Erasmus University Rotterdam

MSc in Maritime Economics and Logistics

2014/2015

The economic impact of the Marco Polo II Programme on the EU economy

by

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Acknowledgements

First of all, this thesis was absolutely a big challenge for me. Since it is the first year for me to study abroad in a totally different environment. With respect to the MEL programme, the first month was difficult for me. After that, I started to enjoy my new life in Rotterdam. Writing this thesis was also a challenge for me since I needed to search through a lot of information about Europe and its culture, which was very unfamiliar for me. Nonetheless, I have to say that I still enjoyed every moment I spent on this thesis. And I want to thank some persons for supporting me.

At first, I want to give my deepest thanks to my supervisor Dr. Koen Berden. His brilliance and sense of humor inspired my interest in the EU economy and also the culture. His help and recommendations on my thesis made everything much easier.

Also many thanks to all MEL officers. It is their hospitality and enthusiasm that helped me to adapt to the new environment and concentrate on the programme. I will never forget their in-time help when I got an allergy and had to go to hospital by ambulance!

Many thanks to my family. It is their support that makes my dream comes true. Love you forever.

Many thanks to my new friends who I met in the Netherlands: Domi, Rachel, Regina, Michael, Kevin and Te. It is their company that has brought so many laughs and happiness, making this an unforgettable year.

Many thanks to my girlfriend. Her fight with the 6-hour jet lag, supporting me and encouraging me as always, have been amazing. Nothing can express my appreciation and love.

Last but not least, although there is no chance for me to see you again, you will always live in my heart. My dear grandfather. R.I.P.

Yifan Yu
Rotterdam, August 2015

Abstract

Road congestion is a huge burden for the EU economy. According to a White Paper released by European Commission in 2011, road congestion costs Europe about 1% of total GDP annually. This number is enormous – especially in a (post) crisis-time where money is scarce, and thus, the European Commission has launched a series of plans in order to ease the congestion rates and also reduce emissions caused by congestion. The Marco Polo II Programme is one of these plans that focuses on easing road congestion and reducing emissions caused by road congestion. It is an important EU policy that should lead to more economic growth and have positive effects for the environment at the same time. This warrants further impact research. Therefore, this thesis looks at the potential impact of the Marco Polo II Programme on the EU economy (GDP and trade) following from the effect on road congestion. To analyze the impact on the EU economy, for the EU as a whole, but also at EU Member State level, the Global Simulation (GSIM) Model is applied to evaluate the policy effects.

We find that in both scenarios, the Marco Polo II programme has a positive impact on the EU economy. In terms of output, we find a very small increase in GDP of 0.02% because of the Marco Polo II programme. This is not large compared to the 1% congestion cost estimate it aims to address. However, 0.02% of GDP is still Euro 2 billion in estimated gains, compared to the Euro 450 million investment through Marco Polo II – which is a significant return on public investment. When we look at welfare, output, trade, and price effects, the impact of Marco Polo II is also visible. Welfare goes up because prices for consumers drop and some producers also gain. Output increases for all EU Member States, and consumer prices drop. Mostly in Belgium, the most congested country in the EU. Although international trade between the EU and the Rest of World and US decreases, intra-EU trade increases a lot because of the Marco Polo II Programme. This means that the Marco Polo II Programme has a positive effect on the EU internal market and the economy's degree of integration.

In addition, the output of two scenarios reveals that the actual achievement rate of the Marco Polo II Programme is the dominant factor. Because the Marco Polo II Programme has a much better performance under the scenario with a higher achievement rate. That implies for policy makers it is important – for the EU to benefit – that Marco Polo II has the highest achievement rate possible.

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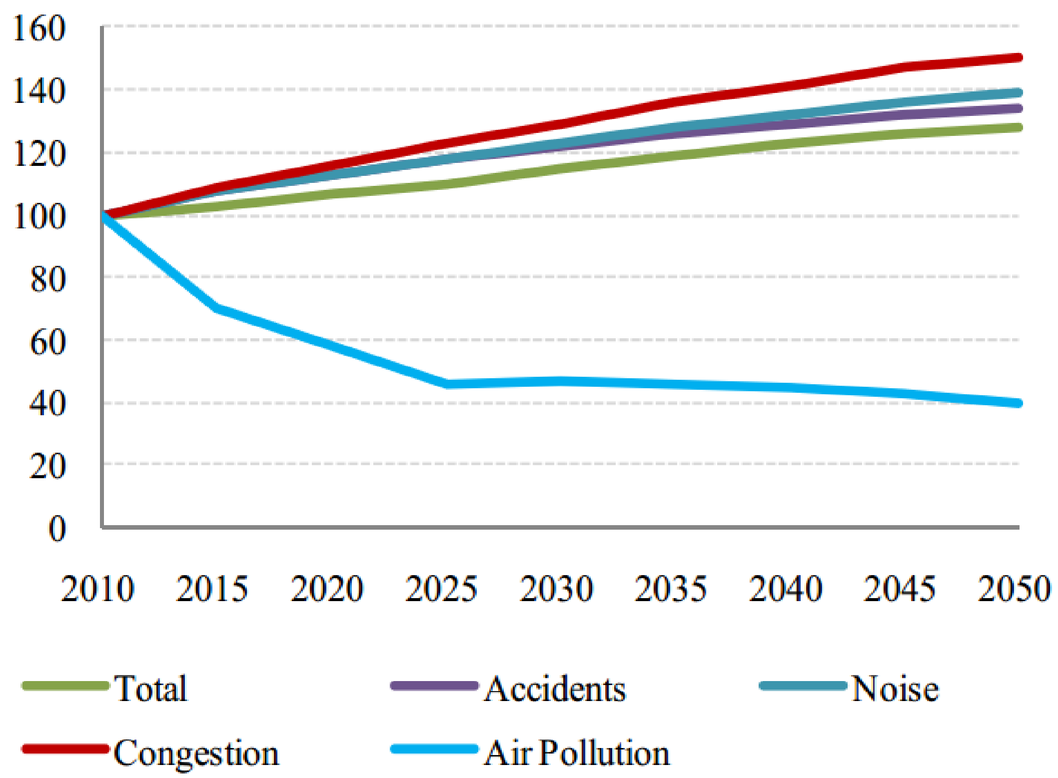
Chapter 1 Introduction

Road congestion is becoming an increasingly important issue and obstacle for the development of the economy and the environment. Road congestion has many negative effects on transportation and the environment, including wasting time of logistics, delays of delivery, decreasing forecast accuracy of travel time, increasing the possibility of accidents and also causing more CO2 emissions.

For the European Union, congestion was estimated to cost Europe about 1% of Gross Domestic Product (GDP) every year (European Commission, 2011). This number is enormous since the whole transport industry contributes 4.6% to GDP (Eurostat, 2012) which is even more than the whole EU budget. According to Eurostat, the aggregate GDP of all 28 member states of the European Union is €13.920 billion (Eurostat, 2015) which means the total loss caused by road congestion costs the EU economy around €139 billion per year. Worse still, according to the latest report from INRIX, an international provider of real-time traffic information, the combined annual cost of congestion in Europe will increase by 50% on average to €267 billion by 2030. The crucial fact, which is indicated in Figure 1.1, shows that congestion will be the biggest part of total external costs in the transport sector in the EU.

Figure 1.1. Forecast of external costs in transport section



Source: (White paper 2011, European Commission)
The European Commission has already realized the importance of reducing road congestion. To reduce road congestion, the EU needs more efficient transport and logistics channels, better infrastructure and the ability to optimize capacity use (European Commission, 2012). On the other hand, because of the growing concern for the environment and the economic downturn, the implementation of new infrastructure seems to be a less applicable solution due to its negative impact on the environment (e.g. particulate matter emissions) and due to budget limitations of EU and EU Member State governments. Finding a more cost-effective solution and building a more efficient transportation system becomes a vital challenge for the EU and the EU member states.

The Marco Polo Programme is one of the European Union's funding programmes for projects which aim to shift freight from road to sea, rail and inland waterways. Through the Marco Polo Programme, fewer cargo is transported by trucks, which means less road congestion and less pollution. The Marco Polo II Programme ran from 2007 to 2013. That is the second period and the continuation of Marco Polo I Programme which ran from 2003 to 2006.

As mentioned before, road congestion places a huge burden on the development of the economy. Quoting the European Commission from Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system:

"In light of the above, the Commission is of the opinion that today's EU transport system does not sufficiently keep pace with mobility needs and aspirations of people and business. High level of congestion cause large costs to the society, inconvenience and dissatisfaction to people and companies. This could ultimately become a brake on economic growth." (European Commission, 2011)

Moreover, the European Commission also analyzed the annual costs of congestion per EU member state, both in absolute terms and as share of Gross Domestic Product. Due to the lack of information, 8 EU member states are not included in the report. The actual numbers of the other 20 EU member states are shown in Table 1.1 and these numbers strongly support the fact that there is a significant impact of road congestion on the economies of the EU Member States.

Table 1.1. Annual cost of congestion per EU member state

	Annual cost of congestion (€ billion)	Cost of congestion as % of GDP 2009		Annual cost of congestion (€ billion)	Cost of congestion as % of GDP 2009
Austria	1.8	0.6%	Hungary	0.7	0.8%
Belgium	3.4	1.0%	Ireland	1.8	1.1%
Czech Republic	0.8	0.6%	Italy	14.6	1.0%
Germany	24.2	1.0%	Lithuania	0.5	1.7%
Denmark	1.5	0.7%	Luxemburg	0.3	0.7%
Spain	5.5	0.5%	Netherlands	4.7	0.8%
Estonia	0.1	0.8%	Poland	4.8	1.6%
Finland	1.4	0.8%	Portugal	1.2	0.7%
France	16.5	0.9%	Slovakia	0.3	0.5%
United Kingdom	24.5	1.6%	Sweden	2.6	0.9%
Total EU (available countries)	**111.3**		**1.0%**		

Source: (European Commission, 2012)

Therefore, this thesis will assess the effect of the Marco Polo II Programme on road congestion for European road freight transportation and also assesses the impact of the Marco Polo II Programme on the EU economy – in terms of the absolute change and percentage change in trade value, and also GDP – based on the results of the first assessment. We will present results that will show the actual achievement of the Marco Polo II Programme, contributing to the ease of road congestion by reducing trucks on the roads and moving cargo from road to the sea, rail and inland waterways. In addition, the results of this thesis will also show whether the EU economy is influenced by eased road congestion due to Marco Polo II and whether the influence is positive or not.

Based on the aforementioned goals, the main research question is:

"What is the potential effect of the Marco Polo II Programme on EU road congestion and what are the economic effects of that for the EU economy?"

The result of the main research question will provide evidence of whether the EU economy will benefit from the Marco Polo II Programme regarding its effect on road congestion. But it also should be noted that The Marco Polo II Programme does not only aim to ease the road congestion but also aims to reduce the pollution produced by road congestion. Moreover, the Marco Polo II Programme also contributes to reducing accidents on roads which is an element related to road safety. These latter two aims of the Marco Polo II Programme are beyond the scope of this thesis. Instead, this thesis will focus on the expected impact of the Marco Polo II programme on road congestion and then on the potential economic impact of that impact on road congestion for the EU; not on other factors such as environment and road safety.

