadian service providers be more integrated in terms of financial and regulatory barriers, a shipping company can be supplied with more efficient options to choose from when deciding which route to ship on. Convergence potentials of cabotage and taxation/user-fee regulations are as such critical to review in this research. Moreover, if technology is improved to such an extent that shore-based pilotage can occur with minimum risks of accidents in those Great Lakes waters where pilotage is obligatory today, regulation on both sides of the North American border should provide the room for reaping the financial benefits.

3.3.5 Drive toward fuel efficient transport may induce rerouting of services

In the short run in which economic recovery is of primary concern opportunities for the GLSLS system may arise as well. Rescheduling and rerouting of transport services in the shipping industry as demand decreases is a phenomenon that is not limited to the waterborne transport section of a route. Rail operators and trucking companies are affected by changing needs as well. Shipping companies will keep looking for ways to decrease their operating costs and the higher oil prices will get, the sooner these businesses will decide to opt for more fuel efficient means of transportation. With waterborne transport services being significantly more efficient than other modes, a divergence of cargo initially transported by truck or rail to ships becomes more likely.

3.4 Conclusion

Based on the outline of global economic developments, the implications for the maritime sector, and potentials identified for the GLSLS system, we have concluded that several issues should be addressed with special attention in this research. A closer look at key markets in the corridor, i.e. the automotive and chemicals sector, provides us with insights into the current GLSLS system potentials as well as projections for the future. Despite the proximity of these markets to Great Lakes waters not a single container is moved through the system today, which implies that other modes of transport are currently more efficient than is their waterborne counterpart. Several barriers standing in the way of container shipping on the Great Lakes have been identified based on the interviews and a literature analysis. Though other barriers have been mentioned, our focus will be on those barriers that seem most prominent; the Harbor Maintenance Tax, cabotage regulation, pilotage regulation, and the seasonality aspect. Suggestions to lower these barriers are offered as well as recommendations for further research.

4 U.S. Midwest – Northwest Europe Key Markets and Growth Areas

When analyzing what sectors should be of primary focus for a potential transatlantic container service on the Great Lakes, one evaluates what the largest markets are today and which developments are forecasted for the near future. A look at import and export volumes teaches us that Northwest Europe is home to some of the world's largest exporting nations with Germany (2nd), France (5th), the Netherlands (6th), and the UK (10th), whereas North America is well represented by the U.S. (3rd) and Canada (11th) (Central Intelligence Agency, 2011). The economic ties between both regions are intense as transatlantic trade has a history of several centuries while cultural differences are not as vast as compared to other regions in the world. Many types of goods and commodities are traded between both regions, ranging from aircraft components to fuel oil and medicinal equipment. Of particular interest in this research however are the ties between the largest manufacturing and consumption market in the Great Lakes area – the U.S. Midwest – and its equivalent on the other side of the ocean – an area encompassing Belgium, the Netherlands, and Germany. Based on the variables location, accessibility and size we are able to identify four key regions of focus in this area for the economic analysis of our research. The Rhine-Ruhr region, Rhine-Neckar region, Basel-Mulhouse twin city region, and the region Badem-Württemberg are each characterized by their large manufacturing industries, particularly in the chemicals and automotive sector. As such, the regions are ideally suited for our analysis given that a number of interviewees mentioned these sectors as key growth segments in the corridor from which the GLSLS system can potentially reap the benefits. In this chapter we aim to back up these findings by analyzing the automotive sector and chemicals sector in the Midwest in more detail.

4.1 Automotive sector

The U.S. Midwest is home to the headquarters – and many of the production facilities – of General Motors, Ford Motor and DaimlerChrysler; the so-called 'Big Three' car manufacturers in North America. Particularly in the region Ohio-Michigan-Ontario (CAN) many U.S. car manufacturing plants are located providing tens of thousands of jobs in local economies. With 'Motor City' Detroit being the center of car manufacturing activities since the early days of the sector, in the state of Michigan alone an estimated 150,000 people work in manufacturing plants, R&D laboratories, and management offices related to this sector. Impressive numbers, yet these jobs were on the line following the financial crisis that hit the industry hard in 2008.

4.1.1 Changing consumer preferences

Due to fast rising fuel prices the American consumer has in recent years altered its preferences with respect to newly built automobiles. Whereas in earlier days a culture of 'the bigger, the better' was prevalent, nowadays people show more interest in small, fuel-efficient cars. As a result, U.S. car manufacturers have recently seen their market shares decrease significantly given that many Japanese, and to a lesser extent European, car manufacturers supplied the American car market with smaller-sized cars. In response to these developments, U.S. car manufacturers have shifted their attention toward the development of small cars and partnerships with foreign companies as their suppliers. Preferences for smaller and more fuel-efficient cars have been inherited in the European industry for automobiles seemingly since the first cars were built. Fuel prices in Europe have been considerably higher than in the U.S. throughout history because of lower oil reserves (and thus a strong demand for oil imports) and relatively high taxes on oil-based fuels. With American car manufacturers shifting their scope from the larger 'pick-up truck', 'SUV', and 'van'-type models towards smaller types of vehicles, U.S. car produce is set to become more competitive in the European market for automobiles. Sales rates of these manufacturers are thus expected to increase not only in the domestic U.S. market but in foreign countries as well.

4.1.2 How the Big Three kept their wheels spinning

The shift of scope by the Big Three towards more fuel-efficient cars was not initiated without an urgent need to do so. In fact, for a large part it can be attributed to the Obama administration that the three companies are still in business. Had the administration decided not to provide GM and Chrysler with the funds necessary following the financial crisis, most likely at least one of both would no longer be existent. Given the importance of the automotive sector for the U.S. economy in terms of employment opportunities, economists tend to agree that the administration did the right thing. In accordance with our findings in chapter 3, the funds were used to restructure entire business models and foster innovation which has since led to increasing market shares (Rushe, 2011). The Big Three is now able to better meet the needs of today's consumer to whom energy-efficiency and climate change becomes increasingly important and they keep investing in the future; Michigan ranks 4th in the U.S. in terms of employment in high tech industries (Michigan Economic Development Corporation, n.d.).

4.1.3 Market size

For the European Union, with Germany as its largest manufacturer in this sector, the automotive sector accounted for over 132 billion euros in export value in 2010 (European Commission, 2011). The biggest export market for this sector is the U.S. and – if we take into account that 'only' 76 billion euros of the 132 billion total are finished car – a significant amount of automotive parts is headed to production facilities of the Big Three in North America. It has to be noted that the Big Three primarily imports automotive parts from Canada and Mexico, but German manufacturers in this sector have historically had a stable share in U.S. import volumes (see figure 3).

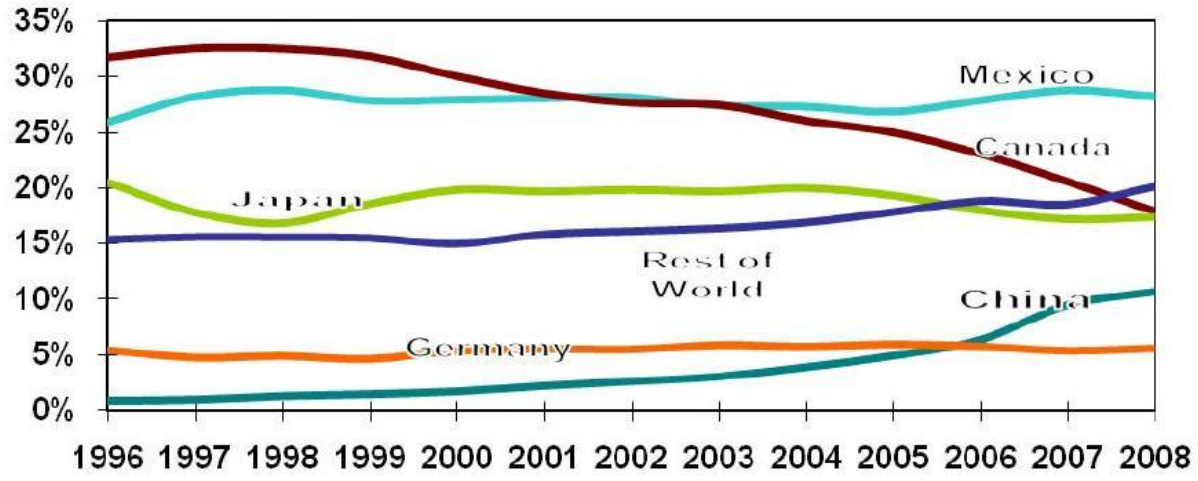

Figure 3 – U.S. Motor vehicle parts import volumes by major source countries – From: Klier and Rubenstein (2009)

Although by far not as large in terms of value and volume as U.S. imports from Germany in the automotive sector, traditionally the largest share of U.S. exports to Germany is found in the automotive sector as well (United States Census Bureau, 2012). If in accordance with our findings in Chapter 3 we are about to enter a new Kondratieff cycle in which energy efficiency – especially in the automotive sector – will be of increasing importance; the ties between the highly innovative automotive manufacturers on both sides of the Atlantic are likely to strengthen, at least in the short run in which specializations provide comparative advantages for specific automotive parts.

4.1.4 Sector demand for transportation and the Great Lakes

Automotive parts are transported in containers and deliveries are time-sensitive, yet suitable for maritime shipments if planned for in time. As such, containerized auto parts could be an interesting segment for a potential feeder service to capture, knowing that quantities are consistent. The main barriers to overcome for such a service are the seasonality aspect – car manufacturers need year-round supplies and do not like switching between modes – and the Harbor Maintenance Tax. The Harbor Maintenance Tax is particularly limiting potentials since it is a tax levied on an ad valorem basis. With auto parts being relatively expensive goods, the amount of tax paid per item rises subsequently.

4.2 Chemicals sector

During the interviews conducted for this research, an often heard potential to increase the feasibility of container shipping on the Great Lakes is found in the chemicals industry. The U.S. Midwest – and especially the states of Ohio and Michigan, which are easily accessible should new shipping services be deployed in the system – is a region characterized by high consumption levels of chemicals. For the production of e.g. cars, paint, and tires; chemicals are among the necessary inputs. As emphasized in the discussion of the Cleveland area by Verboon (2012) in part 2 of this research, large companies of the chemicals industry are represented.

4.2.1 Rising demand for chemicals

One could argue that the U.S. has a large chemicals producing base to satisfy its needs and that additional needs should be met by bulk carriers rather than by container ships. However, the U.S. chemicals sector has in recent years faced a trade deficit; despite it still being the biggest producer of chemicals in the world, stronger demand has led to more imports of chemicals than exports.

4.2.2 Different times require different scopes

The chemicals sector is undergoing some structural changes following the financial crisis. U.S. chemical companies have started to redesign their activities to become experts in the field of science and technology, thereby responding to emerging trends as identified in Chapter 3 such as climate change, resource scarcity and population growth (KPMG International Cooperative, 2010). More specifically, these changes encompass that increasingly research and technology play a role in the activities of chemical companies to stimulate a transformation from the production of base chemicals to specialty chemicals, and a surge for innovations that address environmental standards on a global level. Specialty chemicals can generally be described as high-value products with many different forms and applications. If the tendency of lower wage countries producing more and more base chemicals is to continue, on both sides of the Atlantic the chemical sectors would try to reinvent themselves and to shift their scope towards high-value knowledge and capital-intensive products. In the Netherlands for instance, with chemicals as the top commodity traded with many states in the Midwest as highlighted in figures 4.1-4.4, this phenomenon has been observed in recent years already with a changed focus for companies such as Akzo Nobel and DSM.

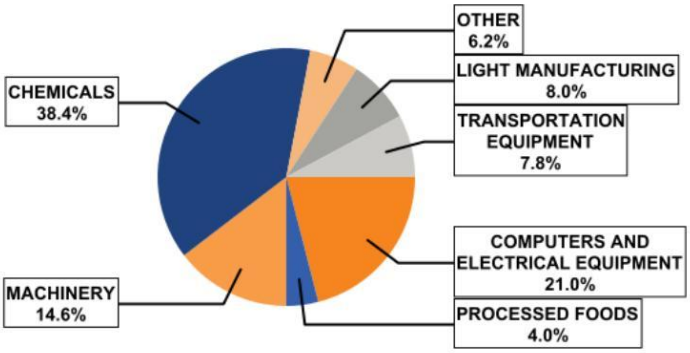

Figure 4.1 – Michigan state chart of exports to the Netherlands

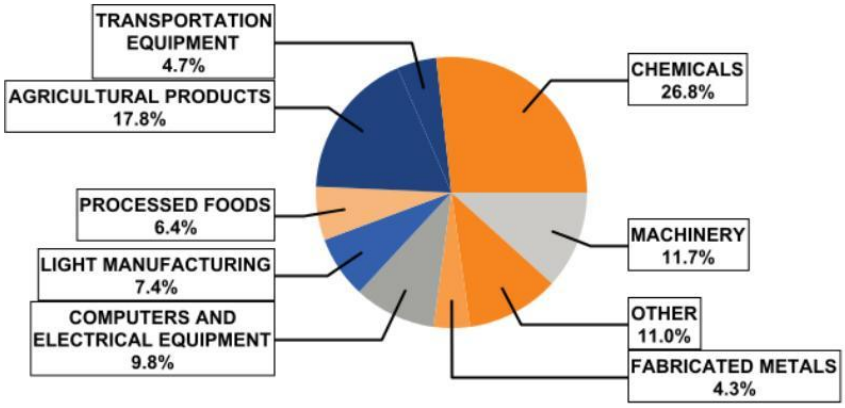

Figure 4.2 – Michigan state chart of imports from the Netherlands

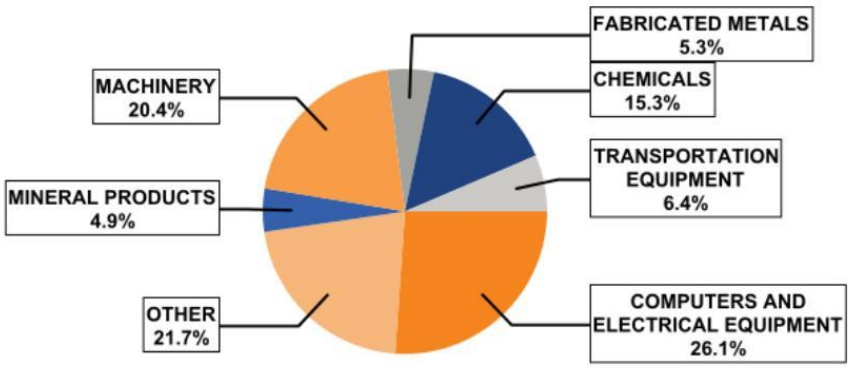

Figure 4.3 – Ohio state chart of exports to the Netherlands

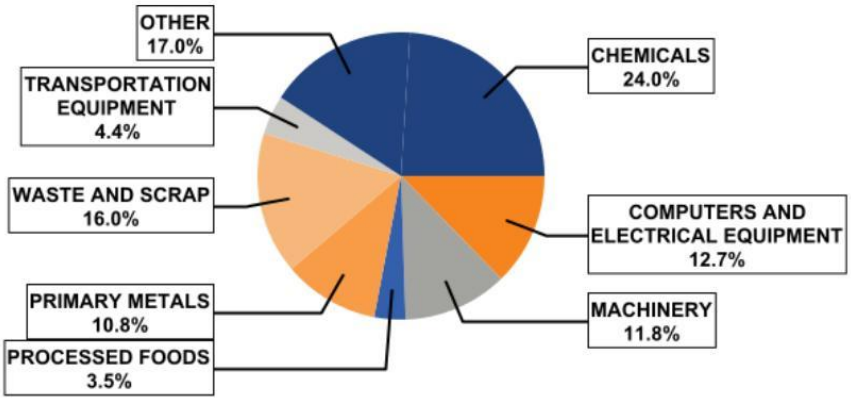

Figure 4.4 – Ohio state chart of imports from the Netherlands[3]

[3] Figures 4.1-4.4 from: The Netherlands Embassy in Washington, DC (2011)

4.2.3 Implications for the GLSLS system

For the GLSLS System, specialty chemicals could provide an additional segment through which container shipping becomes more economically feasible. Interviewed parties namely argued that it is ideal to use chemical tank containers – which have the exact size of containers and therefore, provided that they do not contain hazardous materials, do not cause additional costs or time – to ignite the development of new networks for chemicals distribution. If it follows that demand for a certain specialty chemical in the long run increases to a sufficient extent; that would be the time to use bulk carriers instead of ISO tanks for chemicals. Despite the fact that costs of using such an ISO tank are expected to be higher per tonne compared to using a bulk carrier, as we will discover in the following chapter fuel efficiencies of specific vessels could provide advantages for tanks on waterborne services over chemicals transported by rail operators.

4.3 Conclusion

The findings in this chapter confirm the responses given by interviewees with respect to the question what markets could potentially be served by a container service in the GLSLS system. The automotive and the chemicals sector on both sides of the Atlantic are of considerable size and contribute a lot to local economies in terms of employment. If a marine service can provide a reliable and cost efficient alternative to current routings of the shipping companies operative in these sectors, one can expect that the service could be beneficial to consumers in the Midwest and Northwest Europe.

The key barrier identified for the automotive sector is the fact that deliveries are required on a year-round basis while the GLSLS system is not capable of providing waterborne-only services throughout the entire year due to the seasonality aspect. A closer look at the extent to which this barrier can be tackled is thus required, which is dealt with in chapter 6. Chapter 6 also discusses the Harbor Maintenance Tax and the use of the funds it brings forth. The ad valorem tax is considered an additional barrier for the automotive sector given that automotive parts are generally of high value. An economic analysis of the consequences of lowering the tax barrier is therefore required to get more insight in the potential gains of constructing a different cost recovery framework. Verboon (2012) addresses the impact of the Harbor Maintenance Tax levied on goods traded in both sectors which emphasizes the significance of the burden put in place by authorities.

5 Key System Opportunities

Over the past decades, transport activities have increasingly supported the mobility of people and goods. From public transport services in urban areas to shipping activities in international trade, people and businesses can choose from different modalities to move themselves or their goods from one place to another. Each of these modalities has different characteristics for instance in terms of cost structure, speed and flexibility. This chapter intends to show how these differences impact the competitiveness of each of the modalities in the Great Lakes area. Of main focus are the aspects in which marine transportation provides scope for relief with respect to both internal and external costs of transportation.

Maritime transport can provide lower per unit costs than other modalities once distances over which goods are transported increase; partly because lower fuel costs offset the disadvantage of relatively expensive handling charges. With fuel prices continuously on the rise it is important to consider marine alternatives in a number of fuel price scenarios. Moreover, maritime transport services tend to have less of an impact in terms of societal costs such as health risks and accidents than do their non-water counterparts. Unlike fuel costs, societal costs are not incorporated in the quantitative part of this research due to the limited scope. Nonetheless, some of these costs are considered in this part given that they provide the incentives for policy-makers to evaluate to what extent the barriers to GLSLS container transport should be attacked.

5.1 Fuel efficiency

5.1.1 Rising fuel prices

As emphasized in Chapter 3, one of the developments that call for a close look at the potentials of waterborne transportation is found in the fuel market. As figure 5 shows global prices for oil have increased significantly over the past years.

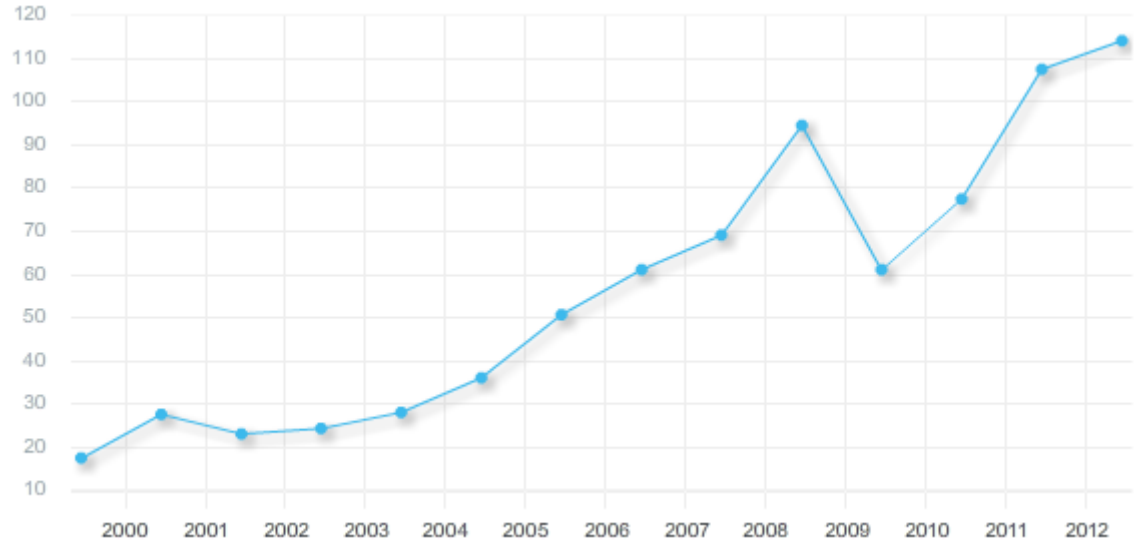

Figure 5 – Oil price index – From: OPEC (2012)

The tendency of rising oil prices can be explained by a number of factors, of which two are most prominent. Firstly, oil reserves are diminishing on a global scale. While countries in the Western world have traditionally accounted for high oil consumption levels, global demand for oil has in the last decade increased exponentially with the emergence of new industrialized countries in Asia and South America. Oil is considered to be the main source of energy in today's world; oil prices therefore show a strong correlation with production levels of industries and agricultural activities.

5.1.1.1 The relationship between economic growth and oil price levels

As was observed in the years at which the financial crisis was most severe, economic turmoil in countries that use a lot of oil in their production processes leads to a lower demand for oil and thus to lower oil prices. The reasoning behind this phenomenon is rather straightforward; when consumers are less confident in the sustainability of their economies their spending patterns change. Employment insecurity and fear of inflation lies in this sense at the basis of consumers feeling the need to save more and spend less. As a result businesses will need fewer commodities for their production simply because they sell fewer products. Meanwhile the danger of a self-fulfilling prophecy arises as lower production levels in the industries may lead to higher unemployment. Seemingly through interplay of policy-making and the level of attention from the media it then depends on the extent to which political leaders can take measures effective enough to restore trust in the economy and thus spending patterns. If these efforts are successful and economic growth is the resultant then productivity increases but so will oil prices.

Along with the financial crisis that originated in 2007 production levels on a global scale decreased, which explains the dip in the graph of figure 5 that started in 2008. Since, markets around the world have shown signs of recovery and thus are oil prices back to record breaking levels.

5.1.1.2 The relationship between political unrest and oil price levels

Aside from the fact that the observed price increases can be explained by the fact that oil reserves are diminishing on a global scale while demand keeps rising; political unrest in Middle Eastern countries – which account for a large supply of oil traded in the world – has throughout history had significant impacts on the price for oil (see figure 6 and 7 for the relationship between oil price and political unrest in the periods 1970-2008 and October 2010-October 2011 respectively). At the start of new political turmoil in these countries in early 2011, price increases of over 11% were observed in a matter of days (Rooney, 2011). With renewed unrest in Egypt and an ongoing conflict in Syria at the time of writing this report, it looks as if uncertainty surrounding oil price indexes is set to remain. International trade and transportation patterns are affected by such uncertainty as the transportation industry, like any other, can grow in times of stability and fixed costs over a longer period of time as shipping companies and ship operators plan their activities for the medium to long run.

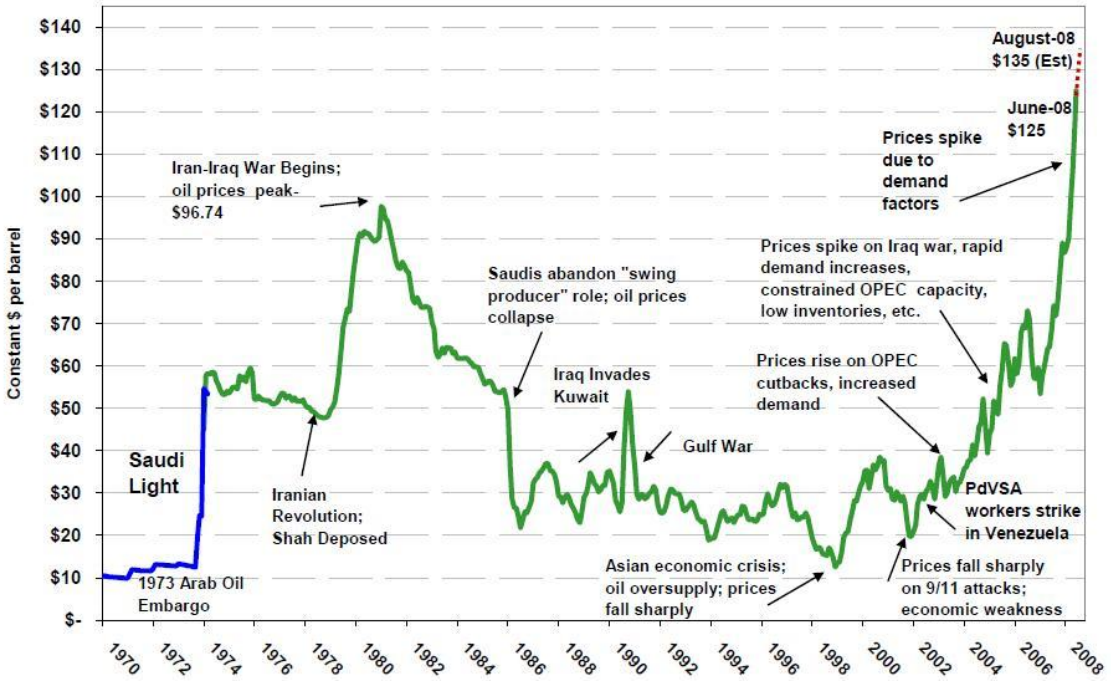

Figure 6 – Oil price volatility (corrected for inflation) – From: TEMS Inc. (2008)

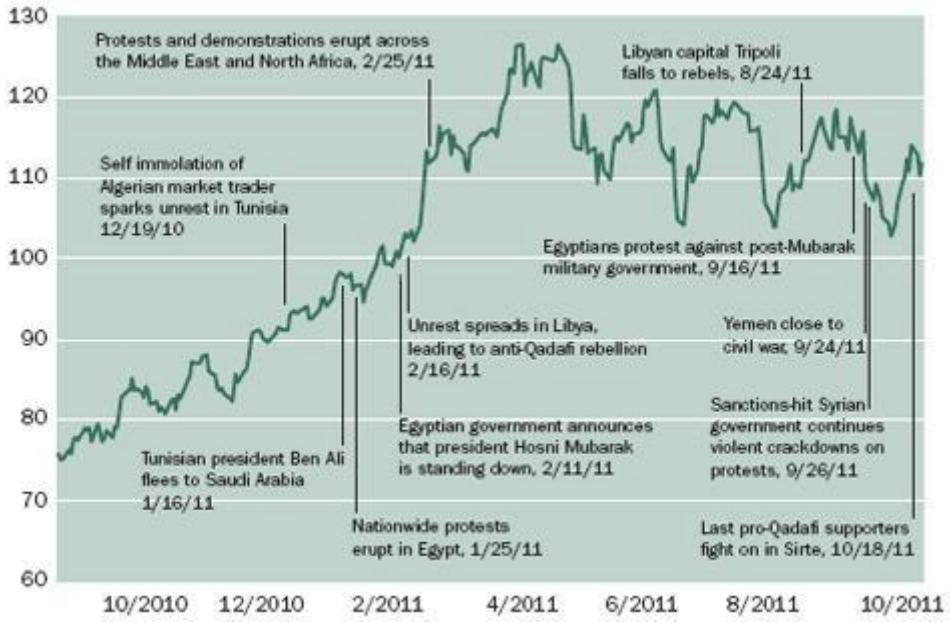

Figure 7 – Oil prices in dollars per barrel and the Arab Spring – From: Platts Insight (2011)

5.1.1.3 The use of oil in maritime shipping

In the shipping industry, fuel prices of gasoline used for ship operations – Intermediate Fuel Oil (IFO) 380 and Marine Diesel Oil (MDO) – have like prices for crude oil undergone exponential increases in recent years. IFO380 is the main source of energy for maritime shipping, MDO on the other hand serves to generate power for a vessel's generators and is per container required in much lower volumes than IFO380. Based on spot prices of late 2011, in our economic analysis we use a price of $700 per metric ton IFO380 and $1.012 per metric ton MDO. To exemplify the substantial price increases; a metric ton of IFO380 cost around $150 in early 2005.