In order to answer the main research question, the following sub-research questions are addressed in the thesis:

1. *"What is the Marco Polo II Programme and what are the goals of The Marco Polo II Programme?"*
2. *"In what way(s) does the Marco Polo II Programme intend to ease road congestion?"*
3. *"In what way(s) does road congestion have an economic impact on the EU economy?"*
4. *"How can we quantify the potential effect of the Marco Polo II Programme on road congestion?"*
5. *"How can we quantify the potential impact of road congestion on the economy?"*

In Chapter 2, we introduce the motivation and the history of the Marco Polo II Programme. We will explain the different structures and features of both the first Marco Polo Programme and the Marco Polo II Programme. Since this thesis focuses on the Marco Polo II Programme, the differences between the first Marco Polo Programme and the Marco Polo II Programme will also be summarized. Chapter 2 will help this thesis to build the methodology and determine the scope of the research.

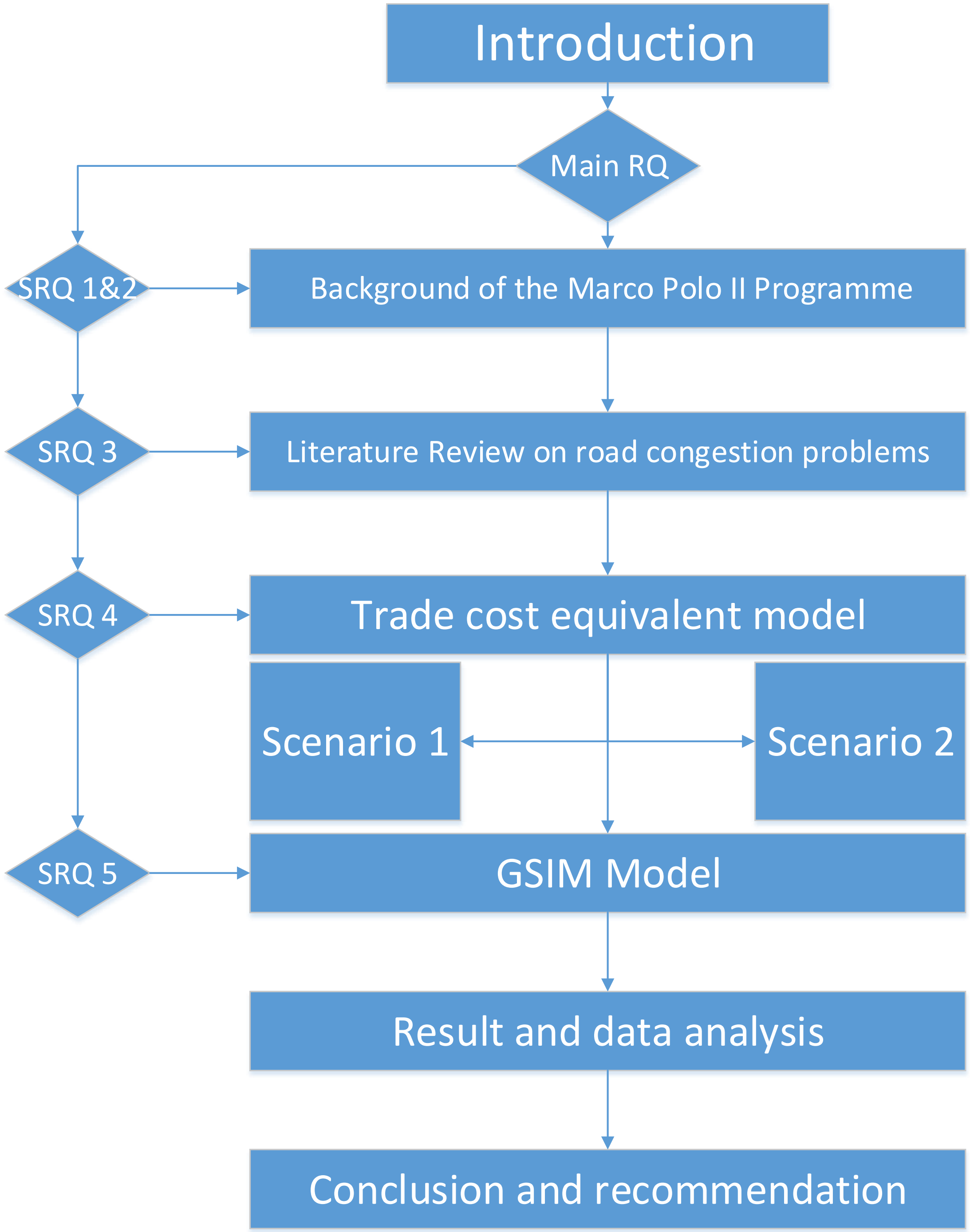
In Chapter 3, the causes and consequences of road congestion will be analyzed by reviewing the literature, whereby we cover *inter alia* also research carried out on the best methodology to estimate road congestion. We will explain the relationship between road congestion and the economy as well as the reason why the Marco Polo II Programme can potentially ease road congestion.

Chapter 4 will explain the fundamentals of the chosen methodology of this thesis. We will introduce the GSIM model that works with trade cost equivalents from congestion in order to quantify not only the initial effect of road congestion on the economy but also the potential effect of the Marco Polo II programme on road congestion, followed by quantifying the subsequent economic impacts.

In Chapter 5 we will present the outcomes and results of both the road congestion model and the GSIM model. We will analyse and interpret the findings in light of the research question.

Chapter 6 will conclude by providing conclusions of the main research question, by giving policy recommendations based on our analysis, and by suggesting areas for further research.
The structure of this thesis is presented below in in Figure 1.2.

Figure 1.2. Structure of the thesis



Chapter 2 Background of the Marco Polo II Programme

To understand and study the impact of the Marco Polo II Programme on road congestion, it is necessary to get familiar with the background of the programme. Thus this chapter explains first what the Marco Polo II Programme is and what the goals of The Marco Polo II Programme are. Then we look at what the literature has to say about the way the Marco Polo II Programme eases road congestion. In order to compare, we also look at the objectives of the Marco Polo II programme compared to the first Marco Polo programme.

2.1 The history and structure of the Marco Polo Programme

Road transportation is a major CO2 contributor which does harm the environment since it is totally dependent on fossil fuel. European Commission has already realize the importance of reducing the CO2 emission and took many actions such as the Trans European Network of Transport (TEN-T) in order to enhance the cohesion of the Europe and also promote the sustainability of the transportation network. On the other hand, The White Paper 2001 also observed that if no decisive action is taken, road freight transport in the EU is set to grow about 50% by 2010 and cross-border traffic to double by 2020. (European Commission, 2001) Moreover, it is hard to overcome the commercial and operational obstacles which influence all the forms of transport and some EU member states are not able to support an ideal solution to the obstacles with the increasing demand in both internal and external market.

Under this circumstance, the first Marco Polo Programme period from 2003 to 2006 was initiated by European Commission in order to relieve the road congestion condition and reduce the impact of CO2 emission caused by road freight on the environment. The main target of the first Marco Polo Programme is to finance the commercially-oriented services to shift international road transportation to short sea shipping, rail and inland waterway.

Three types of projects are supported by the first Marco Polo Programme. The first type is modal shift actions. This type focus on shifting road traffic to other modes of transportation by supporting transportation services with funding. The second type is catalyst actions. This type focus on supporting innovative measures which can improve the traditional non-road transportation operations to some extent or exploit the trans-Europe transportation network. Through supporting these projects, the structural barriers in the EU’s market can be overcome or identified. The last type of the first Marco Polo Programme is the common learning action. This action aims to improve and exchange the new concepts and information among transportation operators in the logistic sector by providing financial assistance.

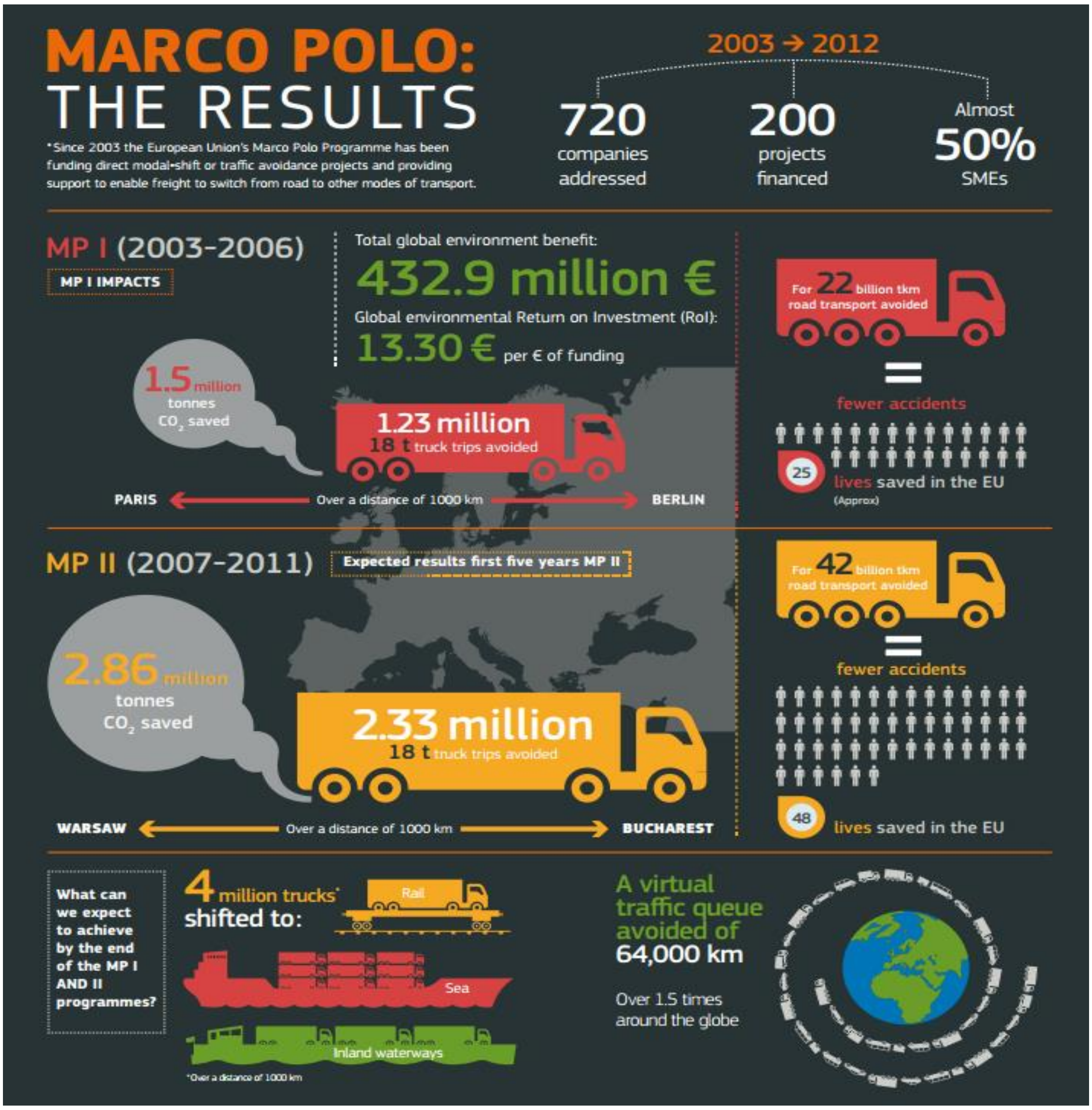
The result and achievement of the first Marco Polo Programme can be concluded in three aspects including effectiveness, environmental benefits and sustainability. For effectiveness, the modal shift actions expected by the selected projects amounted to 47.7 billion tonne – kilometres (btkm), which is approximately equal to the overall target established for the plan (48 btkm). Eventually, the projects achieved an actual modal shift of 21.9 btkm. This result achieve around 46 percent of the overall target of modal shift actions and is the equivalent to around 1,200,000 truck trips over a distance of 1000 km with an average load of 18 tons of cargo.(European Commission, 2013) Regarding the environment, modal shift projects brought around EUR 434 million benefits. And the funds paid for these projects were EUR 32.6 million, (European Commission, 2013) which means that on average EUR 13.3 were generated by each euro invested. Sustainability, which stand for whether the projects remain stable and successful in the end of the funding period, due to the lack of relevant data, cannot be quantified as the impact of the programme.