5.1.1.4 Practices to dampen oil price increase effects

A direct result of the high fuel prices for marine shipping is that shipping lines have practiced the concept of slow steaming; vessels then sail at much lower speeds such that fuel consumption is reduced. The counter-effect of such operations are obviously that transit times increase, but the revenues lost from slower deliveries are still smaller than the alternative of sailing at high speed, high fuel consumption. Part 2 of this research discusses this phenomenon in detail.

To further counter the additional costs for transport services resulting from higher oil prices, shipping companies tend to maximize the length of the maritime section of a trip from origin A to destination B since per TEU distribution costs are much higher for inland movements than for maritime movements (TEMS Inc., 2008). The truck industry – already facing trucker shortages and highway congestion – has as a result been damaged most severe, given its high fuel consumption characteristic. For rail operators, rising oil prices are not as big of a problem because trains are significantly more fuel efficient than trucks. Similarly, waterborne transportation is generally more fuel efficient than both rail and truck transportation leading to relatively low prices per TEU in terms of fuel costs.

5.1.1.5 Fuel costs vs. overall transport costs

For each mode applies that next to fuel costs other factors jointly make up the costs of transport which might offset comparative advantages. For instance, the costs of entering a port or terminal handling costs are relatively high when compared with train and truck discharge operations. Moreover, the correlation between the factors cost and time should not be ignored. Faster transit times allow for a higher rate to be charged for services. Waterborne transportation is generally slower than the other modes and thus does the sector need a cost advantage to remain competitive with other modes.

For ship operators to charge a rate that is sufficiently low for their services to compete with rail operators and trucking companies, it is of the utmost importance that those vessels are operative that maximally exploit economies of scale while not sailing at a too low pace. With 22- to 24-hour and 11-hour transits for the Montreal-Ontario section and the Welland Canal respectively, ship operators on the Great Lakes seem rather disadvantaged given that rail networks run alongside Lake Erie from Montreal into the U.S. Midwest. However, interviewed parties have noted that there are reports of rail traffic on this route can face delays in the Toronto area of up to 72 hours. Despite these findings, researchers argue that the current difference between ships and trains on this route adds up to 4 days, whereas a 2 day difference would make it economically feasible for container ships to compete with rail services (TEMS Inc., 2008). Technologically this would be a feasible option as sailing speed would have to be increased to 18 to 22 knots which modern vessels are capable of, but it should be noted that then the fuel costs per container are inclined to increase. The fact that such a service is non-existent today is due to operators not having the will to launch a new service without commitment of shippers, whereas shippers are not inclined to assign cargoes to new services that have not yet proven to be reliable. Parties interviewed in this respect suspect that it would take an operator to step in and be willing to accept losses during the first years of service in order to reap potential benefits in the long run. In current economic times this will prove to be a tough case, yet – as we discover in Chapter 7 of this report – services running on part of this route have proven competitive and reliable, which might help to convince shippers in future undertakings.

5.1.2 Fuel efficiency of modes

5.1.2.1 Identifying scenarios to predict modal shift

In 2008 a report called 'Impact of High Oil Prices on Freight Transportation: Modal Shift Potential in Five Corridors' was released to shed more light on potential modal shifts from increases in oil prices. The researchers based their findings on the assumption that oil price indexes could develop roughly in accordance with three different scenarios; an optimistic scenario, a central scenario, and a pessimistic scenario. In the optimistic scenario a barrel of oil would cost $60-$80 in 2011, in the central scenario oil prices would stabilize by 2016 in a range between $100 and $120, and in the pessimistic scenario prices are projected to keep increasing to over $200 per barrel. Though slightly outdated, these scenarios and the comparison of modes accordingly provide us with insights as to what the potentials are for Great Lakes container shipping should the oil prices keep increasing as was observed recently. Namely, in 2011 the lowest price for a barrel – which lasted only one week before increasing steadily – was $79.85 while it is expected that prices in 2013 will top current levels (February 2012) up to $125. Based on these figures, the optimistic as well as the central scenario

have proven to be too optimistic. Rather does it seem that the truth will lie somewhat in between the central and the pessimistic scenario (see figure 8).

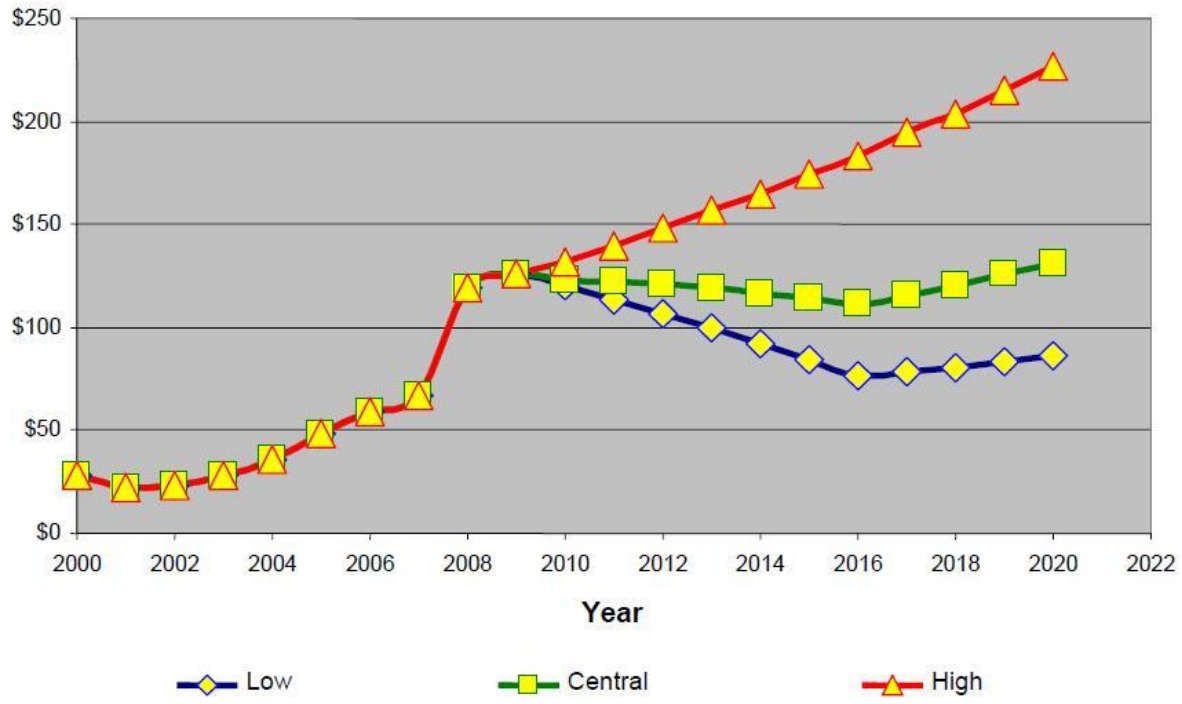

Figure 8 – Crude oil nominal prices projected – From: TEMS Inc. (2008)

Based on these scenarios an analysis of the different modes incorporated in the report shows the differences in costs projected for the year 2020. As far as trucking services are concerned, we can state that there is a direct relationship between the costs for a barrel of oil and those for a barrel of diesel fuel. Obviously overall trucking costs, which additionally include capital, labor, and taxation costs, are correlated with oil prices. These factors would to some extent dampen the effect of rising oil prices, were it not the case that these costs have risen as well in recent years, thereby putting trucks at even more of a disadvantage. Compared to the trucking sector rail service costs show a similar correlation with fuel prices, yet because rail is more fuel efficient the per mile cost increase is much lower in monetary values than in percentages. Other than for trucks and trains, in the maritime sector there is a lot of difference of the vessels that can be employed on specific routes.

5.1.2.2 Shipper preferences and mode selection

The sensitivity of overall costs of these services to oil price fluctuations are to a large extent dependent on the preferences of shippers. If timeliness is a critical issue faster ships that show a stronger correlation with oil price indexes will be put to use, whereas if costs are of primal concern slower but more fuel-efficient vessels are operated. A thorough research on both the needs of shippers as well as on the time factor on potential routes over the Great Lakes is required to show what type of vessel would be optimal, yet the differences can be visualized as in figure 9.

	Fuel Prices		Line-Haul Costs per Container (FEU) Mile				
Scenario	Crude Oil per Barrel	Diesel per Gallon	Truck	Rail IMX*	GLSLS-Max RORO**	Coaster RORO	COB
2002 Historical	$28.85	$1.37	$1.41	$0.30	$0.15	$0.37	$0.19
2005 Base Case	$54.79	$2.40	$1.75	$0.36	$0.23	$0.48	$0.21
2020 Low Case	$59.61	$2.61	$1.82	$0.37	$0.25	$0.50	$0.21
2020 Central Case	$91.03	$3.99	$2.28	$0.45	$0.34	$0.64	$0.23
2020 High Case	$157.18	$6.88	$3.24	$0.60	$0.55	$0.93	$0.28

* *Rail IMX is rail intermodal traffic*

** *GLSLS-Max RORO ships are vessels built to the maximum physical constraints of the St. Lawrence Seaway and other lock restrictions in the Great Lakes*

Figure 9 – Comparison of modes – From: TEMS Inc. (2008)

The findings in this table suggest that both the GLSLS-Max RORO vessel and the COB (Container-On-Barge) have comparative advantages over truck and rail in terms of transportation costs in each of the scenarios, despite the GLSLS-Max RORO vessel being more oil price sensitive. The COB shows the lowest rates of correlation with oil prices and thus seems well suited for waterborne services in the system if oil prices keep increasing, provided that the lower speed at which it sails still meets shippers' needs. Note however that alongside line-haul services a part of trucking companies' operations involve drayage; local deliveries which imply empty truck miles to be driven and non-productive time at e.g. terminals. Similarly, in this table the costs and time inefficiencies of discharging containers for rail and ship operators are ignored.

If we include these costs such that total costs per container are depicted, the outcome does not change significantly. Rail and water transport operators still hold an advantage over their counterparts in the trucking industry due to the relatively fixed costs for their container handling activities combined with lower transport costs per mile. Therefore, the longer the distance over which cargo is shipped, the bigger become the advantages for water and rail respectively. Surprisingly, because of having much more capacity than rail operators, waterborne operators become competitive with trucking after a shorter minimum distance. It is stated that rail operators generally require a minimum distance of 700 to 1000 miles in order to create sufficient profit margins as opposed to 250 miles for waterborne operators. With the distance between Montreal and Chicago being approximately 850 miles, one can understand what lies at the core of some shippers being unsatisfied with the rail services they use on this route. Particularly the COB can provide an economically feasible alternative on this route to both truck and rail services as a result of its high fuel-efficiency, but only for those goods that are not bound by time. The GLSLS-Max RORO vessel provides an alternative that can better meet the demand for timely deliveries and still be profitable, however should oil prices rocket than rail operators have an advantage due to the vessel's higher price sensitivity to oil prices. If considered for longer distances, such as from and to Nova Scotia, the advantages of waterborne services are enforced, but in that case it should be noted that higher investments are needed to deploy more vessels for the service to have a sufficient frequency.

5.2 Corridor congestion

Because of higher consumption patterns and an increasing importance of 'Just-In-Time' (JIT) deliveries truck traffic volumes on U.S. highways increased substantially in recent decades. If we add to this that the miles traveled in vehicles per person has grown at the same time, it seems logical that U.S. highways nowadays increasingly face capacity constraints to accommodate the need for road transport.

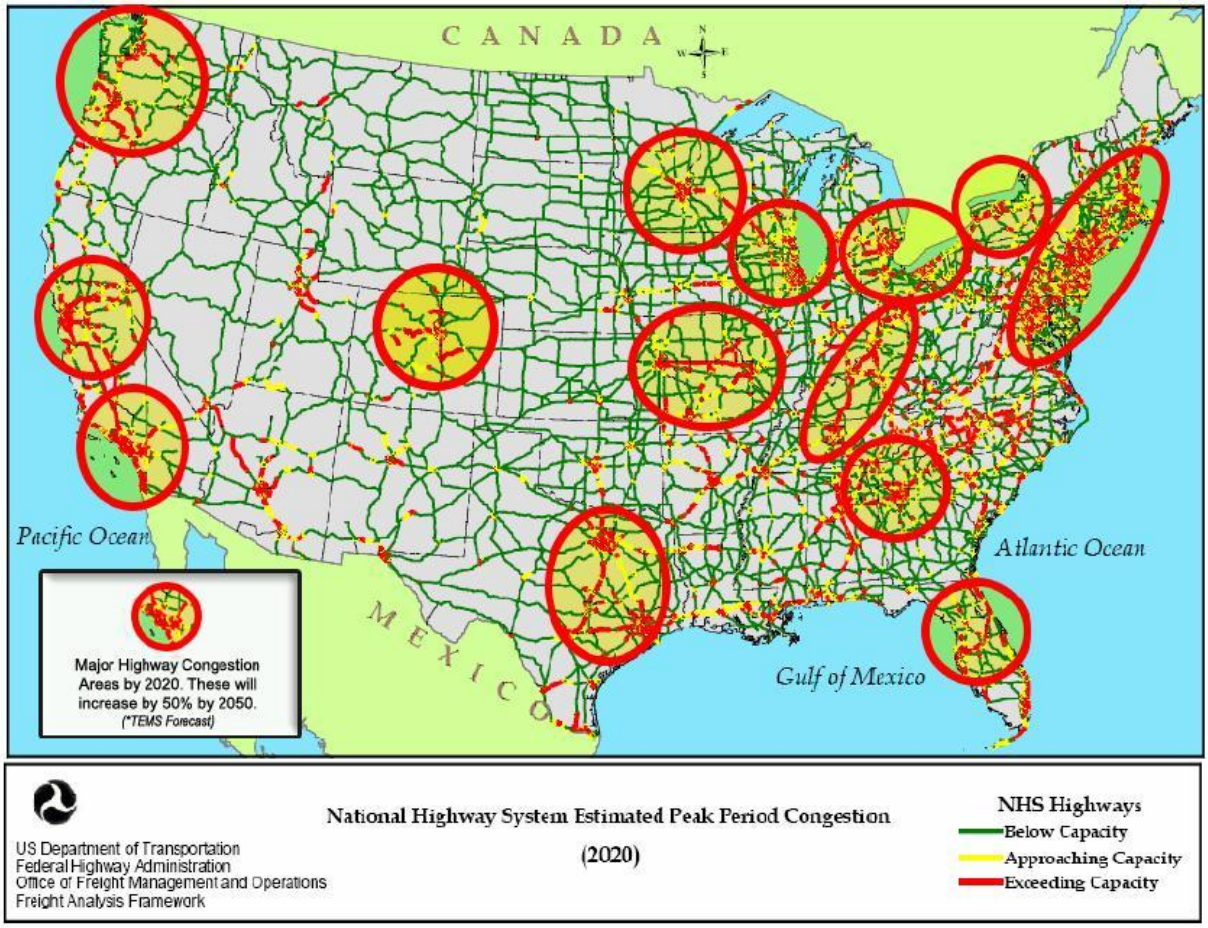

Figure 10 – Major Highway Congestion Areas by 2020 – From: TEMS Inc./RAND Corp. (2007)

5.2.1 Congestion in the Great Lakes area

While cargo volumes transported in the region between the East Coast and the Midwest already use a lot of capacity of the interstate highways, volumes are expected to keep increasing in the years to come. As far as the rail network is concerned we can state that the networks surrounding the Great Lakes are congested as well. As the 2007 report 'Great Lakes-St. Lawrence Seaway New Cargoes/New Vessels – Market Assessment' pictures graphically in figure X and Y, for both modes it holds that particularly in the Great Lakes area, either large investments to increase capacity or a surge for different ways to get goods from point A to point B are needed.

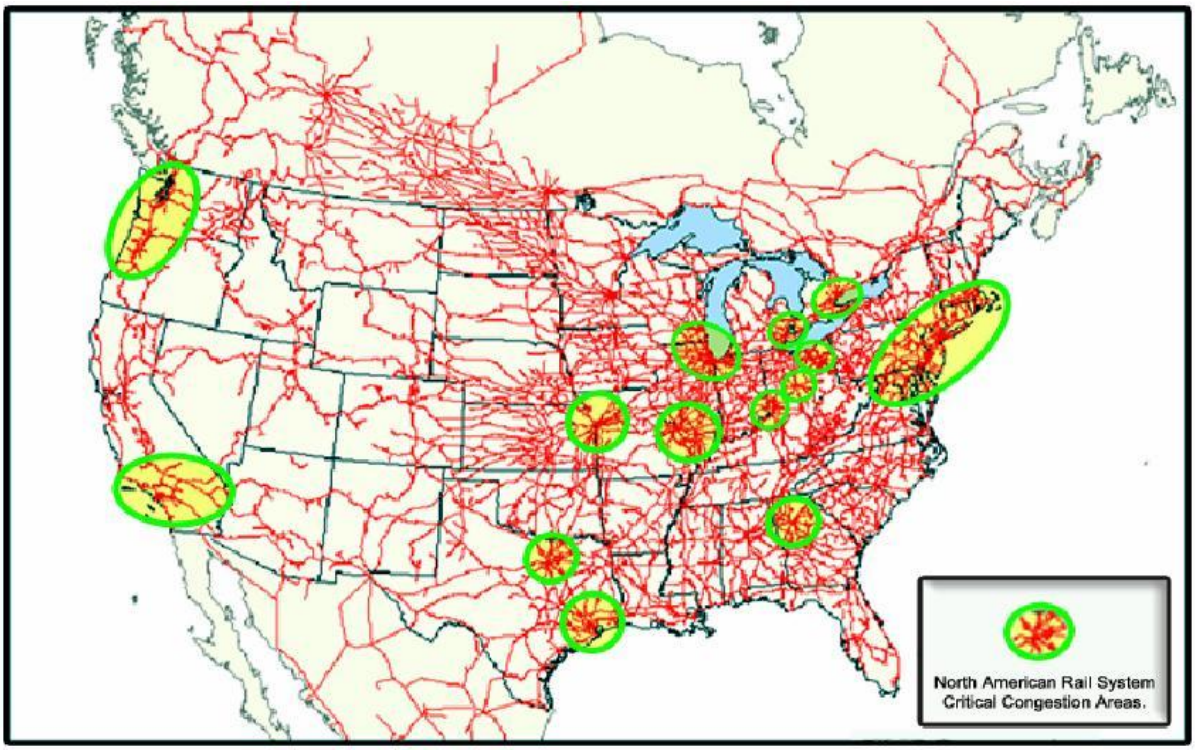

Figure 11 – North American Rail Network – Bottlenecks and Congestion Areas – From: TEMS Inc./RAND Corp. (2007)

5.2.2 Railroads anticipate higher levels of congestion

In response to these developments, rail operators in the East Coast-Midwest corridor have recently invested hundreds of millions of dollars to facilitate growth; CSX and NS, the dominant rail service providers in the region, have optimized their infrastructure to accommodate additional cargo by facilitating double-stack trains along the entire route (Verboon, 2012). As such, for the shipping industry in the Great Lakes area, the largest potential of growth from a congestion point of view seems to lie in capturing a larger share of the cargo volumes transported by truck from the East Coast ports to Midwest markets directly as well as from the volumes transported that arrive in Canadian East Coast ports. Namely, the rail connections crossing the border from Ontario face capacity constraints that do not allow for major expansion.

5.2.3 Capacity at the major Atlantic Canadian ports and railroads

The port of Montreal, of all Canadian ports the biggest player for the U.S. Midwest, is served by rail operator Canadian Pacific (CP). In the Midwest CP has connections with Chicago and Detroit – the largest markets of containerized cargo in the region – but crosses the border through a tunnel between Windsor (CAN) and Detroit which has height constraints. Due to these constraints double stack transport is limited which in turn lowers the efficiency of the service. One would think that these circumstances provide room for the maritime sector in Montreal to get a stronger position; however, the port of Montreal seems to be constrained to facilitate potential shipping services. Basically, the port is characterized by having docks that allow for transshipment of containers from vessels directly onto trains and trucks. With respect to significant container volumes interviewees argued that there is limited space to discharge, store and then load them onto another vessel, and so are the potentials to create such space necessary. Other drawbacks than limited access into the Midwest due to the tunnel and few shore-side expansion opportunities, the port of Montreal cannot

accept many larger-sized vessels; just up to 3600 TEU. On the contrary, the second-largest player in this corridor, the port of Halifax, has plenty of capacity. For the Great Lakes maritime industry its main disadvantage is the distance that needs to be covered to reach Midwest markets, yet for cargo that is insignificantly bound by time the port seems to have potential as a hub from where feeders could go through the Seaway and cross Lake Erie. Part 2 of our research encompasses a description of both ports and the roles they can potentially have in container shipping in the GLSLS system.

5.2.4 Out of system developments

Halifax is identified as one of two ports that could profit from other developments affecting the East Coast (TEMS Inc./RAND Corp., 2007). The heavily congested urban area around New York may in the future be served more by waterborne transport to accommodate transport needs for which the highways are too restrained in capacity, thus for short distances. The forecasted capacity constraints can be attributed to the fact that population in the area – and thus demand for goods – keeps increasing and that the Panama Canal expansion will allow for ships from Asia to sail to the New York market directly instead of using a land-bridge from the West Coast. The port of New York as well as the port of Baltimore are therefore expected to somewhat shift their scope towards local container traffic (TEMS Inc./RAND Corp., 2007). If local markets become more important for these ports, the extent to which they can compete for inland traffic is limited given the capacity constraints of the ports themselves. The ports of Halifax and Norfolk could then emerge as the major hubs for destinations further inland. In this respect, Norfolk is geographically well positioned to accommodate additional cargo that comes in through the Panama Canal. For the European market – as well as the Asian market through the Suez Canal – Halifax provides potentials to find efficiencies in the new situation. Halifax is capable of handling vessels of up to 12,000 TEU, is geographically closest to the major ports in Northwest Europe and currently has spare capacity of 50%. Anticipating these developments the construction of a second terminal in Nova Scotia is momentarily under consideration; Melford International Terminal.

5.2.5 Congestion in the Midwest (sub)urban and industrial areas

For both Canadian ports it holds that a significant share of the containers with destination Midwest are often railed to Chicago and then trucked to Detroit, a market that is crossed by the rail services (Hull, 2012). In terms of congestion and fuel consumption, this is a rather inefficient approach. Chicago is one of the heaviest congested areas in the U.S., which contributes to high external costs of transportation such as air pollution and safety risks. Hull (2012) states that congestion issues are likely to spread given the geographical locations of markets and intermodal facilities such as the new CSX undertaking in North Baltimore, south of Toledo, Ohio. Whereas the corridor cities are facilitated well by the rail services, the large manufacturing areas in Michigan and Ohio seem to go off the radar to some extent. Cleveland, Ohio, which used to be a hub for intermodal transport, is bypassed with the new CSX facilities, likely leading to more trucks entering its region from Toledo and Columbus. Likewise, rail services target the Chicago market primarily and consider Detroit as a spoke in the network, which results in more road transport between Chicago and Detroit. A feeder service from Halifax that discharges in multiple ports along Lake Erie coasts could therefore provide some relief of congestion and its negative impacts. Potentially, and likely providing extensive congestion relieve between Chicago and Detroit, shippers that are least bound by time for their deliveries in the Chicago

area could be included in such a service in that the feeder would go around Michigan in an additional three days and discharge in the port of Chicago or Burns Harbor, Indiana directly.

5.2.6 Conflict between the urge and the potential to combat congestion

Some researchers argue that highway congestion is toughest to tackle (TEMS Inc./RAND Corp., 2007). Thorough investments in highway capacity tend to lead to congestion relief only in the short run; because of fast growth in automobile traffic added capacity is often filled up quickly, leading to a change in volumes but not necessarily in congestion costs. The reasoning behind this phenomenon is as follows; highway users struck by congestion accept a certain delay involved with their transit. As soon as such delay decreases, additional highway users whom previously would choose other modes or different times of the day to transit along the route, now decide to use the highway which in turn increases traffic volumes and likeliness of additional congestion to a new equilibrium. Note in this respect that the costs associated with congestion not only stem from the delays experienced by individual highway users; collectively a cost burden from delays is experienced as well, referred to as the externality cost of congestion. These costs, quantified by the time value placed on the delays experienced, are however borne by the highway users as a group rather than on an external party. Therefore, the way in which congestion costs should be estimated has led to some confusion among scientists (Newberry, 1990). This problem can be explained by looking at the relationship between traffic flow and the cost of delay as shown by figure 12. The critical assumption is that travel time costs are existent even when there is no congestion; congestion merely causes these costs to be higher than in a no congestion situation.