As the successor of the first Marco Polo Programme, the Marco Polo II Programme covers the period from 2007 to 2013. When pursuing the same goal as the first Marco Polo Programme, the Marco Polo II Programme also has some new features. The first improvement is a wider coverage of the programme. Not only the territory of at least two EU countries but also the territory of at least one EU countries and even the territory of a close non-EU country are covered by the programme. Furthermore, besides the catalyst actions, modal shift actions and common learning actions, motorways of the sea and traffic avoidance actions are also included in the Marco Polo II Programme.

Motorway of the sea is an action introduced by European Commission in the 2001 White Paper on European transport policy. This action focus on directly shift a part of the road transportation to short sea shipping or a mixed route with short sea shipping and other modes of transportation while keep the road journeys as short as possible. Traffic avoidance actions support any kind of innovative projects or ideas which aim at the integration of logistic network in order to avoid large proportion of road transportation.

Compared with its predecessor, the Marco Polo II Programme has some other remarkable differences in three aspects. First of all, while Marco Polo I had a budget of €102 million, the Marco Polo II Programme has a budget of €450 million. The second difference is that the Marco Polo II Programme has a wider geographical scope by introducing the possibility for all “close third countries” and new member states to participate to the the Marco Polo II Programme. Last but not least, as mentioned before, in addition to the Modal shift, Catalyst and the Common learning actions, Motorways of the sea and Traffic avoidance actions are also included in the Marco Polo II Programme. These three main differences assure the European Commission that the Marco Polo II Programme can be a greater success than its predecessor. The final result of the Marco Polo I Programme and the expected result of the Marco Polo II Programme are shown in Figure 2.1.

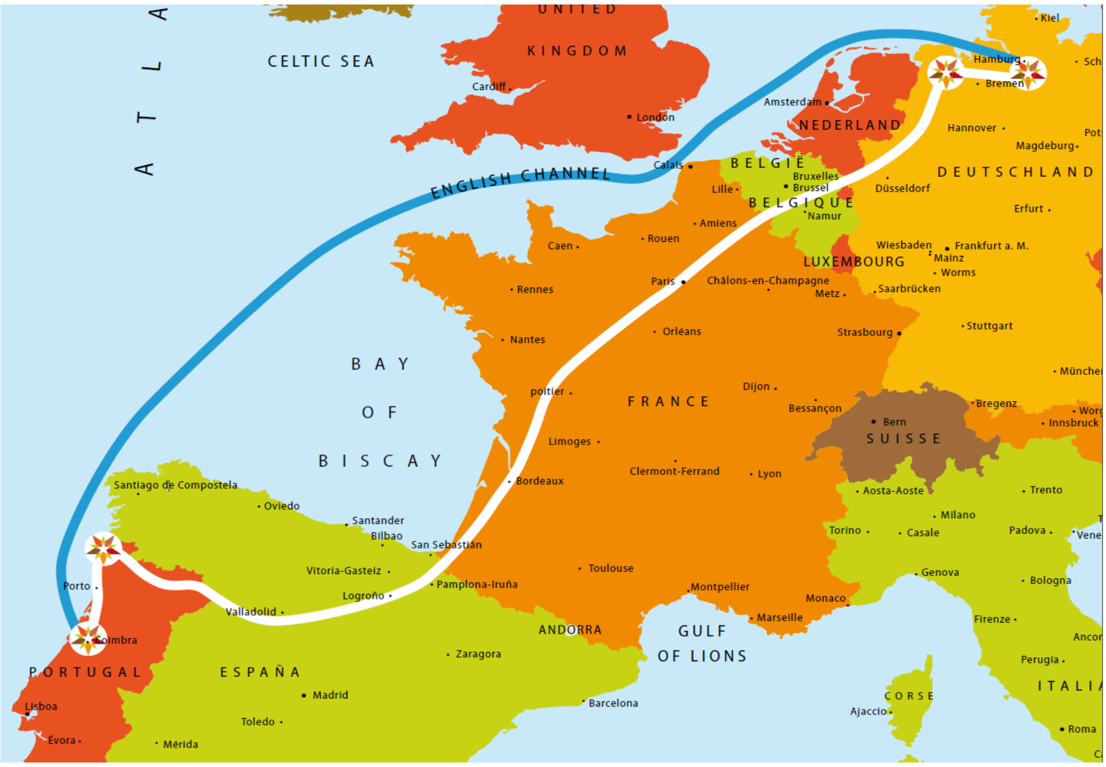
Figure 2.1. The results of the Marco Polo Programme



Source: (EACI, 2013)

ENERCON Tri-Modal is an example of modal shift action under the Marco Polo II Programme. As shown is Figure 2.2, the project uses rail and ship to move components and parts from Germany to Portugal instead of using road transportation through Netherlands, Belgium, France and Spain. The Marco Polo II Programme offered a fund of €1,268,577 to support this project and the volume of goods shifted off the road is 663m tonne – kilometres. Moreover, this project also brought an estimated benefit of 13.6m.

Figure 2.2. ENERCON Tri-Modal



Source: (European Commission, 2009)

2.2 Literature review on the Marco Polo II Programme

"Evaluation of the Marco Polo Programme 2003-2010" is a report made by Europe Economics aiming to assist the evaluation of the Marco Polo Programme covering the period 2003-2010. This report presented the performance factor including effectiveness, environmental benefits, efficiency, deadweight, contribution and legacy of the programme, competition issues, management evaluation and relationships between Marco Polo and other programmes. Moreover, this report also presented the exact expected and achieved rate of each action, i.e. modal shift actions, catalyst actions and common learning actions. Since the report evaluated the whole Marco Polo I Programme and the Marco Polo II Programme was still ongoing, the evaluation of motorways of the sea and traffic avoidance actions are not valid and are just for reference.

The methodology of evaluation is comprehensive and fully analyzed the pros and cons of the Marco Polo Programme so that Europe Economics were able to make many recommendations on the future plans of Marco Polo II Programme. The data used in the report is provided by Executive Agency for Comprehensive and Innovation (EACI) and DG MOVE. EACI is in charge of various EU projects including Marco Polo Programme, thus the data provided by EACI is sufficient and trustable enough for Europe Economics to support a quantitative assessment of the efficiency and effectiveness of the Marco Polo Programme. Nevertheless, the environmental benefit data is not sufficient enough thus the performance of environmental benefit are not explained in detail in the report.

Surveys and stakeholder interviews are also parts of the methodology used by Europe Economics. This strategy helps to find out the key factors for the performance of the Marco Polo Programme and also gives the main reasons for the under-expected result. Last but not least, the recession of economy in Europe which started from 2008 was also mentioned and taken into account into the consideration, but since the main part of the evaluation is the first Marco Polo Programme, the impact of the recession on the evaluation is not significant.

Although the report of Europe Economics has proven to be useful data source and is also helpful in providing data for the analysis of this thesis, the scope of the report is totally different from this thesis. The report mainly focus on the performance of Marco Polo Programme itself and the achieve rate of all types of actions while this thesis mainly focus on the impact of Marco Polo II Programme which is not the main target evaluated in the report by Europe Economics.

“Ex ante Evaluation Marco Polo II” is another report made by ECORYS in 2004 aiming to “Analyze the available policy options and their different impacts, measure and compare potential impact with relevant and credible indicators, assess the risk and uncertainty of the assumptions and provide a cost-opportunity analysis of the Community financial intervention in order to demonstrate its added values.” (ECORYS, 2004)

The methodology of this report is based on the European Commission document ex ante evaluation- a practical guide for preparing proposals for expenditure programmes. As far as the specific details, this report followed a more in-depth guideline in the document named a handbook for impact assessment in the commission – How to do an Impact Assessment. Thus both this report made by ECORYS and the reference guidelines are proven to be useful data sources and references in this thesis.

It also should be noted that the amount of tonne-kilometres, which is the specific and operational objective for each of the actions in the Marco Polo II Programme, is defined as the main programme indicator in this report. All of the result and output calculated in this report are based on the amount of tonne-kilometres provided by each of the actions including modal shift actions, catalyst actions, common learning actions, motorway of the sea and the traffic avoidance actions.
In addition, the estimations of freight transport growth are derived from the PRIMES model which was presented by European Commission in the European Energy and Transport Trends to 2030 report. The reason of applying the PRIMES model is that PRIMES model distinguished 3 modes for freight transport in road, rail and inland

waterways. Besides, the Primes model has a wide geographical coverage of 30 European countries which is applicable in the Marco Polo II Programme. On the other hand, the PRIMES model doesn't take the split into domestic and international freight transport into consideration. Therefore the share of international road freight transport was calculated by ECORYS based on the road freight transportation data from Eurostat.

The most vital feature of the report made by ECORYS, which is essential for the research in this thesis, is that the impact assessment is a separate part in the evaluation. Besides the main indicator tonne-kilometres, external cost parameters is another concept presented in the report. The external cost parameters include air pollution, global warming, noise, safety, congestion and infrastructure. Firstly ECORYS set marginal cost estimation per tonne-kilometre for external impacts of all the six parameters. After that, ECORYS applied the result of shifted tonne-kilometres on the external cost parameters and get the final results of the external costs in billion euro. According to the results of the estimations, the congestion benefits represent around 65% of all quantified benefits so that congestion can be determined as the most beneficial part among the six parameters, which proves the importance of reducing the road congestion and the necessity of this thesis.

The minimum value for specific congestion costs is set at 0.0226 €/tonne-kilometre in the report. Since the congestion is highly time and location specific, this number of minium value of congestion is roughly assumed. Regarding this limitation of the report made by ECORYS, the specific time and location factors will be taken into consideration in the calculation of congestion cost in this thesis.

Chapter 3 Literature review on road congestion problems

To study the relationship between road congestion and the economy, it is essential to learn about the sources of road congestion and also the consequences. Most transportation analysts hold the concept that travel is a derived demand, i.e. that people normally travel to reach another destination where they can start (or carry out) an activity rather than for the sake of travelling itself (Stopher and Meyburg, 1976). On this basis, travelling can be described as a downward sloping demand curve in microeconomic theory.

On the other hand, the infrastructural road facility has a maximum capacity, and road congestion occurs when the volume of travel approaches the capacity of the facility. (Stopher, 2003) Thus, the road congestion problem in Europe means the existing road facility – at specific points in the road network – cannot handle the increasing traffic volume and the demand of road transportation. To solve the problem, one solution is to improve the road facility so that the capacity will increase and can handle more traffic volume. Another solution is to reduce the traffic volume on the road, which is exactly the goal of the Marco Polo II Programme as we have seen in the previous Chapter.

Road congestion also has three main negative consequences (Stopher, 2003). The first one is that road congestion can lead to travel time unreliability: vehicles may flow quite well at normal speed but may also easily break down due to the queues of congestion. This consequence makes it hard to predict the travel time. The second negative consequence is an increase in emissions, mostly as a result of frequent acceleration due to the bad condition of the road and due to unpredictable congestion. Moreover, road congestion means lower speeds on average, and lower speeds lead to the tendency for engines to emit more pollutants including volatile organic compounds and carbon monoxide. The third negative consequence of road congestion is the extra time needed for travelling. Apart from the normal travelling time, extra time for travelling means an additional cost for companies in many aspects, e.g. salary of the driver, fuel consumption, and even a bad impression caused by possible late delivery. Taking the negative consequences into account, road congestion is considered to have a negative impact on the economy. Under these circumstances, different methods are developed in order to estimate the exact cost of road congestion.

Authors Brons and Christidis used the TRANS-TOOLS transport model (TRANS-TOOLS, 2008) to calculate the congestion cost as one part of the total external costs such as air pollution, climate change, noise and accidents. The calculation is disaggregated to country level with the TRANSTOOLS model which includes the value of time for vehicles, the length of the road, the traffic flow per hour, the actual speed of vehicles and the free flow speed for each interurban road segment. The methodology of Brons and Christidis is reliable since the TRANS-TOOLS transport model has already proved itself to be a remarkable model considering the transport policy analysis (Trans-European transport network planning methodology, Ports and their connections within TEN-T). Nevertheless, the obstacle of applying the TRANS-TOOLS model lies in the required accuracy of the input data and the big assumptions of both actual speed and free flow speed that have to be made. In addition, the traffic flow per hour is not stable since there are peak hours on one day (and not on another) which means much higher traffic flows per hour.

CE Delft made a report regarding the external cost of transport in Europe. In this report, the external costs are also separated in five main aspects as the report made by Brons and Christidis. In this report, the TRANS-TOOLS transport model is also used by CE Delft to calculate congestion costs. What should be noted is that the possible user reaction of the external congestion costs are taken into account in the calculation as a price elasticity of demand. CE Delft used -0.5 as the short-term elasticity in road haulage and the long-term elasticity values are recommended to be commonly higher. And this is a good reference for the application of GSIM model in this thesis.

Regarding the elasticity of road freight traffic, Graham and Glaister (2004) made a comprehensive meta-study of all previous research about demand elasticities of road traffic. They collected a database that contains 143 different values for demand elasticities calculated by other researchers and built a linear regression model to find a more conclusive outcome of the demand elasticity with respect to road freight traffic. The result shows that the mean of these 143 numbers is -1.07 and the median is -1.05. The study made by Graham and Glaister (2004) also includes other kinds of elasticity assessments in other sectors like fuel demand elasticities with respect to the fuel price.

Tokarick (2010) did another detailed assessment on the elasticity of both demand and supply including every country in the world. He divided all countries in different groups of income, and the elasticities also in different types including long-run and short-run elasticities. The outcome is very useful for researchers to analyze the economic issues which should take elasticities into account.

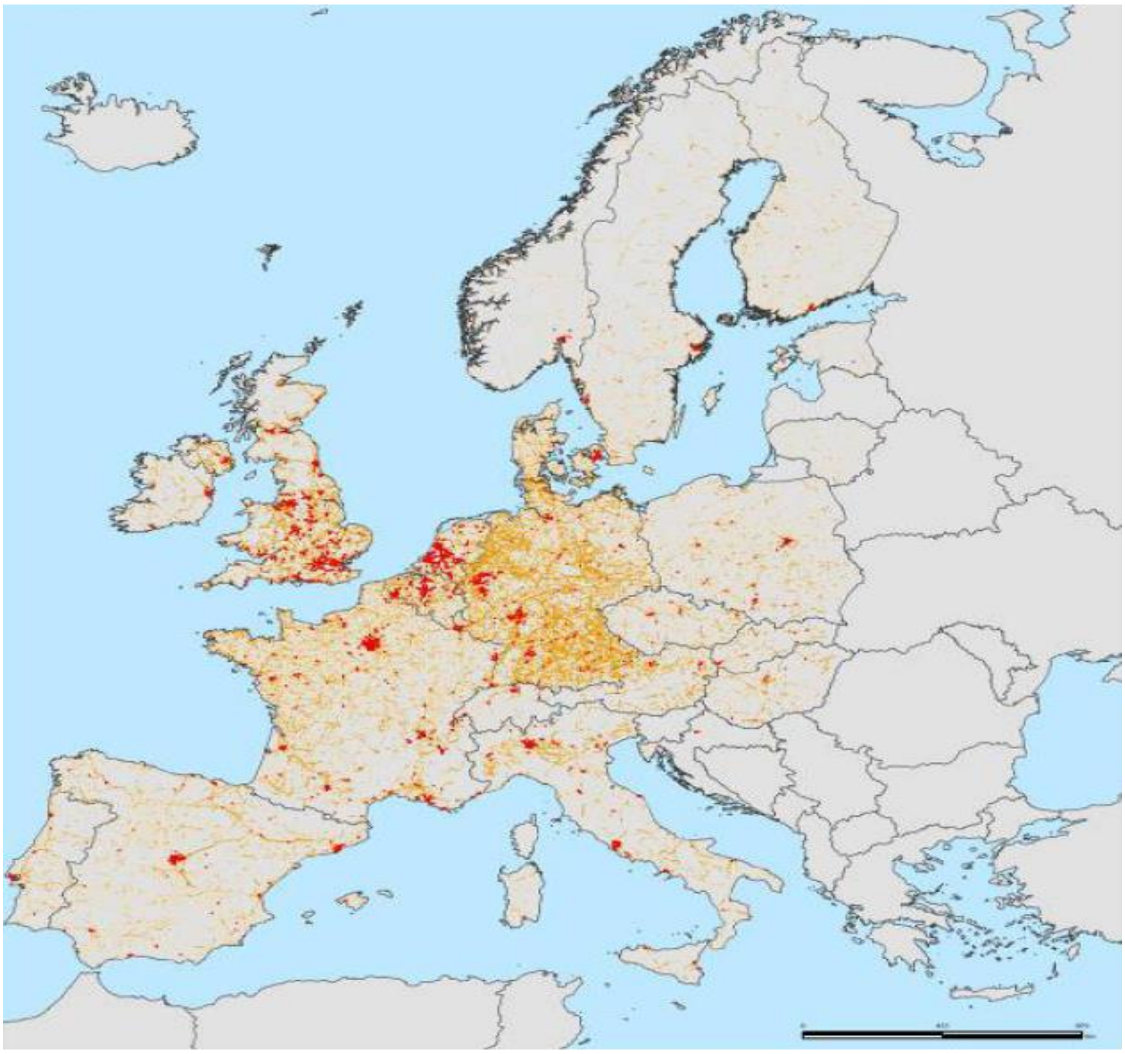
Mandayam and Prabhakar (2014) developed two models of highway traffic. The first model is a deterministic fluid model and the second one is a mean-field model of a series of infinite server queues. They consider the cost of congestion for vehicles traversing the highways as the total extra time they spend on the road due to congestion. And this fact helps them to formulate an optimal solution to shift users from peak to off-peak hours. According to their calculations, a shift of 10% peak time traffic to a 15 minutes interval slightly before or after the peak hour can reduce the cost of congestion by more than 19%. In EU study terms with would imply a 19%

decrease in the 1% costs of congestion is a decrease from 1% to 0.89% estimated cost. That is huge in absolute sense.

Koopmans (2003) made an estimation on congestion costs in the Netherlands and there are two core concepts behind the methodology of his study. The first concept is that in evaluating the costs of traffic congestion, two different types of costs are involved. The actual time losses are identified as the observed costs while the costs connected to changes in behavior that arise from congestion are identified as the unobserved costs. Koopmans has suggested that the unobserved costs can be related to the observed costs while most methods regarding congestion costs only focus on the observed costs. To test his suggestion, Koopmans used two methods to quantify congestion costs in the year 2000. And the output shows that the total costs of congestion in the Netherlands are much higher than the costs only based on observed congestion.

Christidis and Rivas (2012) also published a report of measuring road congestion. In the report, they use in-vehicle navigation systems to measure the real speed in different time periods and days of the week. By measuring the data they have collected, they get the actual congestion conditions of countries and regions which can be shown in a map. Figure 3.1 shows the actual condition of road congestion from the report of Christidis and Rivas. From the Figure it becomes clear that clearly in capitals and in north-west Europe, the congestion condition in the EU is worst. Based on the data collected, Christidis and Rivas (2012) made an advanced congestion classification regarding the average delay per km during 1 hour peak period of almost all EU member states.

Figure 3.1. Map of road congestion in Europe



Source: (P. Christidis and Ibanez Rivas, 2012)

Regarding the research of this thesis, in order to calculate the trade cost equivalent of road congestion (needed later as input for the GSIM model), we have chosen to use the trade cost equivalent model. In the next section, we will present the model and data used to calculate the trade cost equivalent of road congestion. It is also good to mention that from the aforementioned methodologies, we can take some useful insights into elasticities that we will apply in the GSIM model in the next Chapter.

Chapter 4 Methodology and Data

This chapter aims to describe the methodology applied for the evaluation of the impact of the Marco Polo II Programme on the EU economy. The choice of the model approach is explained by the comparison of the model available for this thesis. Furthermore, the mathematical description of the models used in this thesis, the explanation of the Marco Polo II Programme application in GSIM model as well as the methodology and description of the road congestion cost evaluation are also provided in this chapter

4.1 Comparison of the available methods

In order to assess both the impact of the Marco Polo II Programme on road congestion and also the impact of it on the EU's economy, a suitable method has to be chosen which can solve these two problems at the same time and given an answer to the following two sub-questions:

"How can we quantify the potential effect of the Marco Polo II Programme on road congestion?"

and

"How can we quantify the potential impact of road congestion on the economy?"

The chosen model has to be able to quantify the impact of the Marco Polo II Programme on road congestion. In addition, based on that set of results, the model also has to be able to present the impact of the Marco Polo II Programme on the EU economy in terms of output changes and trade effects.