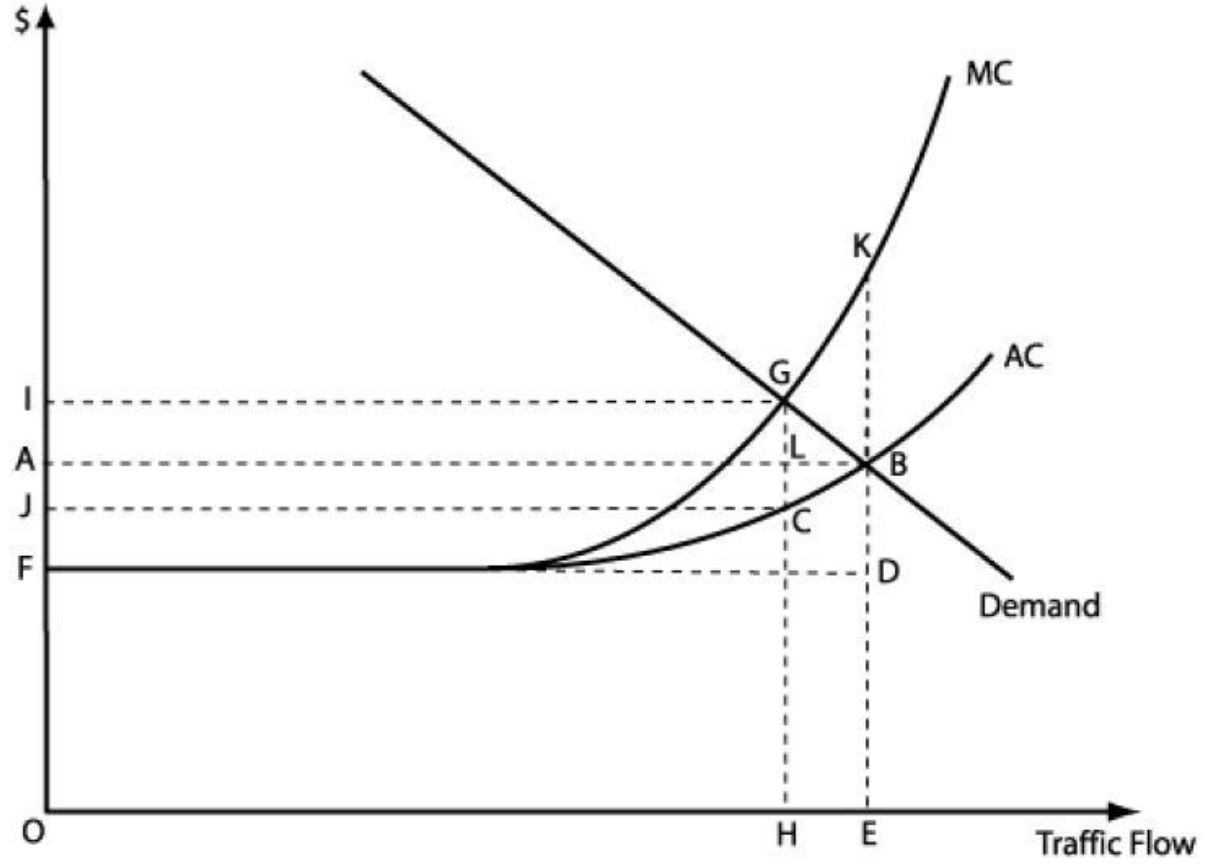

Figure 12 – The Costs of Congestion – From: Zhang et al. (2004)

In figure 12, AC and MC represent the average and marginal costs of travel for different traffic volumes with respect to the demand for travel respectively. Without effective regulatory measures, highway users neglect the delay costs they impose on others and the highway will be used at the occupancy rate at point E with costs that are as high as point A. The total travel costs are therefore identified by OABE. On the contrary, the area OFDE represents these costs in the hypothetical case that no congestion is present, leading to congestion costs being identified by the area FABD. However, increasing road capacity to a level at which congestion is no longer present is considered uneconomical, and thus it can be argued that one cannot consider the difference between congestion costs as present and a hypothetical zero congestion situation (Newberry, 1990). Instead, a comparison of the extra costs of congestion as present with a lower level of congestion where highway users are forced to recognize the congestion cost they impose on others is more appropriate – highway users perceive themselves as a victim of congestion rather than a cause so they initially do not recognize the delay costs borne by fellow highway users as a result of their individual travel patterns. Highway tolls or incentives to use other modes are tools that lead to users recognizing these costs with lower highway traffic volumes as a result. In figure X this is represented by the cost CG which raises the travel costs of highway users individually, leading to a shift of the equilibrium without incentives in point B to the new equilibrium at point G. Consequently, the total social travel costs have declined from OABE to OJCH; highway users then still bear all social costs associated with congestion, yet it allows for a distinction between the total costs under optimal congestion (OCJH) and the excess congestion costs (HGKE) (Zhang et al., 2004).

With respect to the East Coast-Chicago corridor it is found that tolls on many of the interstate highways are already in place and are considered to be relatively high (Hull, 2012). To raise these tolls further in order to decrease traffic volumes could therefore lead to much controversy among stakeholders. Therefore, if the aim is to reduce congestion on highways in the Midwest, it can be wisest from a political point of view to spur the development of other modes such that cargos are shifted rather than piling up on roads. At the moment new plans are made to designate a highway through Columbus, Indianapolis, St. Louis, and Kansas City (I-70) which could potentially provide truck-only toll-free lanes. Evidently, such development would relieve the pressure on the interstates 80 and 90. It should be noted, however, that costs associated with highway maintenance are generally expected to be considerably higher than maintenance costs for maritime infrastructure.

5.2.7 Other congestion issues in the Great Lakes region

Highway congestion issues tend to arise on a wider scale in urbanized areas than they do elsewhere, for the Great Lakes area this is no different. Urban areas account for large volumes of automobiles and are major consumption markets in need of goods delivered to the area. Trucking companies generally tend to accept congestion obstacles given that on a long distance route the additional costs from delays and fuel consumption are relatively low given the entire mileage. Policy-makers realize however that the external costs associated with congestion in urban areas are most severe. Air pollution and safety risks are among other factors negative externalities that cannot be ignored in these times in which the provision of health care services is costly and involving much debate. If we acknowledge the importance of this issue then it should not be forgotten that more and more people decide to live in settlements next to interstate highways from where they commute to the commercial centrals in cities. With expectations of increasing truck volumes in the Ohio and Illinois/Michigan regions, where larger cities are relatively close to one another, the costs from

congestion cannot be underestimated. A good example in this respect is the congestion issues present in the Chicago area. Partly because the rail infrastructure is outdated and due to increasing freight volumes, rail congestion has resulted in delays, highway congestion, air pollution, safety concerns, and interference to intercity and commuter trains (DiJohn, 2010). Accumulated the costs associated with these issues are estimated to amount up to $11 billion on an annual basis.

In response to a number of developments in the trucking industry, authorities in several states have taken initiatives to raise the taxes on diesel fuels such that fewer trucks than expected will hit the roads in the years to come. The outcome wished for is a reduction of congestion and lower impacts of trucking on the environment. Meanwhile, new regulation is imposed on trucks, making the industry less attractive for truckers to work in. The fact that the attractiveness of being employed as a trucker is low is exemplified by the fact that the average age of U.S. truckers is increasing rapidly; few young workers want to be a trucker. With trucker shortage as a result, trucking rates are expected to increase substantially in the years to come; demand for trucking services is likely to be much higher than services offered which leads to truckers being able to select the client with the highest bid. In the economic analysis of our research we therefore incorporate 4 different scenarios; increases of truck rates by 15%, 20%, 25%, and 30%. For the reasoning behind the selection of these percentages we refer to part 2 of this report.

5.3 Transport and environmental sustainbility

Strongly related to our fuel efficiency analysis in the previous section is a review of emissions – carbon monoxide (CO) emissions in particular – by different modes in the transportation sector. It was recently estimated that in the U.S. two of every three barrels of oil are destined to be consumed by the transportation industry (American Physical Society, 2008). Cars, trucks, trains and ships therefore account for a large share of air pollution which, other than it having a negative impact on people's health, is said to cause our earth to heat up to such an extent that in some regions agricultural activities are no longer sustainable. Although not all scientists agree on the correlation between emissions and global warming, industrialized countries increasingly address environmental issues as the call to work towards a green planet gets stronger within societies. With the transportation industry accounting for a significant share of fuel consumption in today's economies, the impact of emissions associated with moving goods should be included in any report that reviews the potentials of modal shifts. Note that next to air pollution there are several other environmental externalities of transportation such as water pollution and noise pollution. Air pollution costs however are considered to be the most extensive of all, primarily because they spread fast and on a wide scale easily.

5.3.1 The impact of transport on air quality

Combustion of fossil fuels in the transportation sector is said to account for 70-90% of total CO emissions, which in turn is estimated to account for 60% of the increase in radiative forcing since preindustrial times (Schipper et al., 1996). CO emissions are but one of the different air pollutants yet this category seems to draw the most attention from policy-makers in this field. Carbon monoxide is a poisonous gas which, other than it being fatal if a person is exposed to it in high concentrations. Carbon dioxide (CO_2) is the greenhouse gas emission that is receiving the most attention in today's world as it is said to affect people's heart and lungs conditions and to warm up the globe.

5.3.2 Searching the means to lower fuel consumption and emissions

The U.S. government has addressed the issues surrounding fuel consumption and emissions by a number of initiatives in recent years. One of the targets that these initiatives aim for is to reduce the U.S. demand for oil significantly in the near future. Not only would less oil consumption contribute to a lower impact on the environment, direct economical benefits arise as the U.S. will not have to import oil against rising prices in numbers as currently observed. Many of the initiatives affecting the transportation industry primarily encompass the installment of financial incentives – taxes and subsidies – with the aim to research and implement technological advances for engines of vehicles and airplanes. Should the fuel efficiency in these most polluting categories improve significantly, so will the environment.

A proven alternative to oil based vehicles are cars and trucks that run on electricity. Electricity is preferred over traditional fuels from an environmental perspective since in its use no direct pollution occurs. It should be noted however that in the production process of electricity pollution does occur and that, perhaps the main barrier to implementation on a wide scale in the short term, its use is limited to the storage capacities of the batteries. Development in this field is ought to provide the U.S. with the position of a global leader in those areas where environmental sustainability meets profitability. Until that time however, different means to lower oil consumption and emissions

should be sought, waterborne transportation in this respect provides opportunities as discovered in paragraph 5.1.

5.3.3 Air pollution costs

According to Rodrigue et al. (2009) the costs of air pollution from transport are threefold; economic, social, and environmental costs can be identified. Among economic costs are among others damage to infrastructure and loss of productivity of people and crops. Depending on the materials used, acid rains, smog and ozone pollution can lead to higher costs as constructions need to be maintained or replaced in a shorter term due to oxidation than would be the case without emissions. The productivity of people is negatively affected in the sense that workers spend more time in health care institutions or need to take care of relatives because of health issues resulting from emissions. In agricultural terms, air pollution may lead to the loss of entire crops or at least to less outcome per unit of input. Though harder to calculate, social costs are rather obvious as well. Life expectancy may be reduced as people inhale more and more emissions, direct costs associated with health care may increase. Of the three categories, environmental costs are toughest to quantify as these relate to entire ecosystems and biological diversity.

5.3.4 Environmental impact of different modes

With ships generally being more fuel efficient than trains and the same holding for trains as opposed to trucks, per tonne CO emissions are expected to be lowest when waterborne facilities are put to use more often in transportation networks. It is therefore striking that Kamakaté and Schipper (2009) find that, compared to other industrialized countries, the U.S. has in recent decades seen its share of waterborne transport as opposed to other modes decline more than in other countries (see figure 13).

Mode	Australia		France		Japan		United Kingdom		United States	
	1973 (%)	2005 (%)	1973 (%)	2005 (%)	1973 (%)	2005 (%)	1973 (%)	2005 (%)	1973 (%)	2005 (%)
Truck	19	39	57	81	35	59	65	66	31	43
Rail	28	38	36	16	14	4	17	9	41	43
Water	53	23	7	3	51	37	18	25	28	15

Figure 13 – Freight activity by modal share, 1973 and 2005 (% of t-km) – From: Kamaté and Schipper (2009)

Based on the percentages presented in figure 13 one could argue that the loss of emission reductions from low intensity of waterborne transport is offset by the relatively high intensity of rail as opposed to truck use. For Canada these numbers are slightly different; 29% of freight was moved by truck, 30% over water, and 40% by rail in 2003, with a trend of an increasing share of truck at the cost of rail (Steenhof et al., 2006). Although we do not attempt to shed more light on this topic by quantifying the results on a Great Lakes individual case-basis, it is helpful to demonstrate how the different modes compare in terms of air pollution in a general setting.

Emissions (grams/ton-mile)					
	HC	**CO**	**NO_x**	**PM**	**CO_2**[35]
Inland Towing	0.01737	0.04621	0.46907	0.01164	17.48
Eastern Railroad	0.02419	0.06434	0.65312	0.01624	24.39
Western Railroad	0.02423	0.06445	0.65423	0.01621	24.39
Truck	0.020	0.136	0.732	0.018	64.96

Figure 14 – Emissions -- Grams per ton-mile – From: Texas Transportation Institute (2007)

Policy makers can decide whether or not the use of one mode should be charged an extra cost if preferred over another if a modal shift is longed for. As far as the U.S. is concerned, Forkenbrock (1999) finds that U.S. regulation for truck and rail services does not lead to full internalization of external costs of transport. He states that the trucking industry accounts for an average external marginal cost of 1.11 cents per ton-mile and that the rail industry accounts for an external marginal cost of about 0.25 cents per ton-mile, yet note that this research was conducted in 1999. It should be acknowledged that extra costs charged for emissions are only a part of the total costs for transportation that a business needs. Hoen et al. (2011) in this respect state that the impact of supplementary charges associated with emissions shows a tendency of being rather small; the charges or the volume or unit costs need to be very high if policy makers want to affect the decision-making of a shipper.

Intrinsically, waterborne transport alternatives are most profitable in terms of lowering emissions, yet factors such as timeliness of service, frequency of service, distance between terminal and destination, and ease of administration all play a role in the decision-making process. For the U.S. Midwest it holds that the target markets as identified in this report are relatively close to potential ports of discharge. Timeliness and frequency however are factors that may limit the feasibility of container shipping on the lakes despite the environmental benefits, especially since in terms of emissions second-best rail services run along the lakes.

Given the fact that measuring the effects of transportation policy on air quality and related social costs is comprehensive and out of the scope of this research; Verboon (2012) does not discuss the economical impact of air pollution and the opportunities the Great Lakes maritime transportation system can provide. As observed above, however, waterborne services can indeed significantly lower the pollution per container transported.

5.4 Safety and transportation

5.4.1 Modal comparison of risk of accidents

As long as technology does not allow for riskless transits between origins and destinations or, if available, such technology is not implemented in all vehicles and human activity determines the speed and directions of different vehicles, any type of transit will involve a safety risk. Technicians and policy-makers keep striving to implement means to reduce such risks and in recent years these have proven successful in the United States. As figures 15 and 16 show, injuries from crashes and fatal accidents have steadily diminished over the last decade and especially in the trucking industry significant improvements have been made.

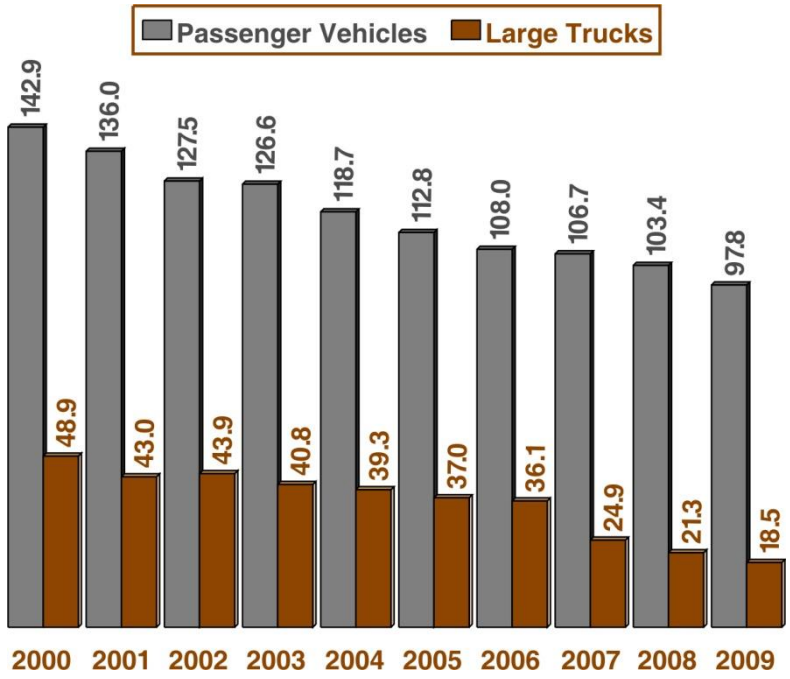

Figure 15 – Vehicles involved in injury crashes per 100 million vehicle miles traveled – From: U.S. DOT Federal Motor Carrier Safety Administration (2012)

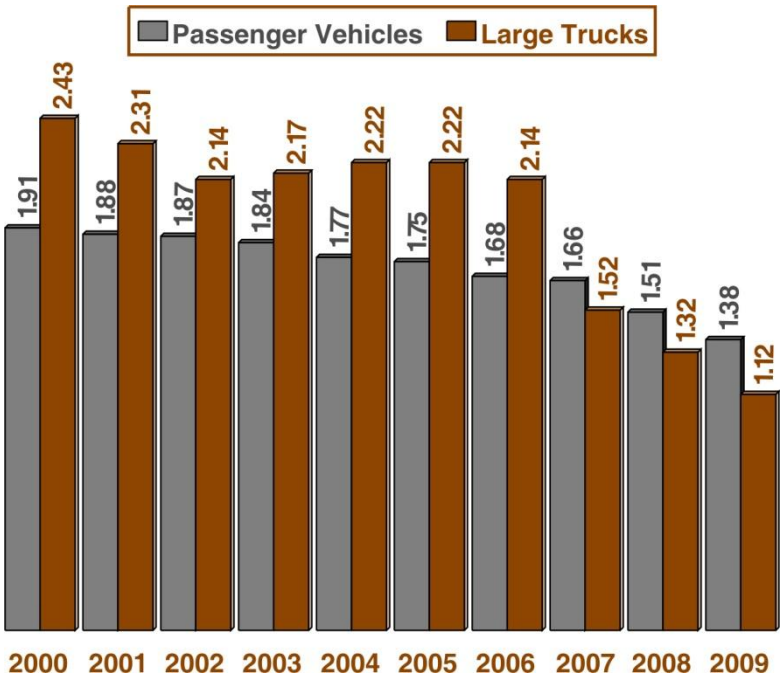

Figure 16 – Vehicles involved in fatal crashes per 100 million vehicle miles traveled – From: U.S. DOT Federal Motor Carrier Safety Administration (2012)

Despite these improvements, of all modes trucking still accounts for the most accidents. Also, the rate of fatality is much higher in road traffic than in rail or marine traffic as shown by a report conducted by the Texas Transportation Institute, which compared all modes based on statistics from 2005 and 2006 (See figure 17 and 18).

Mode	4-yr avg ton-miles (millions)	4-yr avg total injuries	Rate per Billion ton-miles
Highway	1,259,535	**124,750**	**99.044**
Railroad	1,554,130	**9,036**	**5.814**
Inland Towing	287,680	**13**	**0.045**

Figure 17 – Comparison of injuries by mode – From: Texas Transportation Institute (2007)

Mode	4-yr avg ton-miles (millions)	4-yr avg fatalities (operator)	Rate per Billion ton-miles	4-yr avg fatalities (other)	Rate per Billion ton-miles	4-yr avg total fatalities	Rate per Billion ton-miles
Highway	1,259,535	722	0.573227	4,758	3.777585	**5,480**	**4.351**
Railroad	1,554,130	28	0.018017	884	0.568807	**1,008**	**0.649**
Inland Towing	287,680	1	0.003476	7	0.024333	**8**	**0.028**

Figure 18 – Fatality statistics by mode – From: Texas Transportation Institute (2007)

Based on these numbers we can draw the conclusion that marine transport is by far the least risky mode. An additional dimension to these numbers which should not be overlooked is that in congested areas safety risks increase. As we observed in the section of this chapter discussing congestion, both the highways and the railroads in the Great Lakes area account for a significant share of congestion issues measured nationwide. It could thus be that by utilizing more waterborne facilities in the region the accident rates are reduced exponentially. The main problem is however that although people agree on each life being invaluable, shippers are likely to accept higher safety risks if it allows them to profit from economies of scale, especially given the relatively low chance of actually being involved in an accident.

5.4.2 Other safety risks

An analysis of safety risks in current times in which the threat of terrorist attacks is still present, should not be limited to statistics of accidents in recent years. Namely, should a port be under attack of terrorists this could have considerable effects on people's lives and health on a large scale. Moreover, measures to prevent such an attack can be costly.

In the airline as well as in the shipping industry, post-9/11 measures have improved safety of both people at the mainland, travelers, and goods, yet at the cost of many time-consuming procedures. Given today's characteristics of the Western world, in which stimulating trade and employment is of key importance to maintain current living standards and in which the threat of terrorist attacks is still present, authorities seek to balance economics and safety. In this respect, policy makers generally tend to agree on the importance of having a vital economy, however, as threats to population safety seem to differ per country, different safety measures are taken.

5.4.2.1 Policies enhancing safety often affect transportation

Following the terrorist attacks in 2001 the U.S. has been very active developing stricter policies for the passage of goods and people across its borders. Measures taken that are affecting the airline industry have been obvious for those flying to the American mainland upon entering a plane; whereas in earlier days a scan for metals would do, nowadays passengers are required to take off their shoes and get their bodies scanned. For (carry-on) baggage, cargo technologies have been developed that allow for thorough scanning of the items destined for the U.S.

For the enhancement of safety provisions in maritime transport, former U.S. President Greorge W. Bush signed the 'H.R. 1 Implementing Recommendations of the 9/11 Commission Act of 2007' which stated that by 2012 every single container that would enter the United States would have to be scanned at the port of origin. Currently, EU member countries account for safety in the industry by scanning containers on the basis of random sampling. Should the proposed measure be implemented this would result in significant costs for U.S. trading partners given the time and labor intensive characteristics of a 100 percent container scanning system. EU policy makers as well as economists in the U.S. have therefore strongly argued against the regulation to take effect, stating that the negative impacts on trade patterns would outweigh the safety enhancements. Other arguments mentioned by opponents are that today's scanning technologies are insufficient to meet the targets and that 100% scanning would lead to a false sense of security which could actually increase risks.

5.4.2.2 Infeasibility 100 percent container scanning

Taking the above mentioned into account the U.S. Department of Homeland Security decided to drop its plans to install the measure on the grounds of it not being feasible. An approach of layering risks and appropriate methods is now preferred, where intelligence is shared better between countries' investigation bureaus and cross-country cooperation is promoted (Homeland Security NewsWire, 2011). In this respect, the U.S. is currently trying to convince trading partners to join forces in the development of a global standard for maritime security policies. Should these efforts be successful, then it is probable that synergies emerge and that security related costs can be lowered, leading to lower costs associated with the transportation of imports and exports. The GLSLS system would profit most if the U.S. would start with aligning such standards with Canada in order to facilitate multiple loads and discharges in both nations'.

5.5 Conclusion

5.5.1 Fuel efficiency opportunity

With respect to opportunities in terms of fuel efficiency we can state that maritime shipping offers the most efficient means of transportation in terms of fuel consumption on significantly large distances. In discussing fuel efficiency however, one cannot ignore the fact that for different modes, different types of fuel are used. Crude oil prices are similar for every mode, yet differences may arise in the materials added to the oil and in the processing to obtain a substance that is suited for a specific mode. In recent years, we have seen that price for the fuels IFO380 and MDO have increased against with higher percentages than the price for crude oil. Therefore, for the maritime industry the benefits from its fuel efficient characteristic may be partially offset by the fact that its fuel prices rise more substantially than for competing modes. In turn, the advantage of the shipping industry in this respect is that ships generally transport cargo that is less time critical than for rail and truck services, which allows for slow steaming practices and lower fuel consumption patterns.

5.5.2 Congestion reduction opportunity

Congestion issues are considerable already on some of the highways and railroads in the Great Lakes region and are expected to increase in the upcoming decades, causing local economies to be affected by significant costs from travel delays. To respond to these developments U.S. railroads serving the Midwest from the East Coast have been ramping up capacity in recent years and continue to invest in facilities that can better serve the demand for transport. For the railroads in the Chicago area it holds that the infrastructure is outdated leading to congestion both on the rails and additional volumes on the roads. Meanwhile, developments in the trucking industry are such that authorities raise taxes on diesel fuels to combat congestion. The port of Halifax as a central point for transshipment activities, with plenty spare capacity and large depths to accommodate larger vessels, is identified as a possible alternative to current routings; a development that could be catalyzed following the Panama Canal expansion in 2014.

5.5.3 Environmental footprint reduction opportunity

In terms of whether or not diverting containerized cargo from rail to ship in the Great Lakes region would be beneficial for the environment, no strong conclusions can be drawn from the analysis above. It would take a case-specific research incorporating numerous aspects ranging from the vessel deployed to the characteristics of the ecosystems potentially affected by a specific route to shed more light on this topic. What can be stated with more certainty is that air pollution externalities are reduced if containers are diverted from truck to ship. A thorough research that attempts to quantify the costs associated with these externalities is wishful, yet it can be assumed that negative effects of air pollution such as health care provision costs and loss of productivity of people and crops are likely to decrease.

5.5.4 Safety opportunity

Lastly, because of the threat of terrorist attacks in ports and the impact such attacks could have on society, it is difficult to estimate if intensified use of the marine mode would provide benefits in terms of lower costs associated with safety risks. It is costly to prevent terrorist attacks and the U.S. does not intend to lower its security standards. Surely, operational safety risks are much higher in the

trucking industry than for its marine mode alternative. Moreover, accidents occurring on the road are much more often fatal than accidents observed for other modes.

6 Key Physical and Regulatory GLSLS Barriers

With U.S. ports on the Great Lakes located geographically closest of all American ports to ports in Northwest-Europe, one can wonder why container services on the GLSLS system have not developed to the extent that the potential benefits as described in chapter 5 are reaped. It can be argued that the size of the locks through which vessels have to transit to access U.S. Great Lakes ports limit the economies of scale advantage of maritime shipping over other modes in the region. However, as found by Verboon (2012), a service would be feasible from an economic point of view provided that cargo volumes are of sufficient size. It is therefore crucial to have a closer look at other barriers that may prevent potential service providers from taking successful initiatives. Whether or not these barriers can be (partially) removed is likely to determine if in the future the opportunities of the GLSLS can be exploited.

Study of academic literature and expert interviews has led to the identification of these key barriers which are of a physical as well as of a regulatory nature. An analysis and potential scope for relief for each of the barriers are described in this chapter. Note that other than the physical and regulatory barriers identified in this chapter a key system barrier is found in the perception of the Great Lakes and its maritime sector. The extent to which perception plays a role in the attractiveness of the GLSLS system and suggestions as to how these issues can be tackled are integrated in chapter 8 of this report.

6.1 Seasonality Aspect of the GLSLS System

For shippers, notably those operative in the automotive industry, it is of the utmost importance to have reliable year-round transport services available. In-time supplies for their production facilities are necessary to keep up with the output levels businesses produce at. With that in mind, the GLSLS system finds a considerable disadvantage in the fact that during the winter months the system needs to close because of ice formation and maintenance activities. Ocean-going vessels can generally navigate through the system from March 25 through December 26. To be able to accommodate more shipments, Canadian and American authorities keep striving to extend the duration of the system being navigable. In recent years, these efforts have been successful such that time of closure is shortened and more cargo can enter the system.

6.1.1 Does winter closure freeze container shipping year-round?

Some argue however that the GLSLS system will never be as competitive as other modes in the region and that year-round navigation is required for the system to develop to its full potential. As operators of competing modes significantly increase their tariffs for shippers that want to utilize their services only during the winter months when shipping is not an option, this seems a very valid argument. Despite a higher reliability of shipping as opposed to rail services, U.S. Midwest shippers often opt for the latter based on economic motives. Namely, the benefits in terms of reliability and lower transport costs stemming from shipping cargo through the system during the navigable season do not seem to outweigh the losses in terms of higher out-of-season rates for other modes and switching costs – costs involved with diverting cargo between modes. Whether these losses are actually higher in terms of economic value should best be looked at on the individual business' level, yet it is known that perception-wise shippers often have resentment against using different modes at different times of the year. Some argue that the benefits can only outweigh the losses if out-of-season rates for other modes decrease significantly. Rail services meanwhile are not likely to lower these rates as long as it does not increase overall profitability. One could therefore argue that it would take a shipper or shipping line of considerable size, probably with large contracts already in place for other routes with the same rail services company, to have some bargaining power in an attempt to lower transport costs during winter.

In its start-up phase, one of the aims of this research was to determine the economic feasibility of providing a year-round shipping season. Soon however, it became apparent that, despite the fact that icebreaking technologies available today might allow for further season extension, maintenance activities in the locks of both the Montreal/Ontario section and the Welland Canal are too intensive to allow for navigation all year long. As far as season extension is concerned, the system's potential to attract more cargo should therefore be sought in limiting the amount of time required for maintenance. Some parties have argued that maintenance can be taken care of during the low shipping season in between arrivals of vessels at the locks. However, the U.S. Coast Guard and the Canadian St. Lawrence Seaway Management Corporation, monitoring most of the locks, state that the closure of the locks for a period of at least two to two and a half months is necessary for the locks to be maintained to a sufficient extent. In a best-case scenario, the season could thus be extended by approximately one month. Though this seems a significant increase, one should note that maintenance costs increase alongside season extension due to the fact that overtime working hours are needed to realize a considerable season extension. The additional costs involved with

overtime wages should be evaluated against the fact that winter season is a low shipping season, and thus return on investments accounting for additional canal transits may be negative.