We are considering the use of one of the following two models: the TRANS-TOOL transport model and the Global Simulation (GSIM) model.

TRANS-TOOL transport model

TRANS-TOOLS transport model (TOOLS for Transport Forecasting and Scenario testing) is a European transport network model that has been designed in projects which are funded by the European Commission Joint Research Centre's IPTS and DG TREN. It is developed as the main model for policy analysis and both passengers and freight are covered by TRANS-TOOLS model. Brons and Christidis (2008) have applied TRANS-TOOLS model in their report "External cost calculator for Marco Polo freight transport project proposals" in 2012. As one part of the external cost, congestion cost are calculated by TRANS-TOOLS model in this report. CE Delft also used TRANS-TOOLS model in order to calculate the congestion cost in their report "External Costs of Transport in Europe".

Even though TRANS-TOOLS has proved to be a valuable model to evaluate the congestion cost, it still has some limitation considering the goal of this thesis. The most important limitation is that although TRANS-TOOLS model can evaluate the congestion cost, it cannot connect the result of congestion cost to the economy in an EU scope and a scope of every single EU member state. Additionally, the essential input of data required by TRANS-TOOLS is considered as a vast amount which is too sophisticated to process in this thesis.

The Global Simulation (GSIM) model

The Global Simulation Model (GSIM) (Francois & Hall, 2003) is a model designed to analyze the impact of global, regional or unilateral trade policy. Through the approach of a partial equilibrium with a global or regional scope, it is possible for GSIM model to calculate the change in trade flows based on the changes in tariff or trade cost equivalents.

Compared with TRANS-TOOLS model, the biggest advantage of GSIM model is that by applying GSIM model, the impact of the Marco Polo II Programme on the EU's economy can be derived through the approach of a partial equilibrium. The output of GSIM model can show the change in trade flow of the EU and all EU member state.

By using TRANS-TOOLS model, we can get a number in the actual cost saved by the Marco Polo II Programme, but the actual cost saved is still too conceptual and not clear enough to show the impact of the Marco Polo II Programme on the EU's economy. By applying the GSIM model, we can get a clear image of the increase or decrease in trade flow of every EU member state Moreover and even the new trade values between two EU member states.

The GSIM model make it possible to assess the economic impact both in a scope of European Union and also in a scope of EU member states. We can learn the result come out of the GSIM model and see if the Marco Polo II Programme will help the trade between EU member states. And even see the impact on EU member states of different congestion level.

Moreover, by adding the United States and the rest of world as variables in the model, we can also know that whether the change inside the EU will affect the trade between the European Union and other partners. According to the output of the GSIM model, we are able to see if the ease of road congestion by the Marco Polo II Programme will make the EU member states tend to trade more between each other rather than trade with the United States or rest of world.

In addition, the change in total GDP will also be shown by the output of GSIM model, which is also a vital indicator in the evaluation of the economic impact.

The general description of the GSIM model, which is the primary model in this thesis, will continue in the next part of this chapter.

4.2 Methodology of Global Simulation Model (GSIM)

GSIM model input is inserted into three main matrices and three secondary matrices. The first matrix shows the initial trade values between the countries or regions. The second matrix illustrates the initial import tariff or – in this case – trade cost equivalent between the import country and the export country. The third matrix represents the final trade cost equivalent which may be lower or higher under the influence of the research target, e.g. the Marco Polo II Programme in this thesis.

The fourth and the fifth matrices illustrate the production subsidies before and after the search target imposed. And the last matrix provides the elasticities of the research target between the country of supply and the country of demand. The final outputs of the GSIM model are: output effects (% change), trade effects (% change), price effects (% change), and welfare effects (% change). The countries for which these data are provided depend on the number of origin and destination regions or countries that are inserted in the model in the first place.

In this thesis, the methodological approach of the matrices strictly complies with the mathematical structure of the GSIM model. Since the research target in this thesis is the EU's economy, we choose the EU member states as the dimensions in the GSIM model. Thus the output will present the change in trade flows of every single EU member state as well as the aggregate trade flow of the EU as a whole.

On the other hand, since a 28x28 matrix is large and complicated to run and takes the focus away from the main message of this thesis by generating too much data, resulting in an transparent set of outputs, we decided to use the data of the 15 biggest EU member states in trade flows (thus also heavy on transport) and add up the trade flows of the other 13 EU member states together, which will be replaced by "Rest of EU" in the GSIM model. In addition, we also add the United States of America and Rest of World (ROW) in order to make the calculation global and inclusive of all countries.

Furthermore, the initial and final trade cost equivalents will be discussed in the next section since another results of another model are used and reworked to evaluate the trade cost equivalents in the matrices.

The mathematical functions and parameters that are used in the GSIM model are shown in table 4.1.

Table 4.1. Notation of the variables of the GSIM model

Indexes	
r, s	*Exporting regions*
v, w	*Importing regions*
i	*Industry designation*
Variables	
M	*Import quantity*
X	*Export quantity*
$M_{(i,v)}$	*Aggregate imports*
$P_{(i,v)}$	*Composite price*
E_s	*Elasticity of substitution*
$E_{m,(i,v)}$	*Aggregate import demand elasticity (1)*
$E_{x,(i,r)}$	*Elasticity of export supply (2)*
$N_{(i,v),(r,r)}$	*Own price demand elasticity*
$N_{(i,v),(r,s)}$	*Cross-price elasticity*
$T_{(i,v),r}$	*The power of the tariff, T=(1+t)*
$\theta_{(i,v),r}$	*Demand expenditure share (3)*
$\emptyset_{(i,v),r}$	*Export quantity share (4)*
$t_{(i,r),v}$	*The tariff equivalent*

Source: (Francois & Hall, 2003)

In this case, since the Marco Polo II Programme influences all types of goods transported by road, the index i which stands for the industry designation will include all types of goods that are transported in European Union (aggregated into 14 regions), US and Rest of World.

The GSIM model is described in detail in Francois and Hall (2003). For the purpose of this thesis, we cover the main equations only and refer to Francois and Hall (2003) for further details. Some variables in Table 4.1 are defined by the following functions. The first is the aggregate import demand elasticity, defined by formula (1):

(1)
$$E_{m,(i,v)} = \frac{\sigma M_{(i,v)}}{\sigma P_{(i,v)}} \cdot \frac{P_{(i,v)}}{M_{(i,v)}}$$

The second one is the elasticity of export supply, which is defined by formula (2):

(2)
$$E_{x,(i,r)} = \frac{\sigma X_{(i,r)}}{\sigma P_{(i,r)}} \cdot \frac{P_{(i,r)}}{X_{(i,r)}}$$

The demand expenditure share is defined by formula (3) as follows:

(3) $$\theta_{(i,v),r} = M_{(i,v),r}\, T_{(i,v),r} / \sum_s \; M_{(i,v),s}\, T_{(i,v),s}$$

And the export quantity share is defined by formula (4):

(4) $$\emptyset_{(i,v),r} = M_{(i,v),r} \,/ \sum_w M_{(i,w),r}$$

According to the aforementioned functions, a modified version of equation which is defined to achieve a global equilibrium condition can be addressed as formula (5):

(5) $$\begin{aligned} E_{X(i,r)}\hat{P}_{i,r}* &= \sum_v N_{(i,v),(r,r)}\hat{P}_{(i,v),r} + \sum_v \sum_{s\neq r} N_{(i,v),(r,s)}\hat{P}_{(i,v),s} \\ &= \sum_v N_{(i,v),(r,r)}[P_r * + \hat{T}_{(i,v),r}] + \sum_v \sum_{s\neq r} N_{(i,v),(r,s)}[\hat{P}_s * + \hat{T}_{(i,v),s}] \end{aligned}$$

4.3 The Marco Polo II *Programme application to GSIM Model*

As mentioned in 4.2, since the goal of this thesis is to evaluate the impact of the Marco Polo II Programme on the EU economy, we make sure that the entire EU economy is covered. However, in addition, we also specify some EU member states individually – this will help us get more detailed and – from a policy perspective – more interesting results. As explained in the previous section, we also add the US and Rest of World. This means we end up with an 18x18 matrix in GSIM.

As explained above, the GSIM model includes six matrices. The fourth and the fifth matrices stand for the initial bilateral export and production subsidies and the final bilateral export and production subsidies. Because the Marco Polo II Programme is not a programme that deals with subsidies from the governments to the single European Union member states, we will not use this policy option.

The first matrix of the GSIM model is a matrix designed for the initial value of trade flows from the export countries or regions to the import countries or regions. Since we set the 15 biggest EU member states in trade value and add the other 12 EU member states together as “Rest of EU”, the data of these 12 EU member states will be added up and shown in the first matrix as “Rest of EU”. In addition, we will also add all trade data (import and export) from and to the US and Rest of World. That ensures we capture global trade.

The second matrix contains the initial trade cost equivalents between the importing and exporting countries. In this case, the initial trade cost equivalent is related to the road congestion cost due to the negative consequences caused by road congestion. As discussed before, the negative consequences of road congestion include the travel time unreliability, the increase in emission and extra time for travelling. These negative consequences lead to a higher cost for freight transportation, which can be considered as a tariff equivalent in this case. The calculation and explanation of this trade cost equivalent will be brought out later in this thesis.

The third matrix of the GSIM model contains the final trade cost equivalent between the import countries and the export countries. In this case, the Marco Polo II Programme leads to the change in the road congestion condition in Europe. Therefore, the trade cost equivalent will also change due to the application of the Marco Polo II Programme. Based on the explanation and calculation of both the initial and final trade cost equivalent in the second and the third matrix, the fourth sub-research question *"How to quantify the effect of the Marco Polo II Programme regarding road congestion?"* will also be answered.

The last matrix of the GSIM model contains the elasticities of composite demand, supply of the industry and the substitution elasticity. The supply elasticity and the elasticity of substitution have been discussed and set at 10 and 1.5 separately by Francois and Hall in the literature already. Thus we also decided to use these values in this thesis – given the diversity of countries and general trade patterns we look at, this is a best guestimate. Considering the elasticity of demand, we decide to use -1.0 as the elasticity of demand in this case with reference to the study made by Graham and Glaister (2004). In their study, the mean and the median of elasticity of demand with respect to road freight traffic is -1.07 and -1.05. In addition, CE Delft also recommended a long-term elasticity of demand lower than -0.5, which is the estimation of short-term elasticity of demand used in their report. Compared with the elasticity of demand of EU member states, the elasticity of demand of the United States and the rest of world are in accordance with the study of Tokarick (2010). In order to examine the accuracy of the output, we will also run a sensitivity analysis in Chapter 5 to see whether the assumption about elasticity of demand is important in driving the results or not.