6.1.2 Season extension efforts

It has been reported that in the past there has been at least one experiment with significant season extension, yet this did not result in an increase of Seaway passages and was therefore discontinued. Focus has since been on gradually increasing the number of days that the system is navigable. In this respect it should be noted however that there are shippers that have stated they would make use of the opportunity to ship their cargoes into the system during the extended days of the season, provided that season extension is announced in time. Shippers plan their operations and schedule their shipments several months ahead. Obviously, this does not exclusively hold for oceangoing vessels entering the GLSLS System that are employed during the shipping season; similarly to their contracts with shipping lines, shippers sign agreements with alternative route operators for their out-of-season shipments several months ahead in order to assure that their supplies reach U.S. destinations in time. Were a season extension to be announced by the authorities before shippers start planning for their shipments, then this should allow for more activity in the system even in the low shipping season. In this respect, industry experts support the argument that it is feasible to make such announcements in time given the fact that maintenance operations can be planned for at least a year up front.

6.1.3 Maximizing the season's potential

Subsequently, with sufficient icebreaking technologies in place while maintenance activities can be planned ahead, this should allow for the authorities to guarantee specific dates at which the system closes and opens. That way, shippers could count on the system serving their needs at specific times of the year, which in turn reduces the risk of having to reroute their cargo against higher costs. In this respect, the right balance should be sought by authorities between reducing the risk of extensive icebreaking activities needed by closing the system in accordance with seasonal weather patterns on one hand, and optimizing season extension on the other hand. The risk that such extensive icebreaking activities are needed to live up to the season duration guarantees obviously requires financial resources that can be used in time of need. If profitable in terms of additional cargo volumes moving through the system, more economic activity in local markets, and lower emissions; policy makers should seek to agree on cost-sharing formulas that allow for guaranteed season extension in the system.

6.1.4 Interests for winter closure

Next to the fact that it is to be awaited whether season extension would be profitable from an economic point of view, other factors that may limit the scope should be taken into account as well. Given their colonial past the U.S. and Canada both have rather strict policies that aim to respect the wishes of Native Americans. In the Great Lakes region, Native Americans rely on the lakes' natural resources to meet their subsistence, economic, cultural, medicinal, and spiritual needs (Great Lakes Regional Collaboration, 2005). These communities firmly hold on to their traditions; in times of winter these take the form of activities such as ice fishing and using the ice to ease transportation of goods across channels.

Other than Native American communities, environmentalist groups have often opposed season extension. These groups argue that when ships force their way through ice this may result in shoreline damages. Also, of concern in earlier times was that ships breaking through the ice in the Soo Canal – which led to year-round navigation in that part of the system – might have negative effects on water levels in Lake Superior, however the U.S. Army Corps of Engineers never found evidence for this phenomenon (Gale, 2007).

6.1.5 European perception

More relevant for this research, is the extent to which the seasonality aspect of the system is wrongly perceived by European shippers. A regularly heard argument is that the GLSLS system needs to market itself better on the other side of the Atlantic in terms of making shippers aware of the fact that shipping is restricted in less than three months a year. Obviously, many European shippers are well aware of the actual season duration, but it has been reported that there are European shippers which have the perception of the system being closed for 5-6 months a year, raising the burdens to use the system extensively. If this were the case than cargo destined for the U.S. Midwest would need to be diverted to other modes for a much longer period of time and not only in lower shipping months. The extent to which other modes play a role and how to change perception is discussed in the following paragraph and chapter 8 respectively.

6.1.6 Switching costs

6.1.6.1 Switching cost theory

Current market structures in the Great Lakes area are such that no container shipping takes place on the lakes; all containerized imports and exports into and from the Midwest are transported by rail and truck services. The theory of switching costs shows us that – besides the fact that reliability and cost efficiency are important factors – to provide a profitable alternative for shippers, new services on the lakes will in the initial stage have to be substantially cheaper than service providers of other modes. Switching costs can be identified as the costs associated with switching supplier – or in our case transport service provider – and can be attributed to a wide variety of factors. In some cases the height of these costs is rather evident, for instance for equipment costs or exit fees; the payments needed to terminate the contract with the initial supplier (Thompson and Cats-Baril, 2002). Other costs, e.g. those associated with learning the procedures of the new supplier are more difficult to estimate. Besides learning costs, in the much cited study 'The competitiveness of markets with switching costs' Paul Kempeler (1987) defines two main categories of switching costs; transaction costs and artificial switching costs. The latter category refers to costs effectively incurred by initial suppliers to create a disincentive to switch. A clear example is the frequent flyer programs of airlines who wish to keep customers in other ways than by competition based on service and ticket price; once a potential customer is part of the client base of the supplier, the customer will have to consider taking a certain loss if he wishes to switch suppliers. Though not as artificial, the following analysis shows how in the Great Lakes transportation system similar costs play a role.

6.1.6.2 Switching cost barriers for the Great Lakes maritime industry

Despite the fact that switching costs are generally associated with the expenses involved with a switch between providers at a single moment in time; because of the seasonal characteristic of any potential waterborne service in the system, switching costs may create a significant barrier for the Great Lakes maritime transportation system also in the long term. In our case, switching costs between modes in the Great Lakes area can be identified as the cost difference needed between waterborne services and non-waterborne non-seasonal services to incentivize shippers to use ships instead of competing modes. Such necessary cost difference serves to cover for any learning, transaction, or inconvenience costs that occur when a switch to a different mode takes place. A survey conducted by TEMS Inc./RAND Corporation (2007) among shippers who could potentially divert to waterborne services found that in the Great Lakes area the required cost difference varies between identified categories of goods transported (TEMS Inc./RAND Corp., 2007). Whereas for raw materials only a 5% decrease in shipping costs for waterborne services is necessary for shippers to divert from rail to water; for food, semi-finished, and finished goods the discount should be 14%. The largest difference observed is for food transported in trucks; a 25% decrease would be required, likely due to the highly specialized nature of this category (e.g. refrigerated food requires fast delivery). In this report we focus on two types of goods which were by many interviewees identified as significant growth markets for the Great Lakes system; chemicals and automotive parts. We can conclude that with discounts of 5% and 14% respectively, shippers of these commodities may consider using waterborne services to suit their transportation needs during the months in which shipping on the Great Lakes can take place. These savings allow for shippers to cover their costs incurred upon switching back to other modes during the months in which shipping on the Great Lakes cannot take place because of maintenance activities and ice formation. It should be noted however that several interviewees have argued that rail service providers charge higher prices for shippers that only make use of their system during several months a year. This is likely due to the fact that these providers are aware of their competitive advantage with respect to the maritime system's seasonality aspect; they can charge higher prices without significant losses of market share, thereby raising the barrier to switch on a yearly occasion. Another plausible explanation is that to accommodate the extra volume during the winter, the providers have to maintain a certain level of capacity throughout the year while only during the winter months the revenues are collected. In the economic analysis we draw up three different scenarios by which we can estimate to what extent surcharges for rail services in the winter months impact the feasibility of a container shipping service in the 9 months of operation; price increases for rail services between specific Great Lakes ports and Midwest destinations of 10%, 15%, and 20% respectively are assumed (Verboon 2012).

6.2 U.S. Harbour Maintenance Tax

6.2.1 Introduction

When assessing the feasibility of shipping freight with European origin on the Great Lakes one cannot ignore the burdens imposed by U.S. federal regulations. For direct routes for container transport from Rotterdam to any port on the Great Lakes as well as for potential routes that would involve transshipment in a Canadian port followed by a feeder service to U.S. Great Lakes ports, even if we ignore any economies-of-scale effects and transshipment costs of the latter option, U.S. tax regulations discourage the use of the country's own maritime transportation network. In particular, the Harbor Maintenance Tax (HMT), a tax of 0.125 percent charged on the value of any imported cargo arriving in any U.S. port, raises the barriers for shippers to use waterborne transport instead of other modalities. Moreover, aside from the tax being an obstacle from a cost wise perspective, interviewees have argued that the mental aspect should not be underestimated either. Namely, it has proven a tough case to convince shippers that transporting freight with destination U.S. Midwest by ship into a U.S. port can be more attractive than any other option as long as ships can be offloaded in Montreal after which cargoes cross the border by train or truck with no taxes charged. Given the fact that in containers generally high-value cargoes are transported combined with the ad valorem structure of the HMT, this research requires special attention for the issues surrounding the HMT; the use of the funds the tax brings forth, its validity, its effects on shipping on the Great Lakes, and recent developments.

6.2.2 HMT in a historical perspective

As part of the Water Development Resources Act the enactment of the Harbor Maintenance Tax in its original form dates back to the year 1986, when U.S. Congress installed a user fee for deep draft coastal ports and harbors. The intention was that the HMT would cover 40% of the costs of port maintenance activities, which concerns primarily dredging. Until then, general funds from the U.S. Treasury were needed to cover the part of these maintenance costs the federal government accounted for (Skalberg, 2007). The Harbor Maintenance Tax at its current rate of 0.125 percent was enacted in 1990 with the intent that it would cover all the costs involved with maintenance dredging. The tax was created on an ad valorem basis in order to minimize its impact on exports, yet its validity on exports was challenged in 1998 by the United States Shoe Corporation – arguing that as a tax rather than a user fee the HMT violated the Export Clause – and was ruled unconstitutional by the U.S. Supreme Court subsequently (Stewart et al., 2003). Because of the higher percentage used as of 1990, this ruling did not have severe impacts on the revenues the tax brought forth; by 2001 HMT income exceeded the levels from prior to 1998 (Kumar, 2002).

In its current form the HMT puts certain parties at an advantage over others, leading to its controversy. Shippers of high-value, low volume goods for instance prefer a tax or user fee based on tonnages instead of on the value of the goods transported. Similarly, shippers that transport high-volume, low value goods prefer the tax in its current form. As such, the Harbor Maintenance Tax could be the main reason why currently no containers are imported through the GLSLS system given the cost-effective alternative of discharging at Canadian ports, whereas for importing bulk commodities the system proves efficient. In the next section we will have a closer look at this hypothesis.

6.2.3 Harbor Maintenance Trust Fund use

Next to arguments against its legal validity, an often mentioned issue surrounding the U.S. Harbor Maintenance Tax involves the fact that much of the funds the tax brings forth end up covering federal deficits. Meanwhile the country's maritime infrastructure needs more investments to function optimally. The funds U.S. importers pay as Harbor Maintenance Tax are on a federal level collected and monitored in the Harbor Maintenance Tax Trust Fund. This trust fund was brought to life in order to finance harbor operations and maintenance activities carried out by the U.S. Army Corps of Engineers. These activities encompass the dredging of federal channels, disposal of dredged material, and maintenance of breakwater. Also, the Trust Fund is used to balance for costs from federal navigation operations and maintenance activities. Other than the U.S. Army Corps of Engineers receiving funds from the budget, the St. Lawrence Seaway Development Corporation can cover operations and maintenance expenses related to the seaway and the U.S. Customs and Border Protection is refunded its expenses involved with the administrative procedures of collecting the tax.

Because of increasing volumes the fund has during the last decade received significantly more revenues than what is yearly spent for the maintenance of the harbors, even after the U.S. Supreme Court ruled in 1998 that the tax could no longer by levied on exporters but on importers and domestic shippers only. In recent years the tax has generated over $1 billion on a yearly basis while maintenance expenses have remained the same. As such, over the course of more than a decade the tax revenues accumulated in the trust fund had led to a surplus of the fund of over 6.5 billion dollar by October 2011 (U.S. Department of Treasury, 2011). As maintenance dredging costs account for about 80% of operations and maintenance costs – which ranges from $525 million to $700 million per year – the surplus looks to be sufficient to cover expenses for the upcoming years were it not that the budget has factually been spent on general government activities already because the fund is not registered as a separate account within the federal budget.

6.2.3.1 Plenty of funds, insufficient dredging

Besides the fact that the shipping industry feels that it is put at a disadvantage as opposed to other modalities in general because it accounts for substantially more tax revenues than it needs investments, perhaps the most striking aspect is that although the Trust Fund produces a yearly surplus, many ports do not qualify for the maintenance dredging operations they need to continue their operations due to the fact that dredging activities are assigned to ports with a minimum amount of throughput only (1,000,000 tons yearly according to one of the interviewees). As a matter of fact, the ratio of ports that are not (fully) dredged to their authorized depths and widths at the 59 highest use U.S. harbors was by 2010 as high as 2 of every 3 that are operative (Fritelli, 2012). Not maintaining channels to a sufficient extent not only goes hand in hand with safety issues as collisions become more probable, from an economic point of view it is highly inefficient as well. Namely, to avoid groundings or collisions in insufficiently dredged channels ships carry less cargo such that their drafts are reduced. Even for Seaway-sized ocean going vessels, which are generally smaller than their counterparts that sail to ports on the U.S. East Coast, draft limits are of significant importance; for every inch that is added to the draft limit bulk ships can, on average, carry 100 tons more. To put the above mentioned into perspective; the Great Lakes Maritime Task Force reports that at Lake Superior the loss of cargo on each trip due to insufficient dredging in channels and ports amounted up to 8,000 tons by the end of 2006 (Great Lakes Commission, 2006). Though not particularly relevant for

the GLSLS system it should be noted that dredging needs tend to differ between container ships and bulk carriers. Bulk carriers generally ship between a single origin and destination port and as such have more flexibility; operators can more often than those transporting containers allow for waiting time to pass until water levels at the coasts are high because of the tides of the oceans. Container ships on the contrary generally discharge their cargo at different ports on each trip, which alters draft requirements they need to sail between destination ports. One aspect that should not be overlooked in this respect is that with more stops on a trip, the risk of decreased schedule integrity occurs; reliability of the time of delivery may fluctuate more than with single stop trips.

6.2.3.2 Inefficiencies explained

The negative effects of such inefficiency are evident. If the carrying capacity of a vessel is not utilized to its full extent, ship operators are inclined to charge higher prices than they would if ships were used optimally. Obviously this affects the end price that consumers on both sides of the Atlantic pay for their products, thereby reducing purchasing power and the economies' growth capacities. From a more practical perspective; due to vessel under-utilization shippers more than occasionally are not able to send or receive the cargo they need resulting in a distortion of the supply and demand equilibrium in the market for transportation. If importers' needs for cargo supplies cannot be met by the local transportation market in terms of accounting for the input required for business productivity levels, businesses will have to either cut down on their production or ship their supplies through other routes against higher prices. Taking the latter case in mind we can conclude that insufficient dredging leads to cost increases in a wider context; throughout the supply chain prices will be higher and thus limit the end products' competitiveness on a global scale, thereby limiting trade and the scope for economic growth. Moreover, in case prices become so high that the end product is no longer competitive at all, companies will run out of business leading them to lower their production levels – with higher unemployment as a result – or simply to go bankrupt if cutting down production brings along too many inefficiencies.

Other than negative impacts from an economic point of view one can argue that the environment suffers from dredging inefficiencies as well. Analysis of these effects is twofold; vessels operating under their carrying capacity have a relatively high ratio of emissions per ton/container and cargo is diverted to other routes where more extensive use of environmentally less efficient transport modes may be prevalent.

6.2.3.3 Unfair competition

Critics of the Harbor Maintenance Tax in the Great Lakes region have argued that the system is particularly put at a disadvantage in terms of receiving funds for dredging since the economic significance of shipping is calculated on the basis of throughput levels for individual ports. It is a fact that shipping activities in the Great Lakes region are rather diverged when compared to the coastal waters; Great Lakes ports therefore do not always qualify for funds for dredging although the system as a whole significantly contributes to the American economy. A recent study conducted by Martin Associates (reference) shows that the system supports over 225,000 jobs in the region (note: Canada included). Meanwhile, the funds that are assigned to the St. Lawrence Seaway Development Corporation to cover seaway maintenance expenses play a minor part in the overall budget spent annually; about $15 million to $20 million is assigned.

More controversy can be witnessed based on the argument that the division of the funds between ports is unfair. U.S. ports do not have much of an incentive to stand up for each others' interests since domestic shipping volumes between U.S. ports along U.S. coasts equal only 20% of the volumes ports handle from international trade. As such, the ports that account for large contributions to the fund without needing much maintenance particularly feel that they are put at a disadvantage. The port of Los Angeles for instance, being the nation's top generator of revenue, is assigned less than a penny for every dollar contributed (Fritelli, 2012). Meanwhile, other ports such as Oregon Inlet (North Carolina) require extensive amounts of funding while they do not contribute a single penny. Over the past decade Oregon Inlet received over $60 million to keep its channels navigable, yet is only used by commercial fisherman, charter boat operators and recreational craft.

6.2.3.4 The particular disadvantage of the GLSLS maritime shipping industry

With the HMT in its current form, the U.S. maritime industry feels it is put at a disadvantage compared to other modes. For the GLSLS system this is particularly relevant. Namely, (container) vessels with an origin port in Europe can discharge their cargo in the port of Montreal (Canada), after which relatively cheap rail services allow for efficient transport across the American border into the U.S. Midwest. Rail service providers as well as trucking companies do not pay a tax that is similar to the Harbor Maintenance Tax. Although estimates tend to differ between different reports, it is stated that for each 40-foot container the Harbor Maintenance Tax puts the maritime industry at a disadvantage that ranges from $84 to $137 (Gooley, 2012). This amount is based on the average value of containerized goods that are imported into the U.S. If we then take into account that containers loaded with goods traded in the automotive sector on average have a higher value, we can conclude that the GLSLS system is put a disadvantage even more and that it does not seem to operate on a level playing field. Ports in the Great Lakes basin have been attempting to call for attention of their dredging needs, stating that the funds assigned are less than half of the money needed to restore the system to the authorized widths and depths; $90 million per year is spent whereas $200 million is said to be required. When looking at the HMT revenues-dredging costs ratio however, Great Lakes ports have in recent years received more funds than they contributed to the budget. Expenditures in the region accounted for 14% of the total funds withdrawn while HMT income was limited to less than 10% of the funds raised. The question that should therefore be raised is to what extent the GLSLS system would be able to profit from additional in-bound cargo if the tax were to be abolished, and whether those profits would allow for the system to cover its own dredging expenses. We can thus conclude that although stakeholders in the Great Lakes maritime industry may feel disadvantaged when compared to competing modes, overall the ports in the system receive more funds for dredging then they contribute to the tax revenues. Therefore, if the alternative to the HMT would be a user fee for individual ports, ports in the GLSLS system would overall be worse off. The potential of a container service however is not determined by the overall costs in the system but rather on the height of potential user fees of individual ports suitable to accommodate such service relative to HMT payments. In this respect, after an analysis of different ports in the system Verboon (2012) identifies the ports of Toledo and Cleveland to have the most potential. Of both ports, the port of Cleveland holds the most potential when comparing dredging requirements. Although the Cuyahoga River needs significant dredging, the port of Cleveland can be accessed by vessels practically without the need to dispose material; about 11,000 cubic yards every 9-10 years (Cleveland-Cuyahoga County Port Authority, 2011). The port of Toledo on the other hand deals with high maintenance requirements, given the fact that it is located at the point where the

Maumee River enters Lake Erie. Partly attributable to the high intensity of activity in the agricultural sector in its surroundings, sediment loads flow from the river into the port area. The outer port of Toledo requires the dredging of about 200,000 cubic yards of sediment annually and would likely be worse off if authorities would decide to install a user fee instead of the HMT. In response to these problems federal, state, and local authorities decided in 1992 to develop a strategy such that requirements would be reduced in future years and to put the dredged materials to more beneficial use. To date however, Toledo is still characterized by large dredging requirements and material disposal issues (Great Lakes Dredging Team, 2010).

6.2.3.5 Bi-nationality of the system leads in effect to double charges

Upon answering the question posed above, one needs to be aware of the bi-national characteristic of the system, a factor which could allow for the system to thrive in the sense that two different markets could be served by each inbound container shipment, but could be playing a rather negative role. Not only is the maritime industry affected by the unequal charges it has to pay in the form of the HMT, since many locks in the system are operated by Canadian authorities ship operators practically pay twice for using it. The Canadian system for maintenance of its waterways is much different from the U.S. practices leading to each vessel transiting the Seaway locks that fall under Canadian authority to pay a user fee. Operators are thus in fact charged twice on a single transit. The fact that after the enactment of the Harbor Maintenance Tax U.S. authorities decided to abandon user fees in those locks operated by U.S. authorities, does not imply that the system is user-friendly from a user charges point of view. Optimally, U.S. policy makers interested in promoting the utilization of the GLSLS system should seek to join forces with Canadian authorities to align the system's financing protocols for maintenance. This might sound easier than it is however, given the fact that the Canadian transportation industry, both its maritime sector embodied by its ports in Ontario and Quebec as well as its rail and trucking sectors, seem to profit from the tax imposed by the U.S.

6.2.3.6 Cargo diversion study

With that in mind, it is of keen interest for U.S. Midwest businesses and shippers to follow closely a study that is under construction. In the summer of 2011 several U.S. senators of Washington state requested the U.S. Federal Maritime Commission to investigate to what extent disparities are causing U.S.-bound cargo to be diverted to Canadian and Mexican ports on the West coast, given that in 2010 7% of U.S.-bound imports entering on the West Coast came through a Canadian port. The Harbor Maintenance Tax was thereby suggested to be significantly limiting cargo from Asian ports of origin to be shipped to American ports directly. The HMT as well as other factors are now under evaluation and, if proven significant, the Federal Maritime Commission is asked to come up with legislative and regulatory recommendations to restore balance (American Shipper, 2011). Although the study is still undertaken, some have argued that the best way to realize a level playing field for all transport modes on both sides of the border could be to impose a tax on rail and trucking services that is similar to the Harbor Maintenance Tax. These suggestions obviously encounter much resentment among Canadian authorities who state that it is the efficiency of the Canadian transportation network that might have led to diversion, if any is found at all. Should the Federal Maritime Commission find that indeed it is the Harbor Maintenance Tax that drives containers to Canadian ports, discussion on the effects of the tax and its future is likely to increase in U.S. Congress.

Proponents of the Harbor Maintenance Tax argue that the advantage of the system in its current form is that those ports that can most afford to pay, pay more than those who cannot. However, if cargo proves to be diverted to neighboring countries' ports which do not charge similar taxes, the concept is evidently put in a totally different perspective.

6.2.4 HMT Legal Validity

With the above mentioned in mind, critics of the HMT and its current structure have stated that a tax reform is preferable given its 'potential to increasingly support the most fuel-efficient means of moving bulk goods as water levels change because of, largely, fossil fuel consumption itself' (Skalberg and Skurla, 2006). As we have seen before, transportation by ship is more efficient in terms of fuel consumption than transportation by truck. The set-up of the HMT, its ad valorem basis, however, discourages shippers to use the more fuel-efficient mode of transportation. Obviously, this is not in line with the aim of today's leaders around the globe and in the U.S. to seek opportunities to develop economic activity in an environmentally sustainable manner. Yet of more significance is that, although not installed as such, the HMT in fact acts as an import barrier which is not in line with regulation on international trade.

The fact that the HMT is applied to imports but not to exports is in accordance with U.S. legislation, but from a practical perspective it does not hold much ground. After all, exporters require the ports and channels to be operated and maintained as much as importers do. For Europeans businesses, the current structure has an evident negative impact; European exporters face an additional burden to overcome as opposed to exporters in the U.S., thereby increasing the competitiveness of American goods. The European Commission acknowledged its position in this case and therefore filed a Request for Consultations against the U.S. in the WTO's Dispute Settlement Body in 1998. The request, following a previous dispute against the U.S. Harbor Maintenance Fees in 1992, stated that the HMT by constituting an effective import tax violated several articles of GATT – most prominently Article III, the national treatment clause – and was supported by Canada, Japan, and Norway. None of these cases were brought before a panel, which seems remarkable; user fees are an exemption to the national treatment clause, but by arguing that the HMT is not a valid user fee given its weak link with services provided, U.S. Shoe Corporation won its case and saw the burden on exports removed. At this time, the Clinton administration proposed a change of the HMT, yet the legislation necessary was never enacted. With discussion surrounding the HMT becoming more intense, some researchers argue that changes could now be executed by U.S. domestic litigation rather than by a WTO dispute settlement (Busch and Reinhardt, 2002). Others however, state that the EU could still ask for a dispute settlement panel in an attempt to lower transport costs for its exporters (McIntosh et al., 2009).

6.2.5 Possibilities to adapt the HMT structure to industry needs

Acknowledging that with the HMT structure in its current form the U.S. practices for financing its operations and maintenance activities differ intrinsically from practices observed in most other countries, McIntosh et al. (2009) researched what structures could be adopted to relieve the tax's burden in both the short and long run. Somewhat as a follow-up on a research conducted by Kumar (2002) – in which a system of user fees for American ports is suggested as a substitute for the HMT – McIntosh et al. (2009) look into the relationship between costs associated with tonnage handled, time spent in the port and vessel draft.

6.2.5.1 Rate reduction without any harm

McIntosh et al. (2009) state that with the current height of the account balance of the Harbor Maintenance Trust Fund, expenditures associated with dredging shallow drafts (i.e. drafts of 14 feet or less) can be financed from the interest the fund generates. This conclusion is based on the HMTF balance of 2005; approximately $3.3 billion. The interest in that year amounted up to $74.5 million whereas shallow draft expenditures equaled $72.9 million. The researchers argue that for this practice to be sustainable the HMTF balance must be stable around this amount to provide for sufficient funds from interest, provided that shallow draft expenditures do not increase significantly. As we have observed previously, dredging expenditures throughout the U.S. maritime sector have remained relatively stable; shallow drafts are in this sense no different. However, at the time of writing this report, the funds in the HMTF have almost doubled.

Given the trend of accumulating funds in the HMTF over the past decade, based on an econometrical analysis McIntosh et al. (2009) propose a reduction of the HMT rate from 0.125% to 0.09% as an additional measure. They state that this reduction of about 30% is likely to appeal to shippers, thereby improving the competitiveness of American ports. Meanwhile, not much opposition to the reduction can be expected given that exporters will remain to be exempted because the structure will remain in its current form; a reduced HMT would still be a tax rather than a user fee. It should be noted that the reduction that the researchers propose is based on trends in costs associated with dredging needs from recent years. Obviously, there is a variability which leads to a certain risk involved with projecting future costs, yet since the HMTF balance has exploded in recent years these risks could be accounted for by the funds that have accumulated, or perhaps even from additional gains from interest given the almost double figures of the balance of 2011 compared to 2005.

6.2.5.2 User fee alternative

The measures suggested above would be rather easy to implement and are therefore suitable to lower the barrier to put waterborne transport services to use to a larger extent in the short run. For the long run McIntosh et al. (2009) suggest that, to prevent the U.S. to isolate itself as the only nation to impose an ad valorem tax, a user fee should be considered. The HMT is not considered sustainable since there is no balance between the groups paying and those benefitting relatively most from the expenditures. Tonnage, port stay and vessel draft are the variables that could provide the basis upon which a model for fees is to be installed. Jointly these variables explain costs associated with dredging deep drafts for roughly 65%. The remaining 35% can be attributed to fixed costs, yet more data would be necessary to further diversify costs as to optimize the means to determine fees for each different vessel call at a specific port. Installing such a user fee would evidently lead to benefits and costs for different groups compared to the HMT. First of all, a user fee would raise the costs for exporters, thereby lowering the burden for importers. Additionally, given the current ad valorem structure of the HMT, shippers of high tonnage and low value goods would likely see their contributions to dredging expenditures increase, whereas shippers of lower tonnage, higher value goods would profit. The extent to which this would affect the potentials for economic growth has to be evaluated before a user fee is installed definitively, but changes to current financing practices seem inevitable; not only is there a lot of opposition to the HMT in domestic markets, its legal validity remains to be challenged by stakeholders in international markets.

6.2.6 Economic analysis of the HMT

In the economic analysis by Verboon (2012) the impact of the HMT on the potential of container shipping in the GLSLS system is measured based on the HMT payments required for goods of three different categories; chemicals, high valued goods, and automotive parts. Given the relevance of these markets in the Great Lakes areas as found in chapter 4, the outcomes shed more light on the extent to which the potential of a direct or feeder service for containers carrying automotive parts and chemicals in ISO-tanks is affected by HMT regulation. In this respect it should be noted that automotive parts are generally considered to be part of the high valued goods category. The reason for distinguishing both categories is that no source could be found for the average value of automotive parts transported in a container between the U.S. and Northwest-European countries. However, such value was found for automotive parts traded in the U.S.-Asia corridor which proved to be higher than the average value of high valued goods in the Trans-Atlantic corridor. It is assumed that the Trans-Atlantic corridor would exhibit similar values for automotive parts, which makes analysis of the HMT impact on this sector even more relevant.

6.3 Cabotage Regulation in North America

Regulating cabotage strictly to national vessels is a globally observed phenomenon. Throughout history nations have sought to protect the involvement of domestic workers and businesses in international trade as a means to stimulate economic development locally and to strengthen the position of the products they bring forth on global markets. As nations generally put their own interest as a priority over nations in proximity, it has proven to be a tough case to reduce the extent to which regulation affects cabotage practices. It often takes multi-lateral and bi-lateral trade negotiations in a broader sense that can include negotiations with respect to cabotage to stand a chance for success.

An example of such negotiations having a positive outcome on efforts to deregulate cabotage requirements in a multi-national setting is the European Union. Under EU law, shipowners registered in one country can carry out mainland cabotage, off-shore supply services and island cabotage in other EU countries under the provision that they comply with the conditions set by the home country.

6.3.1 The 1920 Jones Act – economical, political and safety motives

A research conducted by Transport Canada concluded that the EU took care of issues revolving cabotage in a manner that could serve as an example to a bi-national model in North America (Hackston et al., 2005). However, it is stated that in the short term it does not seem very likely that the U.S. is to engage in any negotiations surrounding changes to its Jones Act. Although new presidential elections will take place in the year of writing this report, the conclusions drawn are set to hold as long as the Obama administration is in office. Even under strong political pressure during the oil spill in the Gulf of Mexico in 2010, Obama refused to waive the so-called Merchant Marine Act, even on a temporary basis. Belgian, Dutch and Norwegian operators of the world's most advanced oil skimming ships offered to help the Americans clean up the oil, yet they were restricted from doing so as a result of the Act. Critics argue that Obama holds on to the Jones Act to please the labor unions operating in the U.S. maritime industry, which are said to have strong links with many of the Democrat party voters (Portnoy, 2010). These unions represent the workers whose jobs are to a certain extent protected by the Jones Act. Namely, the Jones Act prescribes that for all commercial activities in U.S. waters, "U.S.-flag vessels, constructed in the U.S., owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents" are required. The jobs that are thereby preserved are in itself the primal obstacle to reforming cabotage regulation in North America. It remains questionable however, whether a reform would lead to more losses in jobs due to a lack of protection than job creation as a result of higher efficiency in the market. In this respect, Stewart (n.d.) states that the Jones Act has put American-flag vessels at a competitive disadvantage in the global market place. U.S. shipbuilders produce relatively few large vessels because of the costs of capital, crews and taxation, and therefore less American vessels are engaging in e.g. cross-Atlantic transportation. The Jones Act could be referred to as a shield around the American marine and shipbuilding sectors to protect them from global competitors that can employ lower costs. Embodied by the Maritime Cabotage Task Force, several parties with a strong interest in maintaining the Jones Act in its current form (e.g. ship owners and operators, labour groups, marine equipment manufacturers) have joined forces and are lobbying not to reform the Act. Their main argument is that with the Jones Act in place, a U.S. fleet is created that supports the American military in times of

international conflict. In the age of terrorism, the U.S. cannot rely on foreign ships to support the military when needed, rather does the U.S. need American ships crewed by experienced crew members, so it is argued (Brooks, 2006).

6.3.2 Canada's Coasting Trade Act

In Canada cabotage regulation is directed by the 1992 Coasting Trade Act. The act states that non-Canadian ships are prohibited from coasting trade provided that Canadian vessels are available for the service needed. In case these vessels are not available, foreign ships are allowed to carry out the specific service. As such, marine commerce within Canadian borders is restricted to Canadian registered vessels that are owned, operated and crewed by Canadian companies and Canadian staff respectively. Flexibility in the system is further complicated by the fact that the vessels in business along Canadian coasts must have been built in Canada or, if built elsewhere, owners must have paid a 25% import duty on the vessel price to get it registered. Customs regulations in Canada have limited the flexibility of the system. Empty foreign containers could until recently be used for domestic loads only under strict conditions (Kosior et al., 2009). For example, foreign-owned containers were allowed to remain in Canada for only 30 days. If this deadline was not met, the containers had to be imported into Canada which involved the payment of several duties. Moreover, although for domestic shipments the use of foreign containers was allowed these containers were restricted to be shipped on a single trip only, where the port of exit had to be the port of arrival.

6.3.3 Recent efforts to synthesize North American cabotage regulation

When it comes to the use of foreign containers in domestic moves, the U.S. has less strict regulation as it allows these containers to remain in the nation for a year without any provisions with respect to trip directions. As such, the only requirement to be met is that the carrier is based in the United States. The odd aspect of this is that U.S. policy makers have decided that containers fall into the category of steel packaging, and are therefore subject to NAFTA regulations. On the contrary, Canadian regulations have been drawn up for foreign containers specifically; as a result the costs of transportation increase, system capacity is used inefficiently, and the formation of intermediaries is discouraged (Kosior et al., 2009). At the end of 2009, the Canadian government sought to close the gap between American and Canadian cabotage regulation by amending its standards. Since, containers in Canada can be used for multiple domestic loads provided that they leave the country within a year, similar to U.S. regulations. However, these rules do not include containers moved across the U.S.-Canada border twice on a single trip. Transloading European containers in e.g. the port of Montreal to ship them to the U.S. and back via a Canadian port (and vice versa) is still prohibited. Additionally, flexibility is still limited in the sense that containers must have an import or export load that is booked up front. Canadian regulation is as such only in part similar to U.S. practices and one cannot speak of a single North American container network.

One main difference that is still in existent between the U.S. Jones Act and the Canadian Coasting Trade Act is that the latter allows for owners to acquire foreign vessels and flag them as Canadian vessels provided that all applicable duties are paid and that the vessels meet the Canadian safety requirements.

6.3.4 The relevance of cabotage regulation for GLSLS system development

One could argue that for a feeder service on the Great Lakes the cabotage laws in the U.S. and Canada are not putting a large burden on operations as containers from Europe could be discharged in Canadian ports and subsequently transferred to another vessel to reach final destinations in the U.S. However, for a service as extensive as based on the European Short Sea Shipping Model, the options become limited. Namely, for single trip discharges and/or pick-ups at multiple ports within one of both nations the requirements do apply and thus is there no possibility for foreign ships to carry out these activities with ease. Should foreign vessels be allowed to engage in these activities than this would bring a number of opportunities to the system. Firstly, compared to vessels operated by American parties, foreign vessels tend to have relatively low costs of capital and crewing. With lower transportation costs economic activity in the importing/exporting region is stimulated, leading to more employment opportunities, more money in the pockets of civilians and more tax income for governments. With these funds spent on consumption goods and investments, a snowball effect can be expected benefiting importers and exporters existent in the trade corridor. Secondly, as maritime transport services in the GLSLS System become cheaper the competitiveness of shipping as opposed to using truck or rail services increases. As such, the system's opportunities as identified in chapter 6 (i.e. gains in terms of fuel consumption, emissions, congestion, and safety) can be explored to a larger extent. Evidently, these effects should be weight against the jobs that might be lost in the maritime industry directly as a result of fiercer competition for U.S. vessel operators. A research that quantifies these effects would be ideal to shed more light on whether or not the White House should hold on to the Jones Act and to what extent efforts should be undertaken to seek closer cooperation with Canadian authorities.

6.3.5 Obstacles to regulation reform

Perhaps the biggest obstacle in taking a step towards better market access for foreign vessels is that reform is not likely to be accepted by the public easily. Cabotage regulation has been in place in the North American market for centuries, dating back to the colonial days. A quantitative research on this topic and education in case the findings show significant potential benefits upon loosening regulation is thus a key for success.

With the above mentioned in mind, for the GLSLS System to develop services that better meet the needs of shippers, it seems logical that American and Canadian authorities will seek closer cooperation on the legislative aspect of maritime shipping in North America at some point. For a further analysis of this critical component we refer to chapter 8 of this report.

6.3.6 The European case as a benchmark

In this respect, the European Union might as well have paved the way to more efficient transportation for the North American trading block. In 1986 the European Commission adopted a number of laws known as the 'first maritime package of legislative measures' that allowed for a first step in liberalization of maritime transport services in the European Union. After the enactment services could be provided between EU member states and between member states and third countries (Greaves, 2011). Further deregulation took place in 1992 and included cabotage services, leading to the freedom to provide services along the coasts of individual member states. In 1999, cabotage was liberalized even more as the market was open for vessels sailing under the flags of

countries that in terms of taxation, social legislation and safety or environmental standards, are more attractive to shipowners than European Union member countries. Since, the European market for maritime transport services has been referred to as an open one characterized by rather strong competition. Access to cabotage among member states is no longer restricted with the aim to promote trade in services and to improve transportation efficiency. Opening the market to foreign competition is thought to have a positive effect on the EU economy as the supply of transportation services can better be matched with its demand. Namely, specific cargoes varying by size, weight, etcetera can require specific types of vessels to accommodate the transport demand optimally and thereby keeping transportation costs as low as possible. If a transportation system is open to a larger base of vessels e.g. by lowering its requirements for carrying out cabotage services, the system's flexibility increases and a larger variety of transportation needs can be met with more ease. Again, it should be noted that along with liberalizing the market came a significant decrease in EU employment in the maritime sector.

6.3.7 Theoretical perspectives on cabotage deregulation

Proponents of cabotage liberalization argue that the gains in terms of lower shipping costs outweigh these losses. The theory that backs up these arguments is in detail described by Kosior et al. (2009) and highlighted by Figure 19.

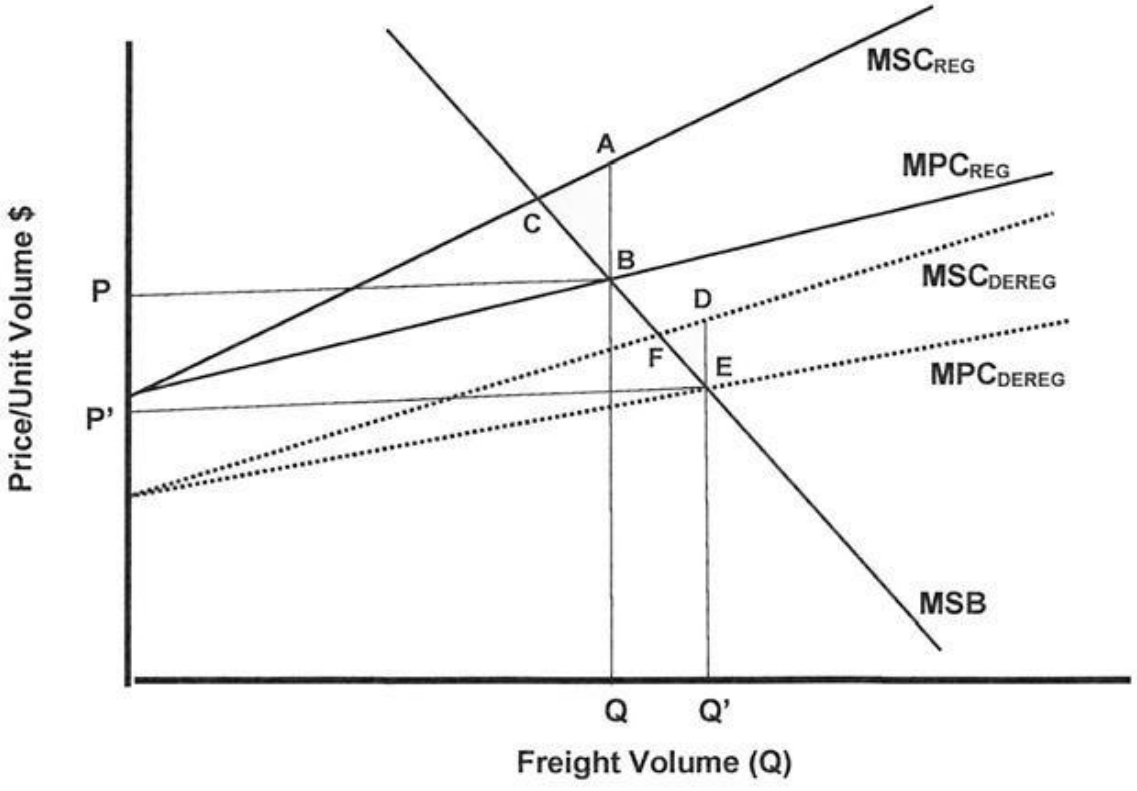

Figure 19 – Effect of cabotage liberalization – From: Kosior et al. (2009)

In this model, freight volume Q on the horizontal axis represents the total cargo volume in the system, thus including both upstream and downstream shipments. The price that is paid to ship each unit of Q is represented by P on the vertical axis. MSCreg and MPCreg show the marginal social costs and the marginal private costs respectively given a non-liberalized setting with respect to cabotage

regulation. Under the assumption that savings from liberalization are reflected in lower costs incurred for shippers (P is thus decreased to P', in turn leading to an increase in volume of Q'-Q), MPCdereg and MCDdereg represent marginal social costs and marginal private costs respectively after liberalization. The savings stemming from liberalization are twofold; efficiencies are created by better matching transport needs and supply of services, therefore less capacity in the system is consumed, and market competition leads to the reduction of prices set by carriers. Marginal social costs are reduced as emissions will be lower by a factor equal to the difference between ABC and DEF, and less private resources are necessary for operations. With lower costs in both a social and a private context shipping becomes more competitive compared to rail and truck facilities, and thus it can be expected that more containers will be transported through waterborne services. Moreover, it can be argued that additional volumes in terms of container transport will be created as the system's efficiency improves in terms of small volumes of bulk commodities being transported by containers.

The theoretic framework as described above shows that for both the U.S. and Canada gains to society in terms of lower emissions and to the private sector in terms of less capital requirements for operations would emerge should efforts be undertaken to liberalize cabotage, or at least get to an agreement for a North American cabotage standard. Given the fact that for the U.S. it is of major concern that safety is guaranteed in times of war, the latter option seems most realistic and would involve a discussion that would not be limited to the maritime sector only but would include authorities responsible for defense and intelligence matters. Not only seem the welfare gains, should such discussion have a successful outcome, evident for both countries from a broader perspective, for the economically struggling U.S. Midwest in particular amendments to cabotage regulation could spur economic activity. Moreover, with the Great Lakes-St. Lawrence Seaway System providing direct access to some of the largest markets in both countries, environmental benefits can be expected to be higher than average. Namely, if we look at for instance the Chicago area market, European origin goods and commodities are delivered over hundreds of miles by truck or rail from mainly East Coast ports and the port of Montreal. With lakefronts at the doorstep of the heaviliy congested rail network in Chicago and down the route in Ohio, efficiencies seem to be waiting to be exploited.

6.4 Pilotage in the GLSLS System

6.4.1 Introduction

To provide for safety upon transiting the Great Lakes, ocean-going vessels are required to aboard one or more certified pilots to guide them through the lake waters. These pilotage requirements are not only an obligation for vessels with a U.S. port as their destination, all foreign flagged vessels discharging at Canadian ports in the GLSLS system deal with the same situation. The costs involved with these pilotage activities are considerable because the system is wide stretched and thus a lot of pilot working hours need to be paid for on each transit. The argument of interviewed parties that the height of these costs contributes to limitations to the feasibility of container shipping in the GLSLS system is an incentive for this research to have a closer look at the regulation in place. Pilotage requirements and according rates thus seem to put a significant burden on the cost-competitiveness of shipping on the Great Lakes as opposed to competing modes. In an attempt to explore the context in which such regulation is enforced, it is important to first consider the nationwide pilotage standards in the U.S. Subsequently, we examine the regulatory frameworks by which pilotage in the Great Lakes area is enforced, including both an American and a Canadian perspective. In the economic analysis part of this research, Verboon (2012) then discusses the extent to which the costs for pilotage impede container shipping in the system, such that appropriate recommendations for policy-makers can be drawn up.

6.4.2 U.S. Pilotage regulation

Regulation of pilotage in the United States is in its structure rather different from international practices. Two jurisdictional layers can be identified at which regulation is governed; both on the state level and on the federal level authorities hold responsibilities.

Dating back to the first Congress of the United States, in 1789 a law was enacted that gave individual states the right to regulate pilotage in state waters. State authorities therefore monitor in what parts of their waters pilotage is required, and what license requirements need to be met by a candidate pilot to be allowed to execute pilotage activities. As a result, each state has a different pilotage regulatory system, yet many similarities between the systems can be found. Compared to the regulatory framework on state levels, the scope for federal regulation is rather limited; the U.S. Coast Guard only accounts for licensing and disciplinary enforcement. In this respect, each state pilot is required to hold a federal license; one that serves as a national minimum standard and that has lower qualification requirements (American Pilots Association, 2006). For navigation in state-specific waters, additional licenses are required. In practically all states pilots are regulated by a pilot commission which decides on pilot training issues, licenses, accidents, etc. These commissions limit the number of licenses they issue in accordance with the number of pilots their system requires in order to prevent competition in the pilotage marketplace. The reasoning behind not having competitive pilotage is that, structured as such, pilotage is assured to be conducted by pilots that are independent and can thus judge each case in which there is a potential threat to safety without having an interest to compete for business. Assigned the task of preserving the nation’s waters and direct environment, it is reasonable that safety is of foremost importance. Economists may argue that the non-competitive character of pilotage regulation leads to inefficiencies in the market for transportation. Should there be competition, costs involved with pilotage activities are likely to be lower, thereby putting the country’s waterways in a more competitive position. Also, it could be

argued that competition does not mean that safety is reduced. After all, a ship operator will not hire a pilot with a record of having caused a number of accidents despite a rapid transit on average through the system. It thus comes down to the question to what extent policy makers foresee that the likelihood of accidents increases if pilotage activities would be put in a more competitive setting, and the U.S. has opted to play safe.

To provide for sufficient funds needed to operate, rates for pilotage activities are regulated by a regulatory body within each state. In some states the previously mentioned pilot commission fulfills this role, in others it is a separate pilotage rate-making body, a public service commission, or a state legislature. Despite the fact that it is said that regulating rates in such manner guarantees that shippers pay a fair rate for the activities, to an economist the lack of concentration of e.g. administrative practices sounds rather inefficient. Due to the limited scope of this research, however, there is no need to have a closer look at these inefficiencies since for the Great Lakes a separate set of regulation is applicable.

6.4.3 Great Lakes pilotage

With the opening of the St. Lawrence Seaway in 1959 large vessels from the Atlantic ocean were provided access to the Great Lakes, resulting in significant increases in international shipping activities on the Great Lakes. Prior to those days the system had no pilotage requirements but members of Congress decided to impose regulation after acknowledging that accidents are more likely as shipping intensity increases.

Pilotage regulation in the Great Lakes area was arguably set up in a different way than was the case in the rest of the country. It was considered neither feasible nor legally possible for each state adjacent to Great Lakes waters to have its own regulatory system in place (Kirchner and Diamond, 2010). A federal approach was taken, resulting in the Great Lakes Pilotage Act of 1960. Originally, this act divided administration of the system between the U.S. Secretary of Commerce and the U.S. Coast Guard, yet after the establishment of the U.S. Department of Transportation pilotage responsibilities were transferred to the latter jurisdictional body. Ultimately, administration of Great Lakes pilotage activities was handed over to the U.S. Coast Guard, which still is the party that monitors the system and its (approximately) 35 U.S.-registered pilots today.

In today's GLSLS system pilotage activities are provided by five organizations which are responsible for different sections of the transit route. Firstly, there is the Laurentian Pilotage Authority, a Canadian authority operative in the St. Lawrence River and Gulf. Secondly, the Great Lakes Pilotage Authority employs pilotage activities in the Seaway and in the Canadian waters of the Great Lakes. The other three associations are U.S.-based; two of these are of interest to our study. Firstly, The St. Lawrence Seaway Pilotage Association accounts for pilotage activities in the binational waters of the St. Lawrence River and Lake Ontario. Secondly, the Lakes Pilots Association provides pilots in the binational waters of Lake Erie, the Detroit River, Lake St. Clair and the St. Clair River. Lastly, due to the focus of our research on U.S. ports along Lake Erie of less importance for our study, the Western Great Lakes Pilots Association is in charge of all areas of Lake Michigan and of the binational waters of Lake Superior, the St. Marys River, and Lake Huron. The areas of service for each of these service providers can be broken down into different sections, which is of importance for the quantitative counterpart of this research.

In order to show the potential of different container services in terms of pilotage cost savings, in the economic analysis of our research we assume that a feeder service would not be involved with pilotage charges in most waters given the fact that licensed American and Canadian captains are available to sail the feeder vessels. As far as a direct service is concerned, recent pilotage rates are used to determine pilotage costs for the entire route through the system.

6.4.4 Implementing Technology in Pilotage

Ship operators intend to minimize costs to be able to provide competitive services in the market for shipping. Pilotage fees can as we see in part 2 of this research impose significant barriers to the profitability of a shipping service. Ship operators are attracted to ports where pilotage fees are relatively low. Therefore, for the Great Lakes-St. Lawrence Seaway System, it seems plausible that cargo that could potentially go through the system is diverted to East Coast ports or, if it does get into the system, is dropped off in a port further downstream than would be the case without the fees, due to a lower level of competitiveness as a result of the pilotage requirements.

6.4.4.1 Continuous technological development

To reduce costs and to increase a transportation system's flexibility in recent years there has increasingly been attention for the employment of technological advances in maritime pilotage. With technology in the airline industry being capable of controlling air traffic entirely ground-based, an increasingly heard argument when discussing pilotage is that it should be possible for the navigation of vessels to be assisted by technology to similarly larger extents. Some even argue that, with technologies available today, having physical pilots on board of a vessel is abundant and rather consumes time and monetary resources than it is necessary to assure safety. There are however various issues that seem to limit the extent to which technology can be implemented in pilotage. Several studies have tried to shed more light on this topic.

Hadley (1999) mentions the inadequacies of radar, difficulties with language, lack of 'feel' for the ship, and a lack of ship motion data as the main obstacles to a full integration of advanced technologies in pilotage, such as Vessel Traffic Services and Vessel Traffic Management and Information Services. GPS-based systems nowadays have the technology to even dock some specialized vessels at a port automatically, yet shortcomings remain. With safety being of utmost importance, the question remains to what extent authorities are willing to take risks in order to cut costs. These risks are generally not life threatening yet if an accident is to emerge a port could be locked down for a long period of time with incredible losses as a result.

The fees paid for pilotage services generally include the supporting infrastructure of boats, boat maintenance offices, communications and associated staff. If this infrastructure can – in part – be replaced by new technologies, potentially large costs savings can emerge. These savings are then passed on to the customer which results in an increase of purchasing power indexes in local markets. It is critical however that such pilotage technology can serve any type of vessel that enters the system with a similar if not higher degree of safety and efficiency than is the case with physical pilots.

6.4.4.2 European pilotage practices

In Europe, two different forms of shore-based pilotage technologies are in use. For the port of Rotterdam it holds that specific ships can be guided into specific waters by communication services. This is however only the case if circumstances lead to a pilot not being able to board a vessel normally, and on the other end of the line remains a physical pilot located at a Vessel Traffic Services centre who talks to the captain in charge. The factors that jointly determine which vessels can use such service are by Hadley (1999) stated as follows:

1. The willingness of the Master
2. The willingness of the port authority
3. The willingness of the VTS-based pilot
4. Length of vessel
5. Draft of vessel
6. Tidal constraints

When these parameters indicate that a vessel can in fact make use of the service, this leads to a cost reduction of 25% in pilotage fees. The gains for shipowners and port authorities are thereby evident as they become more competitive, but also pilots are enthusiastic as boarding risks are decreased.

The second practice of shore-based pilotage, as deployed in the German Bight and the river Elbe, is similar to what we observe in Rotterdam in the sense that a vessel is guided through the waters with the assistance of telecommunications, yet a physical pilot also boards the vessel. The waterways where these techniques are common are characterized by fog and ice on a regular basis and thus is assistance to a large extent vital to guarantee safety. The system has proven its value as a reduction of 50% in accidents has been reported. In this case, removal of the physical pilot on board the vessel would likely cause the rate of accidents to increase significantly, and thus we can conclude that for specific waters, specific pilotage needs are in place. For the Great Lakes-St. Lawrence Seaway System this is not any different. Many of the parties interviewed for this research have stated that the pilotage requirements in the basin are merely an institution than strictly necessary for safety reasons. To some extent this statement was confirmed by a captain of a bulk carrier, who stated that at least after entering the system several times on should be able to navigate through most of the waters safely. In some waters however, pilotage will remain to be a prerequisite for safe navigation even for the most experienced captains of foreign vessels.

6.4.4.3 Technological assistance in the Great Lakes basin

In a study of marine transportation in Ontario, researchers found that Canadian ship owners are convinced that modern technologies combined with the knowledge, skill and experience of the ship crews should allow for exemption of pilotage in specific waters. In these waters qualified deck masters apply for exemptions, but it is argued that the skills needed to acquire qualifications are far beyond the practical needs, especially when modern technologies are implemented (The Mariport Group Ltd., 2006). Despite its current limitations however, pilotage authorities in the GLSLS system are exploring the opportunities of technological assistance in their daily routines. New integrated 'Portable Piloting Units' are ready to be implemented into the set of equipment which assists Great Lakes pilots with navigation (OceansAdvance, 2012). The product is the result of a close cooperation between Canadian pilots and the business producing the equipment called NavSim. In early stages of

the product's development, the business received extensive input and feedback from Great Lakes pilots who are known for their special expertise given the many difficult navigational challenges on the route. As a result, the decision-support tool could be optimized further such that pilots are provided with highly sensitive and accurate information to support their decision-making. The state-of-the-art navigation software allows pilots to steer through waters more precisely through its advanced 'rate of turn' information and has the ability to warn pilots in time for potential barriers to smooth navigation (NavSim Technology, 2012). As of the start of the 2012 shipping season, pilots representing the Great Lakes Pilotage Authority will be able to put the equipment to test and continued collaboration in the product's development process is expected to further expand the technology's potential.