Last but not least, according to the literature review in Chapter 2, the report "Evaluation of the Marco Polo Programme 2003-2010" made by Europe Economics presented both the expected achievement rates and the actual achievement rates of the first Marco Polo Programme. As a matter of fact, the result of the report shows that the actual achieve rate of the first Marco Polo Programme is lower than the expected achieve rate. Since the Marco Polo II Programme was still ongoing when the report was published, we will design two scenarios of the GSIM model in order to make the evaluation more precise. In the first scenario, we assume that the actual achieve rate of the Marco Polo II Programme reach 80 percent of the expected achieve rate, which is good enough compared with the actual achieve rate of the first Marco Polo Programme. Meanwhile, in the second scenario we assume that the actual achieve rate of the Marco Polo II Programme reach 50 percent of the expected achieve rate, which is close to the actual achieve rate of the first Marco Polo Programme according to the report made by Europe Economics.

4.4 Data collection of the trade flow

In this part, we will discuss the first step of data collection for the GSIM modelling in this case.

As mentioned before, the GSIM model in this thesis contains 6 matrices with the size of 18x18. We collect the data of trade value between all EU member states, trade value between EU member states and the United States as well as the trade value between EU member states and the rest of world. In addition, we also collect the data of trade value between the United States and the rest of world.

What should be noted is that the modal split condition should be considered before we put the trade value directly into the matrix. Due to the difference in the modal split condition in the Europe Union, the actual number of cargo volume transported by road also varies a lot between the EU member states. For example, 56.2 percent of the cargos are transported by road in the Netherlands in 2013 while 95.4 percent of the cargos are transported by road in Spain (Eurostat, 2015).

The huge gap in modal split rate leaves a big impact on the trade value of the EU member states. We take this into account. On the other hand, the modal split rates only appear relevant in the calculation of the trade values between the EU member states, because the trade cost equivalent of road congestion is affected by Marco Polo II only within the scope of the EU. Thus the intermodal split does not influence the trade flow between the EU and the United State nor EU and the Rest of World in this thesis.

In table 4.2, the 15 biggest EU member states in trade flow are replaced together by "EU 15".

Table 4.2. Example of the first matrix of GSIM model in trade flow

Matrix 1		Import	Import	Import	Import
		EU 15	Rest of EU	US	Rest of world
Export	EU 15	Trade value	Trade value	Trade value	Trade value
Export	Rest of EU	Trade value	Trade value	Trade value	Trade value
Export	US	Trade value	Trade value	Trade value	Trade value
Export	Rest of world	Trade value	Trade value	Trade value	Trade value

Source: Created by Author

The source of the data is from WITS (World Integrated Trade Solution) and the year of the source is 2013, which is the most recent and reliable data available. The detail of the first matrix of GSIM model can be reviewed in the Appendix.

It is challenging to find the data of trade flows between every EU member state and the Rest of World, since only the total trade flow of one country and the trade flow between two countries are available from WITS. We decide to use the following formulas to calculate the trade values. The variables used in this formula are in accordance with the variables in table 4.1.

(6) $$M_{(rest\ of\ world,r)} = total\ X_r - \sum X_{(r,EU)} - X_{(r,US)}$$

(7) $$M_{(rest\ of\ world,US)} = total\ X_{US} - \sum X_{(US,EU)}$$

4.5 Trade cost equivalent model

In this section, the methodological approach of the trade cost equivalent in the GSIM model will be thoroughly explained. After explaining the method, the road congestion model will be introduced to calculate the trade cost equivalent between the countries of supply and the countries of demand in the GSIM model matrix. The sub-research question *"How to quantify the effect of the Marco Polo II Programme regarding road congestion?"* will be answered in this section.

4.5.1 Methodological approach of the trade cost equivalent

The second matrix in the GSIM model illustrates the initial trade cost equivalent between the country of supply and the country of demand. Thus, in this case we need to transform the road congestion to trade cost equivalent instead of applying an import tariff as in the traditional GSIM model. Due to the scarcity of such kind of data for road congestion, we need to find other data available so as to transform the road congestion to trade cost equivalents.

The European Commission has released a report include the estimation of the annual cost of road congestion per EU member state, both in absolute terms and as share of Gross Domestic Product. According to the absolute number of congestion cost estimated by European Commission and the trade value of every EU member state, we can derive the percentage of congestion cost in the total trade value.

As discussed in Chapter 3, road congestion leads to several negative consequences including travel time unreliability, increase in emissions and extra travel time. All these negative consequences cause extra costs in road transportation, i.e. the road congestion cost. Based on this theory, the percentage of road congestion cost in the total trade value of road transportation, which should be responsible for the higher total transportation cost, is considered as the initial trade cost equivalent in this case.

Due to the huge gap of modal split condition in the European Union member states, the total trade value of road transportation depends on the modal split rate. Hence the modal split rate will be added to the road congestion model to get a more accurate number of the value of trade – upon which we will then unleash the Marco Polo II policy.

Different from the calculation of the initial trade cost equivalent, the methodological approach of the final trade cost equivalent is more complicated in this thesis. The amount of tonne-kilometres is considered a major indicator in the achievement of the Marco Polo II Programme. By deriving the data of total cargo transported by road in tonne-kilometres, we are able to get the percentage of the volume of goods shifted off the road, and this percentage will be one part of the road congestion model presented in this section.

Mandayam and Prabhakar (2014) used two model to evaluate the highway traffic. The first model is a deterministic fluid model and the second one is a mean-field model of a series of infinite server queues. They observed that a shift of 10% peak time traffic to 15 minutes interval slightly before or after the peak hour can lead to a 19% reduction of congestion cost. On the other hand, the congestion rates of the EU member states vary a lot. For example, according to the traffic scorecard presented by INRIX, Belgium has a very high congestion index of 20.2 in a 12 months duration while Portugal only has a very low congestion index of 3.0.

The big difference in congestion index indicates that the peak time last much longer in Belgium than in Portugal, and the longer peak time means that more cargos are shifted off the road in Belgium. Based on the model designed by Mandayam and Prabhakar (2014), if there are more shift of peak time traffic, the reduction of congestion cost will also be greater.

Therefore, taking the gap of congestion rate in different European Union member state into consideration, we calculate the average congestion index of all EU member states and then divide the congestion index of every single EU member state by the average congestion index to get a final rate of congestion rate for every EU member state.

The final percentage of congestion rate influence the actual achieve rate of the Marco Polo II Programme in shifting the road traffic. Besides the congestion rate, the Marco Polo II Programme also has its own standard to evaluate whether one project is successful or not. Hence we design two different scenario for different achieve rate of the Marco Polo II Programme. The road congestion model will use 50 percent as the achieve rate in the first scenario and 80 percent as the achieve rate in the second scenario.

4.5.2 Trade cost equivalent model application

In this section, the methodological approach of the road congestion model which is designed to quantify the trade cost equivalent in the GSIM model will be explained more thoroughly.

As mentioned before, the second matrix in the GSIM model contains the initial trade cost equivalent between the country of supply and the country of demand. To transform the congestion cost in the EU into trade cost equivalent, we use the trade value as the main factor in the transformation. Besides the total trade value, modal split rate is essential to get the accurate volume of cargo transported by road. Thus the actual trade value should be the product of the total trade value and the modal split rate of road freight. And the model of initial trade cost equivalent can be defined in formula (1) as follows.

(8) $$Initial\ Tariff\ Equivalent = 1 + \frac{Congestion\ cost}{trade\ value * modal\ split\ rate}$$

The final trade cost equivalent is quantified by the reduction rate on the basis of the initial trade cost equivalent. The first step to quantify the reduction rate is to calculate the volume of cargo removed from the road freight after the Marco Polo II Programme applied. An important indicator of the Marco Polo II Programme is the number of volume of goods shifted off the road in tonne-kilometres, and the data of total volume of goods transported by road in tonne- kilometres can also be found on Eurostat.

Since the Marco Polo II Programme contains too many projects every year and there are more than 100 projects during the Programme period 2007-2013, it is too complicated to assess all the projects in this thesis. Therefore we choose 18 projects of the Marco Polo II Programme which are the most successful projects and also cover more road traffic routes in EU member states than the others.

Additionally, member states of European Unions have different congestion rates. Some EU member states have much severe road congestion than the other members which means the peak time of these countries are much longer than the peak time of the others. Hence the shift of the cargo volume off the roads have more impact on these countries.

To assess the impact of the congestion rates on different EU member states, we introduce the data of average delay per km during 1 hour peak period collected by

Christidis and Rivas (2012) in their report: Measuring road congestion published in 2012. By calculating all the data of average delay of EU member states, we can get the data of average delay of separate EU member state and find an average of delay for all EU member states. By comparing these two numbers, we get the final congestion index of all EU member states.

Table 4.3 shows the initial basis of the calculation. And formula (2) show the method of the calculation of congestion index.

Table 4.3. Average delay per km during 1 hour peak period

	Average delay per km (second)				
	1 to 5	5 to 10	10 to 20	Higher than 20	Higher than 10
UK	48.2%	25.7%	11.1%	8.8%	19.9%
Belgium	42.7%	35.1%	12.6%	6.4%	19.1%
Netherlands	46.3%	32.0%	11.6%	6.4%	18.0%
Luxembourg	44.5%	36.2%	9.6%	5.8%	15.3%
Germany	46.7%	36.8%	9.5%	4.3%	13.8%
Italy	50.7%	25.2%	7.9%	4.7%	12.6%
Hungary	65.7%	19.0%	7.3%	4.1%	11.4%
Poland	60.8%	21.7%	6.4%	4.5%	10.9%
Slovakia	57.8%	26.6%	7.6%	2.6%	10.2%
Ireland	61.8%	18.7%	5.2%	4.1%	9.3%
Czech	52.8%	28.0%	6.3%	2.5%	8.8%
Austria	55.7%	28.4%	5.8%	2.7%	8.5%
France	61.1%	19.4%	5.3%	2.7%	7.9%
Portugal	57.3%	21.0%	5.5%	2.3%	7.9%
Denmark	62.8%	20.9%	5.2%	2.3%	7.5%
Sweden	70.7%	13.6%	3.5%	1.5%	5.0%
Spain	68.2%	16.8%	3.7%	1.2%	4.9%
Lithuania	78.6%	9.4%	1.9%	1.7%	3.6%
Estonia	74.4%	8.3%	1.9%	1.2%	3.2%
Finland	74.8%	13.4%	2.1%	0.8%	2.9%
Croatia	59.1%	22.81%	6.5%	3.5%	10.0%
Malta	59.1%	22.81%	6.5%	3.5%	10.0%
Cyprus	59.1%	22.81%	6.5%	3.5%	10.0%
Bulgaria	59.1%	22.81%	6.5%	3.5%	10.0%
Greece	59.1%	22.81%	6.5%	3.5%	10.0%
Latvia	59.1%	22.81%	6.5%	3.5%	10.0%
Slovenia	59.1%	22.81%	6.5%	3.5%	10.0%
Romania	59.1%	22.81%	6.5%	3.5%	10.0%

Source: Compile by Author based on (Christidis & Rivas, 2012)

What should be noted is that the data of Croatia, Malta, Cyprus, Bulgaria, Greece, Latvia, Slovenia and Romania are missing in the report of Christidis and Rivas (2012), thus we take the average rate.

Based on Table 4.3, we present the calculation of the final congestion index in formula (2).

(9)
$$congestion\ index = \frac{1*delay\ rate_{1-5}+5*delay\ rate\ _{5-10}+10*delay\ rate\ _{10-20}+20*delay\ rate\ _{20+}}{1*average\ delay\ rate_{1-5}+5*average\ delay\ rate\ _{5-10}+10*average\ delay\ rate\ _{10-20}+20*average\ delay\ rate\ _{20+}}$$

After calculating the final congestion rates of all EU member states, we can get formula (2) calculating the reduction rate of the trade cost equivalent of every single EU member states.

(10)
$$reduction\ rate = \frac{\sum removed\ tonne-kilometres\ off\ the\ road}{total\ tonne-kilometres\ by\ road} * Congestion\ index$$

Based on the reduction rate of the trade cost equivalent of every EU member states, we are able to get the final trade cost equivalent which is the input data in the third matrix of the GSIM model. What should be noted that since there are two scenarios exist in this case, we need two different actual achieve rate in different scenarios.

In the first scenario, we assume that the Marco Polo II Programme is a big success and the average achieve rate reach 80 percent of the initial plan. In the second scenario, we assume that the Marco Polo II Programme is not that successful and the average actual achieve rate is 50 percent, which is almost the same as the first Marco Polo II Programme. The calculation of final trade cost equivalent are shown in formula (3) and formula (4)

Scenario 1

(11)

$$final\ tariff\ equivalent = initial\ tariff\ equivalent - (initial\ tariff\ equivalent - 1) * reduction\ rate * 0.8$$

(12) Scenario 2

$$final\ tariff\ equivalent = initial\ tariff\ equivalent - (initial\ tariff\ equivalent - 1) * reduction\ rate * 0.5$$

The trade cost equivalent between the EU member states and the United States as well as the rest of world is complicated to calculate in this case since we only consider the congestion cost as the initial trade cost equivalent between EU member states. Thus we assume that the initial trade cost equivalent between the EU member states and the United States is the import tariff between them and exclude the non-tariff barriers. And the same as the initial trade cost equivalent between the EU member states and the rest of world.

According to the data of import tariff in 2009, the import tariff of the United States on the EU regarding all type of products is 3.75 percent, and the import tariff of the EU member states on the United States is 5.2 percent. The import tariff between EU and the rest of world is 6.29 percent and 4.41 percent on average. All the assumption of initial trade cost equivalent between EU and other trade partners are shown in table 4.3 as follows.

Table 4.4. Example of the GSIM model in initial trade cost equivalent

Matrix 2	Initial Trade cost equivalent	Import	Import	Import	Import
		EU 15	Rest of EU	US	Rest of world
Export	EU 15	Wait for calculation	Wait for calculation	1.0375	1.0629
Export	Rest of EU	Wait for calculation	Wait for calculation	1.0375	1.0629
Export	US	1.052	1.052	1.0	1.0738
Export	Rest of world	1.0441	1.0441	1.0298	1.0665

Source: Compiled by Author

4.5.3 Initial trade cost equivalent

Based on formula (1), we can get all the initial trade cost equivalent values between the EU member states. The results of the calculations are shown in the following tables. And the data source of congestion cost and trade value are from Eurostat and WITS.

At first, the trade value and the rate of the freight by road are presented in table 4.3.

Table 4.5. Road Trade value of 15 EU member states

Country	Total Trade Value (in thousand Euro)	Modal Split Rate (Road)	Road Trade value (in thousand Euro)
Germany	1405076680	63.9%	897843998
France	737151698	80.6%	594144268
The Netherlands	621032310	56.2%	349020158
UK	550144258	86.7%	476975071
Italy	482443277	86.9%	419243207
Belgium	551579868	64.5%	355769014
Spain	338430642	95.4%	322862832
Poland	270005636	82.9%	223834672
Austria	224141696	52.8%	118346815
Sweden	181881444	61.8%	112402732

Country	Total Trade Value (in thousand Euro)	Modal Split Rate (Road)	Road Trade value (in thousand Euro)
Czech Republic	214293229	79.7%	170791703
Hungary	135848361	75.5%	102565512
Denmark	117437545	86.8%	101935789
Finland	79974149	71.8%	57421439
Slovakia	114681173	76%	87157691

Source: Compiled by Author

Since the modal split rates of the rest EU member states are different and cannot be simply calculated together. We need to calculate the road trade value of the rest EU member states separately according to the different modal split rate. And the results are shown in table 4.4.

Table 4.6. Road trade value of rest EU member states

Country	Total Trade Value (in thousand Euro)	Modal Split Rate (Road)	Road Trade value (in thousand Euro)
Croatia	18828660	76.2	14347439
Bulgaria	33772707	75.9	25633484
Cyprus	7407360	100	7407360
Estonia	23482336	55.9	13126626
Greece	40840146	98.8	40350064
Latvia	21005173	39.6	8318048
Lithuania	32237548	66.4	21405732
Luxemburg	30191308	94.2	28440212
Malta	6393749	100	6393749
Portugal	86773914	94.1	81654253
Romania	89002967	57.5	51176706
Slovenia	39426041	80.7	31816815
Ireland	106869862	98.9	105694294

Source: Compiled by Author

Based on table 4.3 and table 4.4, the initial trade cost equivalent can be calculated. The data of rest EU member states in table 4.4 are aggregated and shown as “Rest of EU” in table 4.5 as follows.

Table 4.7. Initial trade cost equivalent of all EU member states

Country	Road Trade Value (in thousand Euro)	Congestion Cost (in thousand Euro)	Initial Trade cost equivalent
Germany	897843998	24200000	1.027
France	594144268	16500000	1.028
The Netherlands	349020158	4700000	1.014
UK	476975071	24500000	1.051

Country	Road Trade Value (in thousand Euro)	Congestion Cost (in thousand Euro)	Initial Trade cost equivalent
Italy	419243207	14600000	1.035
Belgium	355769014	3400000	1.01
Spain	322862832	5500000	1.017
Poland	223834672	4800000	1.022
Austria	118346815	1800000	1.015
Sweden	112402732	2600000	1.023
Czech Republic	170791703	800000	1.005
Hungary	102565512	700000	1.007
Denmark	101935789	1500000	1.015
Finland	57421439	1400000	1.024
Slovakia	87157691	300000	1.004
Rest of EU	435764786	9811000	1.025

Source: Compiled by Author

4.5.4 Final trade cost equivalent

According to the formula (3) of final trade cost equivalent regarding the impact of the Marco Polo II Programme, the first step in calculating the final trade cost equivalent is to collect the information of all 18 most successful projects among the Marco Polo II Programme. Therefore we will introduce these 18 projects as follows.

Most Successful Marco Polo II Project 1: Reefer Express

Figure 4.1. Overview of Project 1

Reefer Express is a project sponsored by the Marco Polo II Programme aiming to provide short-sea container service between the ports of Bilbao in northern Spain, Sheerness in England and Rotterdam in the Netherlands. The major clients of Reefer Express are fruit and vegetable producers in southern Spain who supply the British and Dutch retail market. The previous routes covers the roads in Spain, France, Belgium and the Netherlands. Reefer Express proves that sea routes can compete for this transport market. And before the project was established, this traffic all went overland by trucks across the Pyrenees and France to the Netherlands.

Source: (EACI, 2009)

Table 4.8. Information of Project 1

Project name	Reefer Express
Lead partner	Modal shift
Volume of goods shifted off the road	286 Million tonne-kilometres (per year)
EU member states involved	Spain, France, Belgium, the Netherlands, UK

Source: Compiled by Author

Most Successful Marco Polo II Project 2: ENERCON Tri-Modal

Figure 4.2. Overview of Project 2

Source: (EACI, 2009)

ENERCON Tri-Modal is a project of Marco Polo II Programme lead by German wind turbine manufacturer, ENERCON. And ENERCON Tri-Modal focus on shifting road freight to rail and ship. The project involves using rail and ship to move components from Germany to Viana de Castelo in Portugal, as well as to installation sites throughout Europe. The novalty is that ENERCON is using rail for over size shipments like rotor blades, the electrical equipment modules and tower sections of wind turbines.

Table 4.9. Information of Project 2

Project name	ENERCON TRI-Modal
Lead partner	Modal shift
Volume of goods shifted off the road	221 Million tonne-kilometres (per year)
EU member states involved	Portugal, Spain, France, Belgium, the Netherlands, Germany

Source: Compiled by Author

Most Successful Marco Polo II Project 3: Via Danube

Figure 4.3. Overview of Project 3

Source: (EACI, 2009)

Via Danube is a river-borne freight service that is trusted by clients and a quality alternative to road transport throughout Europe. The project aims to upgrade the Danube as a freight corridor through the heart of Europe, stretching from northern France via Germany to the black sea. It makes the current road routes from France and Germany to Bulgaria and Romania into intermodal via the Danube. Freight travels by road from Maubeuge (France) and Waghausel (Germany) to Passau in Bavaria and is transferred to river barges bound for Vidin in Bulgaria where it is offloaded to continue by road to Sofia and Bucharest. For some return journeys the departure port has been changed to Russe where is more convenient for the Romanians car plants which have started using the Via Danube service.

Table 4.10. Information of Project 3

Project name	Via Danube
Lead partner	Modal shift
Volume of goods shifted off the road	173 Million tonne-kilometres (per year)
EU member states involved	France, Belgium, Germany, Slovenia, Hungary, Romania, Bulgaria, Austria, Croatia,

Source: Compiled by Author

Most Successful Marco Polo II Project 4: CGTK

Figure 4.4. Overview of Project 4

Source: (EACI, 2009)

Consolidation of Goods Transport over the Kvarken Straits (CGTK) provides a full freight service over the shortest sea crossing between Finland and Sweden from Vaasa to Umea. Before the service started in 2004, large trucks travelling between Finland and Sweden often took the overland route round the northern end of the Gulf of Bothnia. This involved a distance of 820 kilometres, compared with 90 kilometres and a crossing time of four hours for the Kvarken Straits sea link. The new vessels used in CGTK has more lane metres for carrying trucks and the gate and freight-deck dimensions allowed for more and larger loads. The lead company of CGTK doubled the cargo volume during the project peroid as set out in the project proposal. With the additional capacity, CGTK is able to market the service more intensively than before.

Table 4.11. Information of Project 4

Project name	Consolidation of Goods Transport over the Kvarken Straits
Type of Project	Modal shift
Volume of goods shifted off the road	110 Million tonne-kilometres (per year)
EU member states involved	Portugal, Spain, France, Belgium, the Netherlands, Germany

Source: Compiled by Author

Most Successful Marco Polo II Project 5: Sirius 1

Figure 4.5. Overview of Project 5

Source: (EACI, 2009)

Rail is particularly suited for handling single products which are transported in large quantities like bottled water. With the Marco Polo II Project Sirius 1, the French mineral water company, Sa des Eaux Minerales d'Evian, is switching to rail from its Volvic spring in central France to iys German distribution center at Hockenheim, near Frankfurt- a distance of 711 kilometres. From there, it is distributed to final clients in Germany by road. Trains return from Hockenheim with empty crates. Previously, the whole journey in both directions was by road. The modal shift means that 70 percent of the average distance from Volvic to final destinations in Germany is now covered by rail. The company says that in an entire year of operation, the switch is the equivalent of taking 10000 trucks off the road.