6.5 Non-tariff Barriers to Trade in the North America-Northwest Europe Corridor

When analyzing the effects of regulatory barriers on trade opportunities between the U.S. Midwest and North West Europe, one cannot limit the scope of a research to those barriers existent in terms of transportation of goods and commodities. Therefore, other than the factors this research identified to be of key importance for optimal use of maritime transport in the Great Lakes-St. Lawrence Seaway system, there is a need to address regulatory barriers that limit trade in a more general sense. In doing so, one cannot ignore a report drawn up in 2009 by research and consultancy company Ecorys called 'Non-Tariff Measures in EU-US Trade and Investment'. This study measures on an industry specific level the effects that removal of non-tariff barriers would have on trade potentials. Non-tariff barriers are said to outweigh tariff barriers by far, given the fact that the U.S. and EU as trade zones have strong economic ties in which businesses are often interlinked to a large extent. Due to the limited scope of this research the focus will be on those non-tariff barriers that increase the costs of doing business and/or restrict market access for two key sectors; the automotive industry and the chemicals industry.

6.5.1 Economic effects of non-tariff barriers

Upon analyzing non-tariff barriers the study by Ecorys (2009)distinguishes between the concepts of 'cost', stemming from factors that increase the cost of operation for businesses, and 'rent', in which factors contributing to lower market access are analyzed. In terms of the distribution of welfare, these two concepts differ in the sense that higher operating costs result in higher end prices for consumers, which implies a welfare loss to society, whereas lower market access – leading to market concentration and economic power – results in higher end prices for consumers as well, yet part of these price increases flows to those businesses that hold strong positions in their industries, thereby redistributing welfare rather than reducing it. Higher consumer prices have an evident effect on the purchasing power of Americans and Europeans; the lower the prices are, the more products people can buy – leading to more capital for businesses to invest. With more investment, economic activity is stimulated which in turn leads to more employment opportunities. Decreases in market power on the other hand increases competition in the industries in which businesses are operative. With more competition, market concentration is lowered resulting in higher trade and investment levels while consumers pay lower prices. The potential welfare gain of abolishing economic rents is thus that consumers pay less for higher quality goods and more variety of the products they wish to purchase.

Evidently, different industries show sector-specific non-tariff barriers with differing effects. Differences in impact of lowering these barriers for the U.S. and the EU are apparent as well. These differences show that the key sectors as identified in this research have a relatively large potential for growth. First of all, it should be acknowledged that the impacts are dependent on the size of trade and investment flows between both trading zones. For those sectors where these flows are large, such as the automotive sector, a percentage decrease in costs or rents will be large in terms of financial transactions as well. Secondly, the study finds that there is significant potential for reductions of non-tariff barriers in those sectors in which the EU has comparative advantages. Both the automotive sector and the chemicals sector are identified as such. Alignment of regulation in these sectors is therefore estimated to be more profitable for businesses operative in the EU than for their American counterparts. Another aspect mentioned is that, because of the mixed nature of barriers in specific sectors, although both the U.S. and EU gain from lower costs of production, the

EU has larger growth potentials resulting from cheaper imports. It is concluded that, should all barriers be removed on an economy-wide scale, the EU could experience a GDP growth of 0.7% on an annual basis, whereas the U.S. could gain 0.3% of its GDP annually. In 2008 prices, these gains would amount up to over $200 billion a year in terms of trade and investment flows.

6.5.2 Sectoral feasibility of aligning regulation on both sides of the Atlantic

Obviously, in the short run it is not feasible for all barriers to be removed to their full extent in every single sector. We will therefore have a closer look at the automotive and chemicals sectors, while taking into account more realistic estimates of regulatory alignment in the short run as well as full alignment potentials for the long run. It should be kept in mind here, however, that different sectors can influence one another heavily. For example, as far as the automotive sector is concerned, it is found that large impacts could be on the waiting line if regulation is aligned in the financial and insurance services sector. Due to the limited scope of this research, we will therefore focus on the alignment effects for both sectors separately, with all other sectors ceteris paribus. As such, the effects will be much lower than what could be achieved in a situation in which barriers are removed in a wider context, yet the results prove significant.

6.5.2.1 Non-tariff barriers in the automotive sector

For the automotive sector, being one of the largest sectors in the U.S.-EU economic ties, it holds that with full removal of non-tariff barriers GDPs could increase by $15.6 billion and $2.1 billion for the EU and the U.S. respectively. In terms of output growth, the EU would be expected to achieve a 2.3% gain and the U.S. would experience a growth of 0.7% per year. The large difference between these potentials stems as previously mentioned from the comparative advantage the EU holds in this sector. However, it should be acknowledged that if the EU automotive sector were to profit from alignment, U.S. businesses companies would benefit as well. These benefits are twofold; not only do U.S. businesses that are affiliated with EU-based automotive companies get more money in their pockets, also, U.S. consumers would profit from lower prices for automotive parts and components imports built in the EU.

Whereas in terms of GDP growth and industry output the EU profits from its comparative advantage, the U.S. would see its exports from automotive trade and trade-related investment increase by a larger percentage than the EU; 5.3% against 4.3% per year. Note again, that these trade and investment flows cause a multiplier effect in related sectors such as machinery and transport services. With that in mind, the Great Lakes-St. Lawrence Seaway system could benefit significantly from efforts by policy makers to align regulation in this field, given its geographical proximity – or rather direct access – to the U.S. automotive industry (see chapter 7).

The main barriers identified in the automotive sector in the Ecorys study can be found in environmental standards. The differences can be partially explained by the differing needs of the local consumer markets in the U.S. and the EU. Fuel prices in Europe have been considerably higher than in the U.S. throughout history because of lower oil reserves – and thus a strong demand for oil imports – and relatively high taxes on oil-based fuels. Fuel efficiency has therefore been much more of an issue for the European car driver than for the average American. With that in mind and by looking at regulatory standards, it can be concluded that environmental awareness seems stronger in Europe than in the U.S., leading to different standards in, among others, the automotive industry.

Nowadays however, with Americans becoming more aware of the importance of thorough policies to preserve the environment, requirements in the automotive industry are becoming increasingly global.

Other than differences in environmental standards, non-tariff barriers of significance are the Buy American Act, technological R&D support, and security measures.

6.5.2.2 Non-tariff barriers in the chemicals sector

Strongly represented in the U.S. Midwest and with strong ties to the local automotive industry, the chemicals sector is a large contributor to the strong economic ties between the U.S. and the EU as well. The scope for benefits resulting from regulatory alignment in this sector is significant; the costs of non-tariff barriers on westbound trade flows in chemicals could be reduced by over 56%, eastbound there is a potential for cutting these costs of almost 63%.

In the chemicals sector, the main barriers according to the Ecorys study are in “regulation, evaluation and authorization of chemicals, classification and labeling of chemical products, notification procedures of new substances, marketing and application of chemicals, customs regulations, and legislation pertaining to transboundary movement of hazardous chemicals and pesticides”. In this field efforts have been undertaken as well by both the U.S. and the EU to strive for a global standard; the United Nations Global Harmonised Standards. Obstacles to overcome are predominantly emerging from differences in legislative requirements – the EU recently adopted its directives in the REACH (Registration, Evaluation and Authorisation of Chemicals) program whereas the U.S. standards are laid out in the TSCA (Toxic Substances Control Act).

6.6 Conclusion

A number of barriers have been found to limit the competitiveness of the GLSLS system, therefore it is likely that consumers pay in effect a premium for the products they acquire because transportation costs are higher than necessary.

6.6.1 Seasonality barrier

Firstly, the season by which shipping in the system is bound limits the attractiveness of waterborne services in the area for shippers that rely on continuous delivery of goods on a year-round basis. It was found that currently the season has a maximum duration of 9-10 months, while efforts are undertaken each year to extent the season. The ultimate goal for season extension is to reach a 10 month period on a consistent basis. Ice breaking technologies allow for the season to be extended as much as longed for, yet maintenance activities in the locks of the Montreal/Lake Ontario section and the Welland Canal reduce the feasibility for year-round services to zero per cent. Also, there are specific groups of stakeholders that strongly oppose a situation in which the system would not be closed during winter based on cultural and ecological arguments. It should be noted that during the winter months in which the system is inaccessible, a lot of shippers do not require as many deliveries as throughout the rest of the year; it is referred to as a low shipping season. The crucial disadvantage for the marine mode however is that those companies who do need deliveries year-round are inclined to switching to a different mode for 2-3 months a year if they were to use the marine mode throughout the rest of the year. Railroad operators are in this respect aware of their comparative advantage and increase prices for these users. As a result shippers are reluctant to foster the potentials of the marine mode. An additional barrier related to the seasonality aspect is that European shippers lack the awareness of the opportunities the system provides. It was found that some shippers are truly biased and think that the closure time of the system is much longer than is actually the case.

6.6.2 Harbor Maintenance Tax barrier

The Harbor Maintenance Tax was identified as a major regulatory barrier for Great Lakes container shipping, both from a cost efficiency and a mental perspective. In the current structure the HMT benefits shippers with high volume-low value goods given its ad-valorem basis. For shippers of low volume-high value goods the HMT discourages the use of the marine mode, and particularly the Great Lakes maritime sector given its proximity to tax-exempt border crossing alternatives.

More controversy is found in the way the funds the tax brings forth are used as the funds collected are significantly higher than what is spent. In this respect, some researchers have found that without much political and economical drawbacks, the rate of the HMT could be reduced by approximately 30% to 0.09% (down from its current 0.125%). Meanwhile, ports close due to insufficient dredging, the main maintenance activity for which the fund was brought to life. As a result, ships can sometimes not load to their maximum capacities with inefficiencies, both from an economical and an environmental point of view, as a result. Furthermore, the legal validity of the tax can be (and has been) challenged. The European Union has in the past for instance asked for a WTO dispute settlement, yet the case never made it to be looked at by a panel.

For the Great Lakes specifically the HMT in its current form can by some ports be considered advantageous, for others it is limiting their competitiveness. For instance, the port of Toledo needs significant dredging activities yearly, which makes it likely that the port would be worse off if a user fee would replace the HMT as the cost recovery practice. For the port of Cleveland, the oppositie is true. Overall, Great Lakes ports receive more funds for maintenance activities than they contribute to the Harbor Maintenance Trust Fund. It should be noted however that marine activity in the Great Lakes is spread out over a vast number of ports, while these ports jointly contribute significantly to local economies.

6.6.3 Cabotage barrier

In terms of cabotage regulation the Jones Act is perceived as a major obstacle to development of the marine mode in the Great Lakes. The act primarily serves as a safety measure when the nation is in time of war. Additionally, economical motives play a role as the act is said to preserve American jobs. The extent to which this is the case is questionable as theory shows that the gains from cabotage liberalization can outweigh the losses. A drawback for policy-makers to rely on these theories however may be that it takes a longer time for these gains to become visible as opposed to the transparency of rising unemployment levels. Immediate job creation and preservation remain key in times of economic downturn, especially with Presidential elections coming up in 2012. In these times in which unemployment levels keep rising the public is more than ever reluctant to cabotage liberalization.

Cabotage regulation has been liberalized to some extent in Europe which has led for the EU to have a rather openly constructed regulatory framework in this field. As a result, the European market is considered to be highly competitive, which in turn benefits European consumers. Moreover, with more foreign competition a better match can be made between the supply and demand for transportation services, thereby benefitting the EU economy as well. It should be noted that employment levels in the EU maritime sector subsequently went down, therefore decreased employment levels should be weighed against the gains mentioned above and rising employment levels in other sectors as a result.

6.6.4 Pilotage barrier

Pilotage costs can add a considerable cost burden to potential waterborne services in the Great Lakes. American and Canadian operated ships can apply for exemptions on major parts of the route, yet for some parts the qualifications needed significantly outweigh the practical needs. Because of safety considerations, it is highly unlikely that pilotage will in the future no longer be obligatory. For similar motives competition in the sector is avoided, yet rate-making procedures are regulated such that fair prices are charged.

Modern technologies are found to provide a potential relief in terms of pilotage costs at some point in the future. Already operators are using different systems that assist deck masters with their navigation practices and experiments with innovative system are carried out continuously. However, these systems have to be tested over and over again before one can truly rely on their use, given that the costs in case of an accident involving a vessel can be tremendous.

6.6.5 Non-tariff barriers

For two key markets the non-tariff barriers were analyzed for which both exhibited some remarkable potential to be reduced. For the automotive sector it holds that the incentives to work towards reduction of these barriers – primarily with respect to environmental standards – are higher for the EU than for the U.S. given the EU's comparative advantage. U.S. businesses and consumer are however likely to profit as well should the barriers be reduced. For the chemicals sector the main regulatory differences are found in legislative requirements with respect to specific types of chemicals. It is advised to look into these standards because there are very significant gains should the barriers be reduced.

7 Recent Container Transport Undertakings in the GLSLS System

The design of a proper framework that facilitates the exploitation of container shipping potentials on the GLSLS system can only be done successfully if lessons are learned from the past. Since the opening of the St. Lawrence Seaway many services have accommodated markets in the region, yet (partly) due to containerization and a continuing surge for economies of scale the development of the system was somewhat limited in recent decades. However, several initiatives were undertaken in recent years based on the idea that serving the niche market could be beneficial. It is of critical value to see what the experiences of these initiatives were in terms of cost efficiency and reliability, as well as what has limited the services from developing further.

7.1 Sea3

Initiated by the Hamilton Port Authority and operated by McKeil Marine, in the summer of 2009 a new container feeder service called 'Sea3' was launched between the ports of Montreal and Hamilton. The service provided a weekly routing with a vessel of a carrying capacity of 260 TEU; the Niagara Spirit. Benefits of the service mentioned upon it being launched were that it would lower overall transportation costs for multiple types of cargo, it would reduce the environmental footprint compared to other modes of transport, and social costs stemming from rail and truck congestion would be decreased due to a modal shift. Furthermore, the service was set out to prove that short sea shipping activities linking the Great Lakes ports with the St. Lawrence Seaway and East Coast gateway ports would be viable, yet in terms of cargo volumes to exploit economies of scale as well as in terms of route distance questions remain.

Despite the fact that the service proved to be reliable as 96% of the 56 voyages were on schedule and that shippers – over 20 customers – were satisfied with the services provided, the service was operative for only one season (Sea3, 2012). The main reason for the discontinuation as stated by interviewees is its unlucky timing. Following the financial crisis in the entire GLSLS system volumes were significantly lower in 2009 as compared to 2008 and 2010. Not only the marine mode needed to cope with lower volumes; the trucking sector experienced significant drops as well leading to a capacity surplus of the trucking mode. This, combined with reduced fuel prices because of lower oil demands on a global scale, caused Sea3 to lose its initial cost advantage. Moreover, a lack of government support and slow adoption of the new service by shipping lines were factors identified as having attributed to discontinuation of the service (TMACOG, 2010). Some interviewed parties have argued however that the distance over which the service was run was too short. They state that if the service distance would be increased for instance from Montreal to Cleveland instead of Hamilton, the benefits from energy efficiency would become more prominent in cost calculations; the findings in chapter 5 of this report support these statements. In this respect, it should be noted that the Harbor Maintenance Tax is levied on cross-border shipments which to some extent may (partially) offset these benefits.

Based on these findings we can state that new services about to step into the business should carefully consider the economic times at which they launch their concept. Fluctuations in the economy can heavily influence the feasibility of such a service as simply not enough cargo may be in need of transport. Operators will thus have to seek commitment from shippers who trust (part of) their shipments to a new service that has not proven itself yet. Perhaps the reliability rates of Sea3 can help convince shippers that – during the months in which the Seaway is open – cargo is often delivered in time.

7.2 Great Lakes Feeder Lines

Early in the 2008 shipping season a Canada-based carrier launched new container shipping services on the GLSLS. With its ship 'the Dutch Runner' – total container capacity of 221 TEU – short sea shipping services were now in operation on Great Lakes waters, yet the company has struggled to develop a market for Great Lakes feeder services (Roy and Harrison, 2010). The Dutch Runner carried the Canadian flag and is equipped with its own cranes to accommodate deliveries in ports along the lakes that lack the necessary unloading equipment (Samson and Peters, 2008). The cargo options the ship can deliver are not limited to containers; project cargo and breakbulk can be transported as well. Great Lakes Feeder Lines' services were accessible for customers of Canadian ports primarily; cargo was transported between the ports of Halifax, Montreal and Toronto. In July 2009, however, the company extended its services to a first U.S. port; the port of Oswego, NY (Galbincea, 2010).

As of March 2010, GLFL operated a second vessel named 'MV Artic Sea', with a capacity of 270 TEU and own cranes (Canadian Sailings, 2010). An interesting finding is that the GLFL management decided to sail the ship under the Barbados flag given the uncertainty surrounding the 25% duty levied on imported vessels in Canada. In late 2010, it was announced that GLFL was close to signing a deal with the port of Cleveland, which the company identified as easiest accessible – as opposed to the port of Chicago – for deliveries into the Midwest (Galbincea, 2010), yet to date Cleveland does not receive a single container from overseas.

7.3 Conclusion

The experiences with previous undertakings of container service providers in the GLSLS system show that these types of services can be reliable and be used by shippers who are satisfied with the practices. One major limitation to further development have been found to be the unlucky timing in 2009, a year in which much lower volumes were transported throughout the entire system and fuel prices were relatively low due to the crisis. As a result, the prices for competing mode services were reduced leading to the marine mode losing its cost advantage.

Attempts to improve government support and responsiveness by shipping lines are observed as crucial components in the strategy development of a new service. The operator of such service should consider increasing the distance over which containers are transported to fully exploit cost advantages. The longer the distance on which such service operates, the higher the opportunities are in terms of fuel efficiency gains. Note however, that as distances increase, transit times will increase as well. Interviewees have argued that a new service is considered to have any potential only if on a weekly basis ports are entered. As such, for a new service serving ports over a larger distance to be successful, the operation of multiple vessels may be a necessity. Lastly, putting a vessel to use that has a larger capacity than 260-270 TEU may allow for economies of scale that further increase the marine mode's competitiveness. In the economic analysis by Verboon (2012) a vessel capable of carrying about 800 TEU is considered, which would allow for per container transport costs to be reduced compared to lower capacity vessels.

8 GLSLS System Improvement Opportunities

Despite the economic potential that is found by Verboon (2012) to date no container service serves U.S. Great Lakes ports. It seems crucial that if policy makers want to reap the benefits of putting the maritime sector in the region to use more thoroughly, key barriers that hold the potential to be reduced – as found in chapter 6 primarily the Harbor Maintenance Tax and cabotage laws – should be tackled by means of installing more efficient regulatory frameworks. In this chapter key improvement opportunities specific to the Great Lakes-St. Lawrence Seaway maritime transportation system are proposed that may increase the competitiveness of the system as opposed to its non-water counterparts with access to the U.S. Midwest economic centers. The extent to which different institutions can work together towards closer cooperation and integration of regulation is evidently one of the issues addressed, yet other fields specific to the Great Lakes seem to provide scope for improvement as well.

8.1 Joining Forces to Facilitate Great Lakes Container Shipping Practices

The idea of coordinating and integrating the strategies of the different stakeholders in the Great Lakes maritime shipping industry has been posed in an earlier stage already by means of a study conducted by The Mariport Group Ltd (2006). Acknowledging the little alignment of regulatory frameworks and efforts to change the perception of the Great Lakes, the researchers suggest that governmental institutions in Ontario with an interest in Great Lakes shipping seek closer relationships with the governments in the province of Québec and U.S. Great Lakes states. Further, it is stated that limiting public relations activities to a single organization, Highway H_2O, is not effective enough in addressing the issue that the marine industry in the Great Lakes is insufficiently on the radar of the public, the business community, and the financial and investment community. The unpopularity of the marine industry in turn contributes to the fact that educational institutions in the maritime industry do not get enough subscriptions to meet the demand for graduates in the fields of seafaring, logistics, transport intermediary, finance and investment, and ship management. Efforts to stimulate the development of container shipping on the lakes therefore need to encompass measures that affect the behavior of key players in the system's potential markets. As it is found that in the U.S. funds for infrastructure investments are generally assigned to governmental institutions rather than to the private sector whereas the private sector struggles to convince the financial sector of the opportunities of the marine mode, improving the image of maritime shipping on a wider scale seems a necessity (The Mariport Group Ltd., 2006).

8.1.1 Documentary procedures

Considering the fact that the Harbor Maintenance Tax and cabotage regulation are found to provide more scope for barrier reduction than do pilotage and the seasonality aspect when it comes to Great Lakes shipping, and the fact that HMT and cabotage standards are set at the Federal level, a closer look at U.S. national institutions and policy in this field is required. However, some key responsibilities remain with state and local governments which calls for taking a wider perspective with respect to certain areas of focus. In this respect, multiple policy categories can be identified by which the shipping industry is affected. In the framework of this research the following categories have been identified as relevant; safety and security policy, environmental policy, and infrastructure maintenance and investment policy. Note that policy making that affects the transport sector involves many different actors with sometimes conflicting interests. Due to the limited scope of this research it is not feasible to discuss every individual actor involved, yet key players are identified that are advised to seek cooperation to spur the development of the maritime sector in North America.

At the Federal level, funding policies and safety and environmental regulation are among the key roles of the government striving to optimize the U.S. national freight transportation system. Key institutional bodies for the maritime sector are the U.S. Maritime Administration, an agency of the U.S. Department of Transportation, and the Federal Maritime Commission, an independent Federal agency. The responsibilities of these agencies encompass administration of financial programs, identification of critical services and routes in support of international trade, and regulation of shipping lines, terminal operators and intermediaries.

8.1.1.1 Safety and security

In the U.S., safety and security policy for the maritime sector is mainly drawn up on the Federal level. Multiple Federal agencies are involved in safety policy such as the National Highway Traffic Safety Administration, the Federal Railroad Administration, and the Maritime Administration. Security policy on the other hand is governed by the Transportation Security Administration. Moreover, the U.S. Coast Guard acts as the federal regulatory agency responsible for matters affecting the marine industry in both fields which operates under the Department of Homeland Security during peacetime. Should there be a threat to one or more marine elements of the national transportation system, the Coast Guard may increase its Maritime Security (MARSEC) level such that appropriate measures are taken by the maritime industry, the Coast Guard itself, or both. Lastly, the U.S. Customs and Border Protection (USCBP) is the Federal agency involved with customs clearance. Like the Coast Guard, USCBP operates under the Department of Homeland Security. Obstacles for development of Great Lakes shipping have been found in the agency's administrative requirements, crewing requirements for foreign vessels, and delays with respect to implementing new services (The Mariport Group Ltd., (2006).

8.1.1.2 Environment

In the field of environmental policy the Environmental Protection Agency (EPA) is the main governmental institution. The key area in which the EPA is involved is air pollution. As such, its main concern is to set standards for the rail, truck and aviation industry with respect to the environmental footprint on air quality of fuel combustion (Transportation Research Board, 2011). The marine mode is less of a concern to the EPA given that waterborne shipping is relatively fuel efficient. However, there are conflicting interests as shown by a recent dispute concerning ballast water standards in the Great Lakes. Despite the fact that for a number of years no invasive species was introduced into the fresh waters, the EPA convinced the state of New York to impose measures that were beyond of what is considered technologically possible. As a result, new initiatives are taken to come to a national standard with respect to ballast water regulation, initiated amongst others by Great Lakes shipping stakeholders exhibiting the lowest risk rates in the nation. It would be wise for the EPA to streamline its interests internally such that the potential benefits of air pollution reduction from intensified use of the marine mode are weighed against the risk of distorting ecological systems in Great Lakes waters. Consequently, if lower air pollution opportunities are found to hold significant potential, the EPA is advised to take on a more proactive role in stimulating usage of the marine mode for international trade of Midwest businesses.

At the state level air quality plans are developed and implemented, but also local authorities play a role as they can impose restrictions on freight operations to address environmental issues. Furthermore, some port authorities in the U.S. individually embrace a number of environmental policies such as vessel speed limits and port truck emissions limits. Coordination of these plans and standards among authorities with a direct interest in freight transport in the Great Lakes area in a regional setting as well as in cooperation with Canadian authorities would likely increase the transparency and efficiency of the system as a whole.

Further agreement on the Midwestern Greenhouse Gas Reduction Accord could in this respect serve as an ideal step towards increased coordination. The accord is an agreement currently supported by the U.S. states of Illinois, Iowa, Kansas, Michigan, Minnesota and Wisconsin, and the Canadian

Province of Manitoba. Although the U.S. states of Indiana, Ohio, and South Dakota, as well as the Canadian Province Ontario keep a close eye on the development of the accord, so far they have not joined the agreement. Jointly, the members set emission targets and undertake efforts to install a system that allows them to track, manage and credit those parties that successfully contribute to emission reductions.

8.1.1.3 Infrastructure maintenance and investment

Maintenance of the inland waterway system is carried out by the U.S. Army Corps of Engineers (USACE), a federal agency under the authorization of the U.S. Army. USACE activities are funded by the Federal government, primarily through the Harbor Maintenance Trust Fund as described in chapter 6. Highway infrastructure maintenance on the other hand is to a larger extent directed by individual states and local governments. The Federal government contributes funds for highway maintenance and investment undertaking, but lower level governments decide on the level of investment for specific projects. Funds are collected mainly through fuel taxes and tolls. It becomes clear that if stakeholders of shipping in the GLSLS system are to address the issues surrounding maintenance, investment and cost recovery in the maritime sector, efforts to convince policy makers at the Federal level are primarily required. Through coordination at the Federal level, lower level governments can be directed towards a fund allocation for infrastructure projects which incorporates the needs of shippers, consumers and society at large in terms of transport cost efficiency, and end price and social cost reductions respectively.

8.1.1.4 Coordination in support of the maritime sector

Administrative procedures for trade in North America have been found to limit the competitiveness of the GLSLS system. On the other side of the Atlantic, the EU has in recent years adopted a strategy that could serve as a benchmark for North American authorities to work towards a system that is more capable of serving the needs of importers and exporters in their respective markets. To make intra-EU maritime transport more competitive such that highway congestion is relieved the European Union has decided to remove administrative obstacles in the maritime sector. The concept 'European Maritime Space without Barriers' is implemented to remove these obstacles; an initiative that requires support from ports and governments throughout the continent (European Commission, 2010). Amongst other measures ports are encouraged to set aside space for transshipments and member states have to coordinate administrative inspections. Port inspection bodies which assure that maritime transport companies comply with customs, tax and health regulations are reviewed with the aim to streamline their practices. As a result, customs formalities are simplified based on community regulation which increases the ease and speed by which transport services can be carried out. For the medium to long term measures are taken in the form of the Single Window initiative and the e-Maritime initiative. The Single Window initiative enables maritime transport companies to submit standardized information electronically such that the procedure does not have to be repeated many times. The e-Maritime initiative supports further coordination by providing maritime transport companies with information technologies.

Cabotage regulation is another aspect found to impede the GLSLS system's flexibility. The Jones Act not only prescribes that goods transported between U.S. ports need to be carried by vessels built in the U.S., crewed by U.S. citizens and sailing under U.S. flag; the vessel is required to have sailed

under the U.S. flag continuously throughout its lifetime. As such, once a ship is sold from a U.S. owner to a Canadian owner, the ship's resale value is significantly reduced for the investor in a potential new service based in Canada. Namely, U.S. operators can no longer acquire the vessel for domestic trade purposes. If the Canadian owner is then not able to sell the vessel in the Canadian market the vessel will have to undertake a transit to a country outside of North America to be sold, which in turn reduces its resale value (The Mariport Group Ltd., 2006).

Another factor that should be acknowledged is the difference in cost recovery practices between Canada and the U.S. Whereas Canada charges user fees for transits through its locks, the U.S. charges the Harbor Maintenance Tax. In chapter 6 the legal validity of the HMT was challenged and it was found that the Harbor Maintenance Trust Fund contains considerable surpluses while ports are closing due to insufficient dredging. Regardless the question if the marine mode is operating at a level playing field and if the payments are higher than necessary to cover maintenance needs; for a foreign shipper who wants to discharge goods at U.S. Great Lakes ports the perception is that a charge is paid twice. Should Canadian and U.S. authorities in this field be capable to come to an agreement with respect to joint maintenance and cost recovery practices, this would likely induce a higher attractiveness of the system as a whole.

8.1.2 Financing new services

Initiatives to stimulate the development of Great Lakes waterborne services should take into account that the risk a vessel owner undertakes by setting up a new service is much bigger than that of a truck owner. In terms of capital cost, amortization, capital cost allowances, and taxation; the costs associated with such risk therefore play a significant role in the evaluation of whether or not a new service can be feasible regardless of it being competitive in terms of its operating activities (Weisbrod, 2002). The higher these costs, the more reluctant potential service providers are to actually develop the service, unless contracts with shippers can be agreed on up front that assure the profitability of the service. However, shippers often are hesitant to commit to contracts as long as a new service is not operative and has not yet proven to be reliable. Therefore, if governments are to foster the potential of the marine mode, the development of fitted financing structures should be incorporated in their analyses.

8.1.2.1 Marco Polo vs. TIGER

Acknowledging its congestion issues, the EU launched an initiative called the Marco Polo program. For projects that aim to shift freight off of the roads onto rail and waterborne facilities, private companies can apply for a grant that helps them starting up and executing their plans. On an annual basis, between 2007 and 2013 €60 million (over $75 million) is made available. In its previous term (2003-2007) the program proved to successfully lower the financial risks involved with starting up new services. For the marine mode these risks are particularly high, given the substantial initial investment costs. As part of the American Recovery and Reinvestment Act of 2009, the U.S. installed a grant program specifically designed for innovative undertakings in the transportation sector that aim to strengthen the economy in an environmentally sustainable manner. The Transportation Investment Generating Economic Recovery (TIGER) program has in recent years led to specific investments of over $2.6 billion in total by the U.S. Department of Transportation (U.S. DOT, 2012). Similar to the situation in Canada, the critical difference with the Marco Polo program is that the applicability of the TIGER program is limited to state and local governments, and multi-state and

multi-jurisdictional parties. In other words, whereas Marco Polo is business-driven and characterized by subventions for private companies, TIGER is designed to support undertakings by public parties. For the GLSLS shipping industry this setting can be a drawback given its complex and bi-national character. One explanation may be that embedded in the American political climate is that subventions are often seen as too much of an interference with market forces. Despite the benefits an undertaking may provide, e.g. in terms of the external costs as identified in chapter 5, the granting of a subvention is highly unlikely if a service does not prove to be profitable in the short term. The Marco Polo program on the other hand, was specifically designed to reduce external costs, namely to lower congestion levels on European roads.

8.1.2.2 Financial sector awareness

As far as new services are concerned; insufficient access to capital resources is identified as a severe drawback for the development of services in the GLSLS system. Closely related to the discussion of GLSLS system perception in paragraph 8.2; the financial and banking communities are said to lack the understanding of and willingness to invest in marine shipping. For instance, Canadian financial institutions seem to be unfamiliar with the seasonality of shipping earning and are therefore hesitant to supply shipping companies with the financial products that support profitable operations. On the contrary, in Europe banks have offered shipping companies flexible loan arrangements. Such arrangements are of critical value in today's maritime shipping industry given the fact that overcapacity leads to higher risks of inability to resell a vessel (The Mariport Group Ltd., 2006).

8.1.3 The need for comprehensive and accurate data

A solid foundation of data encompassing the entire Great Lakes area is necessary if strategies are to be developed successfully. Ideally, software is developed in which for each specific type of cargo on each specific route the optimal use of different modes is presented based on the preferences of a shipper. The database that lies at the core of such a program should incorporate an inventory of all ports, services and inter-modal opportunities in the area, combined with the possibilities offered by different modes in terms of cost efficiency, time efficiency, reliability, environmental efficiency, etc. For each of these factors multiple variables come into play, most prominently shipping rates, route schedules, congestion levels and average delays, but for instance the per transit impact of a truck on road maintenance or the costs associated with the risk of oil spills or other accidents can be incorporated as well.

One can imagine that establishing a database as extensive as described above is costly and time-consuming, yet any efforts in the direction of providing the industry and authorities with information facilitates more accurate strategy development and policy-making. The good news is that an extensive resource of information in this field is already in the development stage; the University of Toledo is gathering all kinds of data and translating the information into a useful software package. The project identified as 'Regional freight information resources for market opportunities in the Great Lakes Maritime Transportation System' is a long term effort to develop and manage data with respect to vessel movements and commodity flows, port and dock functions, regional economic activity, and regional population/socioeconomic patterns (Lindquist, 2009). Jointly, the data allow for the existence of what is called the 'Atlas of Great Lakes Maritime Commerce', in which maps, tables, graphics, text and other features can help policy-makers to define their transport strategies in accordance with their economic goals. The fact that the resource is centralized, already

comprehensive, and in continuous development with the input of different stakeholders, attributes to the facilitation of a system wide approach toward maximum exploration of the efficiencies waterborne transport can provide to the region. However, to reach its potential, the utility needs to be acknowledged on a sufficiently. Today, not all the information is publicly available because of the involvement and investments of private parties who have access to information that is restricted for others. As such, there is little incentive for shippers with limited investment power to make use of the tool despite the potential benefits it may bring to their organization. In our case, it is most important that authorities assure themselves of access to all the tool features such that it can serve as a basis from which to foster system-wide integration of various regulatory frameworks.

8.2 Perception of the Great Lakes and the Role of Education

It is evident that if container shipping is to exist on the Great Lakes a major barrier needs to be tackled in the form of the system not being capable to provide services year-round because of the winter months. One should note however that the months in which the locks are maintained and ice-breakers are needed for intra-lake shipments are relatively low shipping months; the volumes shippers wish to transport are lower than during the rest of the year. With that in mind, during the interviews it became apparent that some European authorities and shippers have the perception that the Great Lakes are not accessible during 6 months as opposed to the roughly 3 months which is the case. Obviously, shippers are not likely to consider a route viable if for a significant share of their yearly volumes they are inclined to use rail or truck services against higher rates than in case they use these services year-round.

8.2.1 Industry awareness overseas

Inspired by the developments described above, the Canadian St. Lawrence Seaway Management Corporation and the American St. Lawrence Seaway Development Corporation have therefore joined forces to promote the system overseas. The concept 'Highway H_2O' – in which transportation stakeholders in the GLSLS system's region are represented – was brought to life to inform port authorities, shippers, and shipping lines about the service level of the system in an attempt to raise awareness of its potential. Advertisements directed at specific industry segments, information for audiences of websites and social media, and trade missions and exhibitions are among the key activities to reach the goal of attracting more cargo to the system. Based on the evaluation of these activities and other incentives (such as a multi-year toll freeze) the alliance draws the conclusion that efforts show to be a success; cargo volumes transported through the system have grown substantially over recent years if we ignore the impact of the economic downturn in the years 2007-2009.

Despite these results it is striking that some people at management positions in authorities and shipping businesses in Europe lack the awareness of the limitedness of the seasonal aspect of the system, as was found by some of the interviewees. We can at least to some extent conclude that the educative and promotional efforts undertaken by stakeholders in the Great Lakes maritime shipping industry insufficiently achieve their goals. One possible explanation is that the message transferred is too much perceived as promotion instead of education, in the sense that the receiver of the message, a shipper with an interest in the corridor informed about the system at for instance a trade exhibition, is simultaneously informed about already existing routes that do not involve maritime transport on the lakes. For European shippers of containerized cargo the system currently does not offer any services that reach U.S. Great Lakes ports; these shippers are not inclined to research the system's potential as long as no efforts are undertaken by North American authorities and businesses. It seems that if the Canadian and American governments are convinced that the system could potentially play a role in accommodating shipping needs of shippers overseas, streamlining information concerning the various route options is crucial. It could thus be beneficial for North American governments to identify industries in specific regions of the continent that are suited to make use of specific routes and make recommendations accordingly. As such, the opportunities that marine transportation brings can be exploited maximally.

8.2.2 Domestic industry awareness

Based on our findings however, raising awareness overseas only is not likely to be sufficient for further system development. Not only does the system seem to have an issue with its image on the other side of the Atlantic, an often heard argument during the interviews conducted was that in the perception of the average American, the Great Lakes are observed as waters that solely serve the recreational industry. Smaller-sized shippers are said to lack the awareness of the fact that the lakes can serve as a vital part of a solid supply chain, particularly in terms of cross-Atlantic trade. Today, the marine transportation system accounts for over 220,000 jobs on both sides of the North American border (Martin Associates, 2011). Much of the employment stems from bi-national trade rather than cross-Atlantic trade. Potentially, the share of cross-Atlantic trade can be spurred if the barriers discussed in chapter 6 of this report are reduced, yet domestic shippers will need to be informed about the opportunities. One example highlights this need; an interviewed party representing a significant exporter in the corridor, aware of the benefits of marine transport as opposed to other modes, was surprised to hear that the Great Lakes are geographically closest to Europe and that transit times can be around 14 days or less.

8.2.3 Public awareness

Next to shippers, informing the public – and thus changing the perception of the Great Lakes as a recreational area solely on a wider scale – could be the means to get the environmental and economic potential of the lakes in the mindset of (potential) stakeholders. In this respect, Luttenberger (2011), who examines the Croatian shipping industry, states that students at maritime transport faculties and high schools should be informed thoroughly about the economic, societal, and environmental aspects of maritime transport, whereas the emphasis in this field of education is often primarily on the technical aspect. She then continues and goes as far as to recommend that all educational institutions "from kindergartens to PhD courses" educate students in the field of environmental protection and the potential of maritime transport to address issues in this field. Moreover, Luttenberger (2011) advises that all children living in coastal communities are obligated to learn sailing skills such that they become familiar with the industry. As much as these recommendations sound rather drastically; for the U.S. Midwest it holds that, if these measures prove successful, the region is embedded with educational institutions specialized in maritime shipping which could facilitate such efforts, such as the Great Lakes Maritime Research Institute, the Great Lakes Maritime Academy, the Maritime Academy of Toledo and the University of Toledo – whose relevance we highlight in the next section.

8.2.4 Relevance awareness for business operations

Taking a broader perspective, businesses today increasingly search for ways to make their operations more environmentally sustainable. The trend of consumers demanding their suppliers to produce responsibly continues to gain strength. Nonetheless, businesses often have doubts as to whether or not they can change parts of their business models to 'go green' as they are afraid that it is costly and will have severe impacts on the business' profitability. Much literature has been written on the subject of balancing sustainability and profitability in competitive markets and obviously findings will vary for each industry and business, such as Steinson (2009), Hawkins (2006) and Kerr (2007). In this respect, Quariguasi Frota Neto et al. (2008) find that a focus on corporate social responsibility does not necessarily hit the bottom-line in financial reports, it rather creates opportunities for businesses

with a pro-active approach toward sustainable development. Not only do these businesses attract consumers that hold environmentally sustainable practices in high regard; they often find it relatively easy to comply with the sometimes cumbersome regulation and can also anticipate future regulation easier. Extensively informing businesses hesitant to explore these opportunities can stimulate managers to examine the environmental footprint of their transport service suppliers.

8.3 Modernizing Lock Technologies

8.3.1 Hands Free Mooring

In order to make use of its potentials, the St. Lawrence Seaway Management Corporation has adopted a number of strategies to optimize transit through its locks and channels. The most prominent and advanced strategy is that tests have been conducted with a vacuum mooring prototype; the so-called 'Hands Free Mooring' technique. When a vessel enters a lock and gets to its position, pads attached to hydraulic cylinders suck themselves onto the vessel, pull it onto the lock wall and then raise the vessel. With the Hands Free Mooring technology more different vessels can enter the Great Lakes through the Seaway locks. Accommodating more different-sized vessels can spur the use of the system and research has shown that there is much potential; of the world's commercial fleet (over 83,500 ships) about 25% has the measurements that would allow the ship to transit through the locks. However, most of these Seaway sized vessels are not 'Seaway fitted', leading to a number of only several hundreds of vessels that can actually transit the locks. If the Hands Free Mooring prototypes prove to be a success and are installed on a wider scale, the system becomes more flexible in terms of handling smaller-sized vessels, and thus will the flexibility of ship operators to deploy a vessel that serves transportation needs optimally be increased as well. Moreover, the technology allows for lower crewing requirements associated with lock transits, transit times can be reduced, and crew safety and productivity is enhanced.

8.3.2 Vessel self-spotting

Another technical advancement in development in the lock system is the vessel self-spotting feature. This technology allows the captain of a ship to put the vessel into the right position for mooring activities easier by making use of a 3D laser scanner. On a display panel the captain will get accurate information with respect to distances from the vessel entering the lock to its final mooring position, assisted by automated radio communication. This allows for faster transit through the locks, as well as productivity improvements as lock personnel will become available for mooring operations earlier in the process.

8.3.3 Seaway expansion considerations

When evaluating the lock system of the St. Lawrence Seaway it is important to note that there have been considerations to expand the locks and make them capable of accommodating Panamax size vessels in recent years. At the time that the locks were built in the late 1950's there were already ongoing discussions concerning their size; even in those years the lock sizes were too limited to accommodate the larger vessels of the global commercial fleet. It is due to strong lobbies from the American ports on the East Coast and the Canadian rail operators – who feared strong competition from the GLSLS system – that the locks were not built bigger. The construction of deeper and larger locks has since been evaluated multiple times, with a research conducted by the U.S. Army Corps of Engineers as one of the most recent efforts. The potential economic benefits of expanding the locks to a draft of 35 feet and 110 x 1200 feet lock chambers for the Welland canal section and the Montreal-Lake Ontario section were weighted against the investment costs. It was estimated in 2002 that the costs would amount up to 10 billion dollars associated with infrastructure improvements, whereas the gains were estimated to be $1.5 billion annually (USACE, 2010). Non-estimated additional costs for landside infrastructure improvements and crossings were not incorporated in

these calculations. One could state that the gains outweigh the investment costs in a relatively short term, but the Canadian government was quoted not to feel that expanding the system is prudent at the time, and that both the U.S. and Canada feel that expansion of the system is not warranted at this time. The question is however to what extent additional costs from projected congestion on highways and railways have been incorporated in the analysis. For the Canadian government, the incentives to heavily invest in the Seaway's infrastructure seem rather limited since congestion is not as severe as in the Midwest. Moreover, should the Seaway be expanded, then it could be that ships bypass Montreal and enter U.S. Great Lakes ports directly. In terms of employment opportunities in both the maritime and the railway sector, Canadian authorities seem to have an incentive to explicitly oppose expansion initiatives. With many of the locks in the Seaway falling under the supervision of Canadian authorities, the scope for the success of future expansion considerations from U.S. authorities seems rather limited.

8.4 Conclusion

8.4.1 Coordination and cooperation for development

In terms of documentary procedures; safety and security matters, environmental aspects, and infrastructure maintenance and investment practices are advised to be evaluated if coordination is sought between Canadian and U.S. authorities with an interest in Great Lakes shipping promotion. Agreements on cabotage regulation as well as on cost recovery measures are identified as the fields that provide significant scope for improvement. Additionally, efforts could be undertaken to educate the banking industry about the maritime sector such that financial structures allow for easier investment in new services. New services could additionally be supported by government initiatives, as is done by the EU's Marco Polo program and the European Maritime Space Without Barriers initiative.

Thorough provision of data is considered necessary to provide a solid basis for further coordination. The Great Lakes region is lucky to be embedded with institutions and systems that already account for significant aspects of data that can be useful in support of joint efforts to promote the system.

8.4.2 Improving perception

Some EU shippers have found to believe that the shipping season in the GLSLS system is limited to only half a year because of the fact that the lake waters freeze. It is important for North American authorities with an interest in GLSLS system development to come up with initiatives that promote and raise awareness of the system overseas. Already, such initiatives are taken by HWY/H2O, a body representing different types of stakeholders in the Great Lakes area. Both promotional activities as well as financial incentives have led to success for the system, yet a lack of awareness seems to persist among authorities, businesses and the public.

Awareness is particularly relevant for the business community given that consumers increasingly hold environmentally sustainable business operations in high regard. Some businesses however are reluctant to shift their scope towards greener ways of production as they are concerned that profitability of their activities is negatively affected. Research shows however that with the proper legislative frameworks in place it rather creates business opportunities to strive towards sustainable operations than that it creates negative effects (Quariguasi Frota Neto et al., 2008). Informing businesses that share these concerns about these findings is therefore considered highly valuable.

8.4.3 Improving physical infrastructure

Physical infrastructure improvements are currently undertaken by authorities in the Great Lakes area such that the system allows for easier transits of vessels in the future. The Hands Free Mooring technique is one of such innovative programs that increases the speed by which vessels can go through the locks and allows for a wider variety of vessels to enter the system. Improvement to this technique remains necessary, but continuous tests are undertaken to work towards a smoother flow. Moreover, the vessel self-spotting technique already in place allows for deck masters to be put in the position that they have accurate information and support at hand to assist them with their navigation activities.

Further improvements to the physical infrastructure in terms of expanding the locks in the system have been considered in recent years. The costs of such an expansion are estimated at about $10 billion, whereas the gains are estimated at $1.5 billion per year. Although it seems that cost recovery can occur in a relatively short period of time, governments on both sides of the border have argued that for now it is not necessary to expand capacity. Interestingly, increasing the length of some of the locks is argued to require relatively little effort (Valentine, 2012). As such, longer-sized vessels would be able to call in the major Canadian ports downriver off the Welland Canal. Should the length of the locks be increased in the Welland Canal section such that these vessels can enter Lake Erie and U.S. Great Lakes ports in the Midwest, more challenges occur.

9 Conclusion

9.1 Conclusions Qualitative Part Research

To draw up the final conclusions we need to consider the research questions identified in chapter 2 of this report. In this respect, the main research question to be answered is 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 existence of sustainable container transport services between U.S. Midwest ports along the Great Lakes coasts and ports in the Hamburg-Le Havre range in Northwest Europe?"

Note, however, that in order to be able to answer the main research questions, several sub-research questions were drawn up. In this part of the research the first two of these sub-research questions can be answered; to be able to come to the answer concerning the main research question the answer to sub-research question 3 (see 2.2.2.c.) needs to be incorporated. In the final report in which both the findings by Verboon (2012) and this report are combined, encompassing all sub-research questions, the main research question is answered.

9.1.1 Sub-Research Question 1

Reconsider the first sub-research question answered in this part of the research identified under 2.2.2.a.:

"Which key opportunities of intensified use of the marine mode in the Great Lakes area can be identified to facilitate 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?"

The U.S. is found to have an interest in seeking coordination with Canada for multiple reasons. First of all, by coordinating cabotage regulation the flexibility of the GLSLS system is enhanced which lowers the burden for new service providers to enter the market. These services provide opportunities in terms of fuel consumption, environmental sustainability, and safety.

9.1.1.1 Fuel efficiency

In terms of fuel consumption, the evidence is rather clear; waterborne transport can provide alternatives to rail and truck services that are considerably more fuel efficient. Per container input, the use of fossil fuels is much lower for the marine mode than it is for the trucking alternative. For the rail services it holds that marine transport is more fuel efficient as well, despite the fact that the difference is not as large as between services on the road and on water. Fuel prices have undergone tremendous increases in recent years, a trend that is not expected to change soon. Given the high consumption patterns of the transportation sector, it is of the utmost importance for the U.S. to seek

an alternative to what extent modal shifts can help decrease the dependency on imports of oil-based products, next to its surge for thorough use of alternative fuels.

9.1.1.2 Congestion

Additionally, congestion on U.S. roads and railroads increasingly leads to losses attributable to travel time delays. Congestion issues might be on the rise even more when the Panama Canal expansion is completed in 2014 if additional Asia-bound cargo enters U.S. ports on the East Coast. The GLSLS system on the other hand has plenty capacity, both in terms of lock transits and port facilities, and can therefore serve as the means to lower congestion issues on interstate highways as well as in densely populated areas in the Midwest.

9.1.1.3 Environment

In terms of environmental considerations, air pollution is identified to be of most concern to policy makers. Negative effects of air pollution are observed in terms of the loss of crops and productivity, and higher costs of health care services. An analysis specifically designed around the case of the Great Lakes area and the potentials to reduce these costs with intensified use of the marine mode is required to draw strong conclusions, yet it is found that the marine mode is significantly less polluting than its surface transportation counterparts.

9.1.1.4 Safety

The marine mode also proves to be safest when compared to rail and road services. Not only do accidents occur in a much lower frequency; the rate of fatalities per accident is considerably lower as well. It should be noted however that if an accident occurs in the marine sector the effects are generally much bigger than elsewhere, which causes authorities to consider safety procedures that are costly and time-consuming.

9.1.1.5 Maintenance costs

One of the direct opportunities of putting the marine mode to a better use is that maintenance of road and rail infrastructure is generally much more expensive than maintenance of facilities in the maritime sector. The biggest potential in this respect seems to lie in modal shifts from road to water services, given that highway maintenance is funded by authorities. For the rail alternative it holds that private businesses often finance maintenance activities themselves.

9.1.1.6 Employment

Moreover, if a container service were to enter U.S. Great Lakes ports employment of U.S. workers would be stimulated; both companies operative in the transportation sector and shippers involved in international trade may become more profitable. Containers with destination U.S. Midwest coming into the system are today primarily discharged at the port of Montreal from where they are transported across the border by rail, thereby contributing to the Canadian economy despite the fact that goods have the U.S. Midwest as origin or destination. These rail services operate in a competitive setting given that there are two operators, yet there is no marine alternative for shippers on this route. With increasing fuel prices and a higher fuel efficiency for rail than for truck services, the competitive advantage of the rail operators is expected to further increase. As a result,

transport rates charged by the Canadian railroads may increase which raises the barriers to trade for importers and exporters in the Midwest. The lower these barriers, the more room is provided for U.S. companies to get involved in international trade, thereby enhancing profitability and employment levels.

9.1.2 Sub-Research Question 2

The second sub-research question answered in this part of the research (2.2.2.b.) is as follows:

"Which key barriers to intensified use of the marine mode in the Great Lakes area can be identified that limit 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?"

Several key barriers were identified to limit the prospects of development of container shipping in the GLSLS system. For some of these barriers, it holds that they can likely be reduced if authorities on multiple governmental levels and in a bi-national setting seek cooperation and coordination of activities.

9.1.2.1 Seasonality

A barrier that seems tougher to overcome is the fact that during 2 to 3 months a year the system is inaccessible to vessels from overseas. Although it is often thought that it is because of ice formation, primarily in the locks, that vessels cannot transit; the main reason for closure is that maintenance activities are required on a yearly basis. Moreover, several parties have strong opposition to year-round services should the need for maintenance activities be reduced given the cultural and ecological importance they assign to temporary closure of the system during winter.

As a result, shippers who wish to foster the potential of the marine mode in the Great Lakes area will have to find an alternative mode for the winter months. During these months, however, these other modes charge significantly higher rates than for shippers who use their services on a year-round basis. It was found that for shippers to consider the marine alternative, the costs associated with switching between these modes require the marine mode to be cheaper in a range from 5% to 14%.

9.1.2.2 Harbor Maintenance Tax

The Harbor Maintenance Tax is considered one of the barriers that can be reduced. Not only can it be challenged from a legal point of view; it has been proven that the height of the tax rate can be reduced as well, thereby consistently sustaining the funds necessary to carry out the activities for which the tax was brought to life. Particularly for container imports the ad-valorem tax places a significant burden on the use of marine alternatives to rail and road services, given the higher value containers generally carry as opposed to bulk commodities. As long as the tax is in place and railroads run along the Great Lakes across the Canadian-American border without any charges, the Harbor Maintenance Tax limits the development of the marine sector both from a cost and a mental perspective.

9.1.2.3 Cabotage regulation

Cabotage regulation is like the Harbor Maintenance Tax one of the barriers that provides scope for reduction. It is not likely that the U.S. will abolish its Jones Act because of security reasons and voting interests, yet there is room for improvement. Administrative procedures have been identified as time-consuming and costly, yet closer cooperation between the U.S. and Canada could serve as a basis from which North American cabotage regulation can be integrated and designed against a more efficient framework. Should such efforts be successful then an additional benefit is that the flexibility of the maritime sector is enhanced, which is particularly relevant for the GLSLS system given its bi-national character. In Europe, efforts in this direction have been undertaken in recent years by implementing intelligent technologies that make it easier to transport goods by ship from one member state to another. Theory shows that liberation of cabotage laws is intrinsically beneficial; consumers profit from lower prices because efficiencies emerge from a better match of transport needs and the supply of services, and increased competition in the market leads to lower rates charged by the carriers.

9.1.2.4 Pilotage requirements

Also particularly relevant for the GLSLS system is the fact that for foreign vessels pilotage requirements are in place. The costs associated with these requirements seem to put a significant burden on the cost-efficiency of potential container shipping services. Because of safety reasons, it is not likely however that these costs can be reduced; pilotage will remain obligatory for captains who do not have the proper qualifications. Also because of safety reasons, the pilotage sector is restricted from competition, therefore there is little scope for barrier reduction. Fortunately, the rates are charged against fair prices because they are governed by U.S. and Canadian authorities. Perhaps in the future some relief can be provided as technologies may allow for smoother transits through the system, as deck masters are assisted with optimized communication systems.

9.1.2.5 Non-tariff barriers

Non-tariff barriers on the other hand are found to provide considerable scope for barrier reduction. For the automotive and chemicals sectors respectively, it holds that with further integration between safety standards and security regulation significant gains can be expected. Europe and the U.S. have a long tradition as each other's trade partners and are embedded with relatively similar cultural characteristics. As such, efforts to cooperate if the political will is present are likely to be successful.

9.1.2.6 Perception

Another key barrier to overcome is the perception of authorities, businesses and the public about the Great Lakes, both in Europe and in the U.S. Some European shippers and authorities are convinced that the system is accessible only 6 months a year due to ice formation; more than double the duration which is actually the case. American shippers on the other hand are often not familiar with the Great Lakes as a potential alternative to other modes of transport. This problem is not only observed among businesses; the public also perceives the Great Lakes to be an area ideal for recreation rather than for commercial activities. Efforts to streamline these perceptions with reality are considered important if stakeholders are to foster thorough development of the system. Fortunately for these stakeholders the Great Lakes area is embedded with the educational

institutions that can provide the means through which to alter perception; ranging from vessel handling education to supportive data providers.

9.1.2.7 Lack of support

Lastly, from previous undertakings in the Great Lakes container shipping market it was found that services can prove to be reliable and cost-efficient. Users of these facilities were content with the services they were provided with. However, the initiatives were launched and/or operated in the midst of an economic crisis, leading to significantly lower volumes observed throughout the system. One key barrier to be tackled in this respect is that shippers only consider a new marine service if it has already proven to be reliable. New services on the other hand require deals with shippers such that cargo volumes are guaranteed. The financial services sector, which is already not very familiar with the marine sector, is without solid agreements not likely to invest in new services given the high risk. Moreover, fund allocation by the U.S. Federal government is structured such that initiatives from the private sector seem to be hardly taken into consideration at the Federal level. Rather is the private sector limited to applications for funds at the (multi-)state and local levels of government, which evidently limits the probability that applications for larger amounts of investment are successful.

9.1.3 Global economic developments

Related to the fact that throughout the system lower volumes were observed following the economic crisis, note that the opportunities and barriers directly related to the GLSLS system should be evaluated against the background of key developments in the global economy as well as in the North American and European economies. In this respect, it can be stated that these economies are still trying to recover from recent crises. As such, the effects with respect to for instance demand for fossil fuels – and thus the price of fuels – and willingness of the financial sector to be supportive of new and often risky investments have to be incorporated in any analysis concerning the potential of container shipping in the GLSLS system. A coordinated approach in which shipping routes and practices are designed in response to developments in key growth sectors, thereby incorporating the needs of shippers, consumers and society, holds the key to selection of the optimal means of transportation in which the interest of our planet is balanced with profitability.

9.1.4 Call for action

According to the findings in this report, a coordinated approach will need to encompass a number of steps to be taken by policy makers as top priorities. Below recommendations are made to tackle specific issues that today limit the feasibility of container shipping on the Great Lakes.

9.1.4.1 Redefine maintenance cost recovery

Firstly, the controversy surrounding the Harbor Maintenance Tax should incentivize authorities to reevaluate current cost recovery practices of maintenance activities in the maritime sector. Many arguments can be brought up that call for an entire abolishment of the tax in its current form or at least a reduction of the tax rate, but for the Great Lakes area specific aspects are particularly relevant. For the container shipping industry the tax's ad-valorem structure is highly disadvantageous. With Canadian railroads in close proximity of American Great Lakes ports and without a tax similar to the Harbor Maintenance Tax applied to goods imported by rail, U.S. shippers

are said to discharge at Canadian ports because of the tax burden. Given that some of the containers transported into the Midwest carry above-average valued goods for the automotive industry, the comparative advantage of the rail mode is further increased. It is therefore advised that a study, similar to the study on cargo diversion attributable to the tax on the West Coast, is carried out with respect to potential cargo diversion from American Great Lakes ports to the port of Montreal. Should it be found that cargo diversion does occur as a result of the tax, then stakeholders have stronger arguments to convince policy makers of the negative effects the tax has on the U.S. economy.

Another aspect that may not be to the advantage of container shipping on the Great Lakes is the fact that the tax is levied only on commercial marine activities. The Great Lakes are a great resource for recreation activities; many private boats sail the lakes with people who wish to enjoy the landscapes and places that surround them. Although these trips require maintenance in the ports, none of these sailors contribute to the funds used. Not only does this lead to opponents of the tax arguing that the set-up is unfair; one can imagine that the structure as such contributes to the perception of the Great Lakes as a recreation area rather than a potential route for commercial shipping. As observed, perception can play a significant role in the potential development of new services. Taxing Great Lakes recreational boating can on the other hand lead to a decrease of economic activity in the area as the cost burden of sailing with private boats is increased. Policy makers are therefore advised to evaluate the effects of including private boat owners in port maintenance cost recovery practices and adapt the tax structure accordingly if necessary.

9.1.4.2 Integrate cabotage regulation

Liberalization of cabotage regulation has in theory and practice shown to be beneficial for consumers as they reap the benefits from lower transport costs for shippers. These benefits are said to outweigh the potential losses in terms of domestic employment. As far as the U.S. is concerned, liberalization in this field in the short term is quite unlikely because of safety reasons and the voting interest of protecting U.S. jobs. That does not mean however that regulation cannot be improved. Discrepancies between Canadian and American cabotage regulation persist despite efforts to streamline certain aspects of the legal frameworks. The EU has dealt with a similar situation and, besides the fact that it has liberalized its regulation, it has initiated a program that aims to ease time consuming and costly administrative procedures. Through the implementation of intelligent technologies transport companies can be facilitated with relevant information and equipment that allows them to submit standardized information electronically. Policy makers in the U.S. who aim to reduce the administrative barrier of shipping should foster the potential of these technologies in terms of time and cost savings. For these technologies to be most beneficial, the system through which they operate should be integrated with its Canadian counterpart. For the Great Lakes area this is particularly relevant given its bi-national character which increases the likelihood of vessels charging and discharging at ports on both sides of the border. The fact that vessels enter ports in both nations on a single trip also on the East Coast increases the potential of such system integration.

9.1.4.4 Match perception with reality

9.1.4.4.1 The European bias

The fact that some authorities and shippers in Europe consider the Great Lakes-St. Lawrence Seaway Transportation System accessible for only half a year highlights the necessity to inform parties overseas about the marine shipping potentials of the Great Lakes area. The U.S. Midwest is a major market for many companies in Europe leading to large cargo volumes transported between both regions. If North American authorities can convince shippers overseas of the fact that shipping in the system can occur during 9 to 10 months a year, the likelihood of the system's opportunities being exploited can increase significantly. Moreover, the Great Lakes are not perceived as a basis for commercial activities by relevant parties in domestic industries. In particular, the shipping industry and the financial sector are said to be insufficiently aware of the fact that the Great Lakes are more than just an area suitable for recreation purposes. Awareness of the system's potentials is crucial for these sectors to be supportive of container shipping on the lakes. To increase awareness and change the perception of the Great Lakes a number of measures can be proposed. Firstly, promotional activities of the system in Europe, e.g. through magazine advertisements and conferences, can be directed at emphasizing the duration of the season. A positive development in this respect is that the system is already promoted by Canadian and American stakeholders jointly under the name Highway H_2O. Changing perception takes time and the effects of the efforts taken by the organization should be reviewed over a longer period of time. One could argue that, although Highway H_2O attends multiple gatherings of stakeholders in the corridor each year, it could be wise to install a representative of the organization overseas who attends meetings at a higher frequency and who actively approaches potential customers. In addition, one can think of it being beneficial if North American authorities streamline can streamline information concerning route options for European shippers. For specific markets and cargoes different routes can provide different opportunities and barriers. The Canadian rail service providers for instance are not fond of oversized and overweight cargoes and charge higher prices for transportation of these goods as a result. If authorities on both sides of the border can jointly advise shippers overseas on suitable routes for their cargo, efficiencies throughout the North American transportation system can emerge.

9.1.4.4.2 The domestic bias

Changing perception among authorities, businesses and the public in the domestic setting is likely even tougher given that people have lived in the proximity of the recreationally attractive Great Lakes for generations. Thorough promotional initiatives are likely required if the commercial potential of the lakes is to sufficiently get in the mindset of people. These initiatives can take many forms, ranging from advertisements in magazines and on billboards in business districts to meetings with branch organizations. Embedding awareness of the commercial potential of the lakes amongst the public is considered another factor likely to be supportive of system development. As mentioned previously, a redefinition of the Harbor Maintenance Tax in which private boat owners sailing the lakes are obliged to contribute to maintenance cost recovery could spur the awareness among the public of the lakes as a transportation system. Additionally, educational institutions in the proximity of the lakes – regardless of whether or not these institutions are affiliated with the maritime sector – can incorporate information about the economic relevance of the lakes for the region in their programs. On the other hand, those institutions that are affiliated with the maritime sector can set

up programs that facilitate the sharing of knowledge about the system with authorities and businesses.

9.2 Limitations Qualitative Part Research

9.2.1 Marine mode bias

A number of factors are found to limit the extent to which this research draws strong conclusions. First of all, the interviews conducted involved primarily stakeholders from the maritime sector. If stakeholders from the rail and road transportation sectors would have had more input, it is probable that additional barriers to using the marine mode could be identified.

9.2.1 Opportunities and barriers research limitations

Because of the limited scope of this research, the extent to which analysis of the key opportunities and key barriers is conducted provides room for improvement. With respect to the opportunities, particularly the fields of congestion and air pollution require more of a case-specific analysis of the Great Lakes region to shed light on the height of the costs associated with the issues. For the barriers identified additional limitations are as follows. The Harbor Maintenance Tax has been challenged on numerous occasions from within and from outside of the U.S. The reasons that lie at the core of the fact that the tax has not been altered or abolished could have been found if interviews were conducted with more government officials and with politicians. With respect to the cabotage law barrier it holds that, despite the fact that theory shows the benefit of liberalizing regulation, it is unknown to what extent regulation can be integrated with Canadian regulation, as well as to what extent such integration would be beneficial given that the U.S. is not likely to further liberalize its policies.

9.2.2 Markets research limitations

Aside from limitations with respect to the opportunities and barriers, an additional limitation is the fact that the size and dynamics of the automotive and chemicals market can be investigated more thoroughly. For instance, with respect to the potential identified for the chemicals sector; one of the interviewees argued that putting ISO tanks to use for a potential new GLSLS container services. Whether ISO tanks are suitable for delivery to the majority of local businesses as opposed to pipeline delivery is unknown. About the analysis of the automotive market we can state that additional information concerning the volumes and value of cargo transported to destinations in the Midwest and Ontario specifically would have been helpful. In this respect, it should be noted that in the U.S. it is rather costly to obtain import and export statistics that go beyond the scope of data on the national and state level.

9.3 Recommendations for Future Research following Qualitative Part Research

9.3.1 System use opportunities

Partly induced by its limitations, this research may inspire to conduct additional research project in order to investigate the true potential of the GLSLS system. In this respect, interesting fields would encompass a closer look at the gains of congestion and air pollution relief specific to the Great Lakes region. Moreover, the extent to which regulation can be integrated between North American institutions can be analyzed more thoroughly by interviewing parties that each have their individual responsibilities and interests, for instance in the fields of defense, environmental sustainability, and transportation.

9.3.2 The means to change perception

Additionally, one of the system improvement opportunities found was the perception of the Great Lakes by authorities, businesses and the public. Particularly the financial sector seems to have a lack of knowledge concerning the maritime sector and its potentials. A future research investigating the means to which this perception can be altered can provide significant benefits in terms of awareness among stakeholders, and willingness to put to use the Great Lakes commercial potentials consequently.

9.3.3 Market opportunities

It would be interesting to have a closer look at the suitability of the automotive sector and the chemicals sector for a container service on the Great Lakes. Case studies that look thoroughly into different segments of both sectors can be recommended as the means to acquire insight information with respect to shipping needs of different actors in these sectors. Getting to know the preferences of these actors in terms of reliability, cost efficiency, speed, and seasonality of transport is crucial when evaluating the likelihood that shipping needs in these sectors can be accommodated by a new service.

9.3.4 Great Lakes cargo diversion

Although a research is conducted concerning potential cargo diversion from American to Canadian ports on the North American West Coast, it is unknown to what extent the Harbor Maintenance Tax causes importers to discharge at the port of Montreal instead of at U.S. Great Lakes ports. Should a similar study be conducted in the Great Lakes region, some interesting results may be found given the proximity of Montreal to the U.S. Midwest as a major target market.

9.3.5 Competing modes

Lastly, given that in this research most input stems from sources affiliated with the maritime sector, it would be interesting to research the actions that would be taken by truck and rail service operators in response to a new service. Evidently, these providers would seek the means by which they can offset any advantage attained by a maritime service. If the actions these providers take following the development of a new service are known, the sustainability of the new service can be estimated with more precision.

List of references

Below the sources used for this research are listed in alphabetical order. Note that three categories are distinguished; articles, books, and web pages. Of these, academic journals were used as much as possible, though when no relevant information could be found in these journals, other sources were consulted.

1. Articles:

American Phyisical Society (2008). *Energy Future – Think Efficiency*. APS Physics September 2008

Brooks, M.R. (2006). *The Jones Act under NAFTA and its effects on the Canadian shipbuilding industry*. Research paper – Atlantic Institute for Market Studies.

Busch, M.L. and Reinhardt, E. (2002). Transatlantic *Trade Conflicts and GATT/WTO Dispute Settlement.* Conference on Dispute Prevention and Dispute Settlement. Florence, Italy, 3-4 May 2002

De Langen, P.W. (2007). *Port competition and selection in contestable hinterlands: the case of Austria.* European Journal of Transport and Infrastructure Research 7 (1), 1-14

DiJohn, J. (2010). *Chicago's CREATE Rail Program: A Successful Public-Private Partnership.* Canadian Transportation Research Forum 45th Annual Conference, Toronto, Canada.

ECORYS Nederland BV (2009). *Non-Tariff Measures in EU-US Trade and Investment – An Economic Analysis.* OJ 2007/S 180-219493

European Commission (2010). *The European maritime transport space without barriers: fostering internal market and advanced short-sea shipping technologies.* Publications Office of the European Union

Forkenbrock, D.J. (1999). *Comparison of external costs of rail and truck freight transportation.* Public Policy Center, The University of Iowa

Fransoo, J.C. and Wouters, M.J.F. (2000) *Measuring the bullwhip effect in the supply chain.* Supply Chain Management: An International Journal, Vol. 5, Iss: 2, pp. 78-89

Fritelli, J. (2012). *Harbor Maintenance Trust Fund Expenditures 2011.* Congressional Research Service 7-5700, R41042

Great Lakes Regional Collaboration (2005). *To restore and protect the Great Lakes.* Great Lakes Regional Collaboration Strategy Executive Summary

Greaves, R. (2011). *Cabotage & Short-sea shipping.* Maritime Transport and EC Law and Policy – Seminar 4. Universities of Glasgow and Oslo

Hackston, D., English, G., Taylor, R. and MacDonald, J. (2005) *Research Study on the Coasting Trade Act.* Transport Canada. Research and Traffic Group

Hadley, M. (1999). *Issues in Remote Pilotage.* The Journal of Navigation, Vol. 52, No. 1

Hoen, K.M.R., Tan, T., Fransoo, J.C. and van Houtum, G.J. (2011). *Effect of carbon emission regulations on transport mode selection under stochastic demand.* Working paper series 349.

Hull, B. (2012). *The Chicago-East Coast Corridor: Changing Intermodal Patterns.* Transportation Journal

Kamakaté, F. and Schipper, L. (2009). *Trends in truck freight energy use and carbon emissions in selected OECD countries from 1973 to 2005.* Energy Policy 37, pp. 3743-3751

Kerr, J.E. (2007). *Sustainability Meets Profitability: The Convenient Truth of How the Business Judgment Rule Protects a Board's Decision to Engage in Social Entrepreneurship.* Cardozo Law Review, Vol. 623, pp. 664-665

Kirchner, P.G. and Diamond, C.L. (2010). *Unique institutions, indispensible cogs, and hoary figures: Understanding pilotage regulation in the United States*. U.S.F. Maritime Law Journal

Klemperer, P. (1987). *The competitiveness of markets with switching costs.* RAND Journal of Economics, The RAND Corporation, vol. 18 (1), pp. 138-150

Klier, T.H. and Rubenstein, J.M. (2009). *Imports of Intermediate Parts in the Auto Industry – A Case Study.* Measurement Issues Arising from the Growth of Globalization conference. November 6-7, 2009, Washington, D.C.

Kosior, J., Vido, E. and Prentice, B.E. (2009). *Creating Lean, Green and Agile Supply Chains: the Benefits of Cabotage Liberalization.* Canadian Journal of Transportation, Vol. 3, Part 1

Kumar, S.N. (2002*). User charges for Port Cost Recovery: The U.S. Harbor Maintenance Tax Controversy.* International Journal of Maritime Economics, Vol 4, 2

Lindquist, P.S. (2009) *Regional Freight Information Resources For Market Opportunities in the Great Lakes Maritime Transportation System: Phase II*. The University of Toledo University Transportation Center – U.S. Department of Transportation

Luttenberger, L.R. (2011). The role of environmental education in promoting short-sea shipping. International Conference IMLA 19 Opatija

Martin Associates (2011). *The Economic Impacts of the Great Lakes-St. Lawrence Seaway System.* Lancaster, Pennsylvania

McIntosh, C., Skalberg, R. And Skurla, J. (2009) *Analyzing Alternatives to the Harbor Maintenance Tax.* Labovitz School of Business and Economics – University of Minnesota Duluth

Min, D., Wang, F. and Zhan, S. (2009). *Impact analysis of the global financial crisis on global container fleet.* ICSSSM '09. 6th International Conference on Service Systems and Service Managment. pp. 161-166

Newberry, D.M. (1990). *Pricing and Congestion: Economic Principles Relevant to Pricing Roads.* Oxford Review of Economic Policy, 6, pp. 22-38

Quariguasi Frota Neto, J., Bloemhof-Ruwaard, J.M., van Nunen, J.A.E.E. and van Heck, E. (2008) Designing and evaluating sustainable logistics networks. Int. J. Production Economics 111, 195-208

Roy, M.-A. and Harrison, P. (2010). *Short Sea Shipping in Canada: Lessons learned and research model for the development of new services.* CTRF 2010 Annual Conference

Samaras, I. and Papadopoulou, E.M. (2010). The Global Financial Crisis – The effects on the liner shipping industry and the newly adopted practices. *1st Olympus International Conference on Supply Chains*

Schipper, L., Scholl, L. and Price, L. (1997). Energy use and carbon emissions from freight in 10 industrialized countries: An analysis of trends from 1973 to 1992. *International Energy Studies, Vol 2, 1*

Skalberg, R.K. (2007). *The U.S. Harbor maintenance tax: a bad idea whose time has passed?* Transportation Journal, Vol 46, 3

Skalberg, R.K. and Skurla, J.A. (2006). *Tax Systems and Barriers to Great Lakes Maritime Commerce.* Great Lakes Maritime Research Institute

Sneirson, J.F. (2009). *Green is good: Sustainability, Profitability, and a New Paradigm for Corporate Governance.* Iowa Law Review, Vol. 94, No. 3

Steenhof, P., Woudsma, C. and Sparling, E. (2006). Greenhouse gas emissions and the surface transport of freight in Canada. *Transportation Research Part D 11*, 369-376

Stewart, R. (n.d.). *Great Lakes Maritime Transportation System*. White Paper – Midwest Freight Corridor Study

Stewart, R.D., LaVoie, T. and Shutes, N. (2003). *Parameters for a roll-on roll-off marine intermodal service on Lake Superior*. Transportation Research Board 2003 Annual Meeting

Texas Transportation Institute (2007). *A modal comparison of domestic freight transportation effects on the general public.* Center for Ports and Waterways

The Mariport Group Ltd. (2006*). Marine Transportation in Ontario.* Ontario Marine Transportation Forum – Ontario Ministry of Transportation

Transportation Research Board (2011). *Impacts of Public Policy on the Freight Transportation System.* National Cooperative Freight Research Program. Report 6

USACE (2010). *Supplemental Reconnaissance Report – Great Lakes Navigation System Review. U.S.* Army Corps of Engineers, Great Lakes & Ohio River Division

Verboon, H.M. (2012). *The Great Lakes: The world's most underutilized waterway*. Erasmus University Rotterdam – Erasmus School of Economics

Weisbrod, R. (2002). *Freight ferries: taking a fresh approach.* Marine Transportation System Short Sea Conference, New York, 12 November

Zhang, A., Boardman, A.E., Gillen, D. and Waters II, W.G. (2004). *Towards Estimating the Social and Environmental Costs of Transportation in Canada*. Report for Transport Canada

2. Books:

Gale (2007). *Encyclopedia of American Industries.* New York: GreyHouse Publishing

Great Lakes Regional Collaboration (2005). *Great Lakes Regional Collaboration Strategy, To Restore and Protect the Great Lakes.* United States

Hawkins, D.E. (2006). *Corporate Social Responsibility. Balancing Tomorrow's Sustainability and Today's Profitability.* New York: Palgrave MacMillan

Kondratieff, N.D. (1926). *Die langen Wellen der Konjunktur (The Long Waves of Economic Dynamics)*. Archiv für Sozialwissenschaft und Sozialpolitik 56, 573-609

KPMG International Cooperative (2010). *The Outlook for the US Chemical Industry*. Switzerland: KPMG International

Nefiodow, L.A. (2001). *Der Sechste Kondratieff (The Sixth Kondratieff).* St. Augustin: Rein-Sieg Verlag

Notteboom, T. (2009) *The relationship between seaports and the intermodal hinterland in light of global supply chains: European challenges*, in: OECD/ITF (ed.), 'Port Competition and Hinterland Connection', Round Table no. 143, OECD – International Transport Forum (ITF): Paris, p. 25-75

OECD International Transport Forum (2009). *Transport for a Global Economy – Challenges & Opportunities in the Downturn. 2009 Forum Highlights.* France: OECD

Rodrigue, J.-P., Comtois, C. and Slack, B. (2009). *The Geography of transport systems.* New York: Routledge

Rothengatter, W., (2010), *Economic Crisis and Consequences for the Transport Sector*, in: Rothengatter, W., Y. Hayashi, W. Schade (eds.): Transport Moving to Climate Intelligence, New York: Springer.

Saunders, M., Thornhill, A. and Lewis, P. (2000). *Research methods for business students.* Financial Times/Prentice Hall

Schumpeter, J.A. (1943). *Capitalism, Socialism, and Democracy*. London, Allen and Unwin.

TEMS, Inc. (2008). *Impact of High Oil Prices on Freight Transportation: Modal Shift Potential in Five Corridors, Technical Report.* United States: USDOT

TEMS, Inc./RAND Corporation (2007). *Great Lakes-St. Lawrence Seaway New Cargoes/New Vessels Market Assessment Report.* United States/Canada: USDOT/Transport Canada

Thompson, R.L. and Cats-Baril, W. (2002). *Information Technology and Management.* Columbus: McGraw-Hill/Irwin

3. Web pages

American Pilots Association (2006). *Pilotage in the United States.* Available: http://www.americanpilots.org/PilotageInUs.html. Last accessed: 2012.

American Shipper (2011). *Cargo diversion's political stir.* Available: http://digital.americanshipper.com/i/45646. Last accessed: 2012.

Ben Rooney. (2011). *Oil prices spike to $103, then drop back.* Available: http://money.cnn.com/2011/02/24/markets/oil/index.htm. Last accessed: 2012.

Canadian Sailings (2010). *Great Lakes Feeder Lines adds second ship.* Available: http://www.canadiansailings.ca/?p=1334. Last accessed: 2012.

Central Intelligence Agency. (2011). *The World Factbook*. Available: https://www.cia.gov/library/publications/the-world-factbook/index.html. Last accessed 2012.

Cleveland-Cuyahoga County Port Authority (2011). Port of Cleveland's strategic action plan: Technical Appendices – Appendix G. Available: http://www.portofcleveland.com/assets/attachments/file/Appendix%20G%20Dredging%20and%20CDF.pdf. Last accessed: 2012.

Dominic Rushe, The Guardian. (2011). *Detroit's carmakers seize back market share as sales rise 11%.* Available: http://www.guardian.co.uk/business/2011/jan/05/detroit-carmakers-seize-back-market-share. Last accessed: 2012.

European Commission (2012). *Marco Polo – About the programme*. Available: http://ec.europa.eu/transport/marcopolo/about/index_en.htm. Last accessed: 2012.

European Commission. (2011). *Trade, Creating Opportunities, Economic Sectors, Industrial goods, Automotive*. Available: http://ec.europa.eu/trade/creating-opportunities/economic-sectors/industrial-goods/automotive/. Last accessed: 2012.

Galbincea, P. (2010). *Cleveland port close to becoming U.S. home base and lone Great Lakes city for international container service*. Available: http://blog.cleveland.com/metro/2010/10/cleveland_close_to_becoming_us.html. Last accessed: 2012.

Gooley, T. (2012). *The brewing battle over the HMT.* Available: http://www.dcvelocity.com/articles/20120123-the-brewing-battle-over-the-hmt/. Last accessed: 2012.

Great Lakes Commission (2006). *Great Lakes Coastal Needs Assessment Port and Navigation Element Literature Review*. Available: http://www.glmtf.org/dredging_crisis.html. Last accessed: 2012.

Great Lakes Dredging Team (2010). *The Port of Toledo and the Maumee River Basin.* Available: http://www.glc.org/dredging/case-toledo.html. Last accessed: 2012.

Great Lakes Seaway Review (2012). *Facts about the Great Lakes St. Lawrence Seaway System.* Available: http://www.greatlakes-seawayreview.com/advertise/media-kit/market/. Last accessed: 2012.

Homeland Security NewsWire (2011). *U.S. no longer mandating 100 percent screening of cargo containers.* Available: http://www.homelandsecuritynewswire.com/us-no-longer-mandating-100-percent-screening-cargo-containers. Last accessed: 2012.

Jacoby, D., Boston Strategy (2009). *The Bullwhip Effect in Global Trade – This is One Wild Bull.* Available: http://www.bostonstrategy.com/images/bullwhip.pdf. Last accessed: 2012.

Krugman, P. (2011). *Disagreement among economists.* Available: http://krugman.blogs.nytimes.com/2011/03/19/disagreement-among-economists/. Last accessed 2012.

Michigan Economic Development Corporation. (n.d.). *Michigan's Automotive Industry.* Available: http://www.michiganadvantage.org/cm/Files/Brochures/1283Auto%20brochure.pdf. Last accessed: 2011.

NavSim Technology (2012). *NavSim PPU.* Available: www.navsim.com/product/navsimppu. Last accessed: 2012.

OceansAdvance inc. (2012). *NavSim equips Great Lakes pilots with Next-Gen. Systems.* Available: www.oceansadvance.net/press-releases/navsim-equips-great-lakes-pilots-next-gen-systems. Last accessed: 2012.

Organisation for Economic Co-operation and Development (OECD). (2012). *Key Employment Statistics.* Available: http://www.oecd.org/document/53/0,3746,en_2649_37457_42788213_1_1_1_37457,00.html. Last accessed 2012.

Organization of the Petroleum Exporting Countries. (2012). *OPEC Basket Price.* Available: http://www.opec.org/opec_web/en/data_graphs/40.htm. Last accessed: 2012.

Platts Insight (2011). *2012 Global Energy Outlook*. Available: http://www.platts.com/IM.Platts.Content/insightanalysis/insightmagazine/2011/pdfs/2011_geo_insight.pdf. Last accessed: 2012.

Portnoy, H. (2010). *What is the Jones Act, and why won't Obama waive it?* Available: http://hotair.com/greenroom/archives/2010/06/12/what-is-the-jones-act-and-why-wont-obama-waive-it/. Last accessed: 2012.

Samson, R. and Peters, T. (2008). *Great Lakes Feeder Lines finally sets sail.* Available: http://autumnfireweb.com/glfl/glfl_v3/images/8_11_08%20Cdn%20Sailings.pdf. Last accessed: 2012.

SCDigest Editorial Staff (2008). *Financial Crisis Hits Ocean Shipping Too, as Rates Plummet.* Available: http://www.scdigest.com/assets/newsviews/08-10-13-2.pdf. Last accessed 2012.

Sea3 (2012). *Revolutionizing Seaway container shipping.* Available: http://sea3.ca/about/default.aspx. Last accessed: 2012.

Supply Chain Digest (2008). *Financial Crisis Hits Ocean Shipping Too, as Rates Plummet.* Available: http://www.scdigest.com/assets/newsviews/08-10-13-2.pdf. Last accessed: 2012.

The Netherlands Embassy in Washington DC, United States of America (2011). *Jobs, Foreign Direct Investments and Trade between the US and the Netherlands.* Available: http://economicties.org/all-states/. Last accessed: 2012.

TMACOG (2010). *Sea3 – Short Sea Savings*. Available: http://tmacog.org/OCF_10/Presentations/Williams_Defiance/Tuesday/Hamilton%20_Global_container.pdf. Last accessed: 2012.

U.S. Department of Treasury (2011). *Harbor Maintenance Reports – October 2011*. Available: ftp://ftp.publicdebt.treas.gov/dfi/tfmb/dfihm1011.pdf. Last accessed: 2012.

U.S. DOT (2012). *Tiger grants.* Available: http://www.dot.gov/tiger. Last accessed: 2012.

U.S. DOT Federal Motor Carrier Safety Administration (2012). *Crash Statistics.* Available: http://ai.fmcsa.dot.gov/CrashProfile/CrashProfileMainNew.asp. Last accessed: 2012.

United States Census Bureau. (2012). *Business & Industry, Foreign Trade.* Available: http://www.census.gov/foreign-trade/. Last accessed: 2012.

Valentine, H. (2012). *Prospects for Longer Ships on the St. Lawrence Seaway.* Available: http://www.maritime-executive.com/article/prospects-for-longer-ships-on-the-st-lawrence-seaway#.T7TTpQ7JqJc.email. Last accessed: 2012.