Table 4.12. Information of Project 5

Project name	Sirius 1
Lead partner	Modal shift
Volume of goods shifted off the road	114 Million tonne-kilometres (per year)
EU member states involved	France, Belgium, Germany, the Netherlands

Source: Compiled by Author

Most Successful Marco Polo II Project 6: Marocco Seaways

Figure 4.6. Overview of Project 6

Source: (EACI, 2009)

The goods, which now carried by sea, took a longer overland route before Italian shipping line, Grandi Navi Veloci (GNV) launched its RO/Pax service from Genoa to Tangiers in Morocco via Barcelona. From Italy, they went by road to Algeciras at the southern tip of Spain before crossing the Mediterranean. The service carries goods from the hinterland of both European ports- stretching as far as the Milan region in the case of Italy

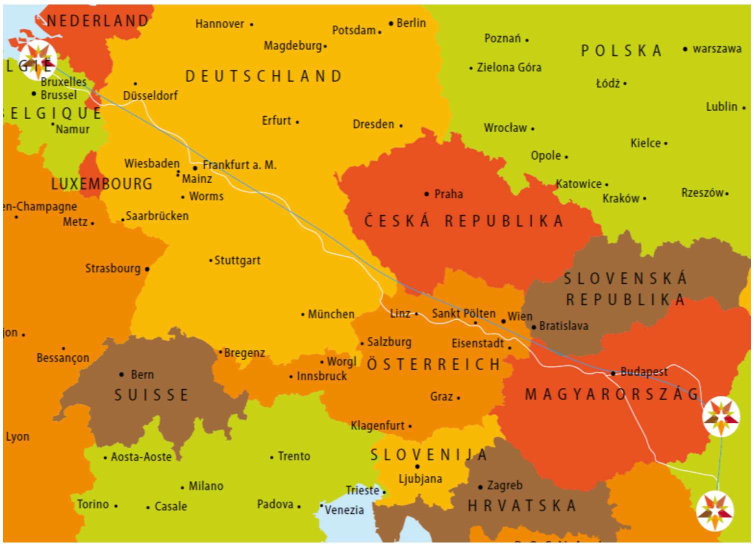
Table 4.13. Information of Project 6

Project name	Marocco Seaways
Lead partner	Modal shift
Volume of goods shifted off the road	307 Million tonne-kilometres (per year)
EU member states involved	Spain, France, Italy

Source: Compiled by Author

Most Successful Marco Polo II Project 7: T-REX

Figure 4.7. Overview of Project 7



The new services provided by T-REX (Trans-Romanian Express) rail freight services between Belgium and Romania is faster than sending goods by road – 42 hours rather than 48 hours. The timings are more reliable and the service is available over the weekend – when Austrian

Source: (EACI, 2009)

and German roads are closed to trucks. Goods are loaded on the train in Genk, in the hinterland of Antwerp on Friday evening and will be delivered in Bucharest or

Sofia on Monday morning. This is an impossible mission by road. IFB, the lead partner of this project, estimates that the rail service is taking 11500 trucks a year off the road or 225 kilometres of trucks from head to tail.

Table 4.14. Information of Project 7

Project name	T-REX
Lead partner	Modal shift
Volume of goods shifted off the road	214 Million tonne-kilometres (per year)
EU member states involved	Belgium, the Netherlands, Germany, Austria, Hungary, Romania

Source: Compiled by Author

Most Successful Marco Polo II Project 8: L.O.G.I.S.T.I.C.

Figure 4.8. Overview of Project 8

Source: (EACI, 2009)

The project named L.O.G.I.S.T.I.C. took advantage of rising demand for LPG (Liquified petroleum gas) in central and eastern Europe, and falling consumption in Italy at a time when production was rising as a by-product of increased diesel fuel and petrol output. A rail service existed, but was not competitive because it was based on single and hoc loads. L.O.G.I.S.T.I.C. launched a delicated block train service- 12 to 14 wagons at a time.

Table 4.15. Information of Project 8

Project name	L.O.G.I.S.T.I.C.
Lead partner	Modal shift
Volume of goods shifted off the road	90 Million tonne-kilometres (per year)
EU member states involved	Italy, Austria, Germany, Czech, Poland, Slovakia, Slovenia, Croatia

Source: Compiled by Author

Most Successful Marco Polo II Project 9: Gulf Stream

Figure 4.9. Overview of Project 9

Source: (EACI, 2009)

Gulf Stream is a Marco Polo II project offering a motorway-of-the-sea alternative for freight traffic between northern Spain and southern England. It has two special features. The first feature is that it is a freight-only roll-on/roll-off service. This means that trucks and unaccompanied trailers do not have to compete for space with tourists vehicles during the holiday season. The second feature is that the service operates one return sailing every weekend between the Spanish port of Santander and Poole on the English south coast so as to take advantage of the weekend ban on heavy trucks using the French national road network. According to Brittany Ferries, which operates the service, the door-to-door cost and duration is less than overland transit via France. The main users of the service are transport firms based in Spain and Portugal at the southern end and UK and Irish hauliers at the English end. The service eases congestion at the Franco-Spanish frontier and at the Channel ports.

Table 4.16. Information of Project 9

Project name	Gulf Stream
Lead partner	Modal shift
Volume of goods shifted off the road	145 Million tonne-kilometres (per year)
EU member states involved	Spain, France, UK

Source: Compiled by Author

Most Successful Marco Polo II Project 10: Scandinavian Shuttle

Figure 4.10. Overview of Project 10

Source: (EACI, 2009)

The Scandinavian Shuttle uses the Oeresund fixed link, which is one of Europe's biggest infrastructure projects co-funded by the EU, to help create a viable rail freight corridor between continental Europe and Scandinavia. It targets the central stretch of the corridor – from the Ruhr region of Germany to southern and central Sweden via Denmark. The Scandinavian Shuttle operates a daily rail service with fixed journey times, providing just-in-time goods deliveries in both directions. It uses the Oeresund tunnel and bridge between Copenhagen and Malmoe. Before the Scandinavian Shuttle, the main option for customers was a combination of truck and ferry services between Germany and Sweden.

Table 4.17. Information of Project 10

Project name	Scandinavian Shuttle
Lead partner	Catalyst action
Volume of goods shifted off the road	231 Million tonne-kilometres (per year)
EU member states involved	The Netherlands, Germany, Denmark, Sweden

Source: Compiled by Author

Most Successful Marco Polo II Project 11: ItaloExpress

Figure 4.11. Overview of Project 11

When outside evaluators looked at the ItaloExpress project for the European Commission, they commented positively on the punctuality and reliability of this new rail service from northern Germany to northern Italy. These had previously been major issues on this route. By introducing tracked-and-traced intermodal service using its own locomotives and wagons, ItaloExpress has been able to offer

Source: (EACI, 2009)

change not only in reliabiliy and punctuality, but also in the form of flexibility and transport pricing.

Table 4.18. Information of Project 11

Project name	ItaloExpress
Lead partner	Catalyst action
Volume of goods shifted off the road	338 Million tonne-kilometres (per year)
EU member states involved	Italy, Austria, Germany

Source: Compiled by Author

Most Successful Marco Polo II Project 12: BaSS

Figure 4.12. Overview of Project 12

The aim of BaSS is to increase the share of sea transport in the overall freight traffic between Germany and the Baltic states, and on to Poland and Russia. An existing service between Rostock and Liepaja was moved to Ventspils, another Latvian port, and expaned through the deployment of an additional vessel. This doubled capacity and frequency

Source: (EACI, 2009)

Table 4.19. Information of Project 12

Project name	BaSS
Lead partner	Modal shift
Volume of goods shifted off the road	219 Million tonne-kilometres (per year)
EU member states involved	Germany, Poland, Lithuania, Latvia

Source: Compiled by Author

Most Successful Marco Polo II Project 13: FGI System

Figure 4.13. Overview of Project 13

Source: (EACI, 2009)

Production of glass is not evenly distributed across Europe. The production plants are in northern Europe, in particular Belgium, France and the Netherlands, and the consumers are everywhere. This creates a need for specialist long-distance transport. The FGI system project is for the first time deploying a modified design of the special inloaders and using cranes to transfer them from the road to flatbed railway wagons.

Table 4.20. Information of Project 13

Project name	FGI System
Lead partner	Catalyst action
Volume of goods shifted off the road	100 Million tonne-kilometres (per year)
EU member states involved	France, Belgium, Italy

Source: Compiled by Author

Most Successful Marco Polo II Project 14: The WestBed Bridge

Figure 4.14. Overview of Project 14

Source: (EACI, 2009)

The WestBed Bridge is an improved service after the Marco Polo Eurostars project which ran from 2004-2006 and launched a route go across the Mediterranean instead of go by road through northern Italy, acorss southern France and down the Spanish coast to get from Civitavecchia just north of Rome to Barcelona in Spain. The WestBed Bridge has bigger vessels with increasing loading capacity for rolling freight by 65%. And it is over 40% cheaper and one-third faster by sea than by moving the same freight by road.

Table 4.21. Information of Project 14

Project name	The WestMed Bridge
Lead partner	Modal shift
Volume of goods shifted off the road	750 Million tonne-kilometres (per year)
EU member states involved	Spain, France, Italy

Source: Compiled by Author

Most Successful Marco Polo II Project 15: DZRS

Figure 4.15. Overview of Project 15

Source: (EACI, 2009)

DZRS provides a train link between the world's largest inland container port Duisburg and two of northern Europe's major seaports, Zeebrugge and Antwerp. Previously the containers had a difficult road journey. The traffic shifted off the road to rail exceeded forecasted by over 5 percent in the first two years. In Zeebrugge, containers arrives at terminal for direct transfer to ships which mainly for the Far East and the UK. In Duisburg, they can transfer directly to a Vienna-Budapest rail shuttle or make use of international combined transport networks operating out of a dedicated terminal.

Table 4.22. Information of Project 15

Project name	DZRS
Lead partner	Modal shift
Volume of goods shifted off the road	84 Million tonne-kilometres (per year)
EU member states involved	Belgium, Germany, the Netherlands

Source: Compiled by Author

Most Successful Marco Polo II Project 16: Ro-Ro Past France

Figure 4.16. Overview of Project 16

Source: (EACI, 2009)

Ro-Ro Past France provides a motorway-of-the-sea alternative to get freight off the congested inernational road transit corridor across France. Ro-Ro Past France initially offered three sailings a week and rising to five in September of 2009 in each direction between Bilbao in northern Spain and the Belgian port of Zeebrugge. Each vessle carries up to 200 unaccoumanied road trailers. At the end in Spain, trucks deliver trailers to Bilbao destined for the Benelux, northern Germany, the United Kingdom and Sweden. Trailers for the UK and Sweden are transshiped to another ferry at Zeebrugge. Other trailers continue by road to their final destination.

Table 4.23. Information of Project 16

Project name	Ro-Ro Past France
Lead partner	Motorway of the sea
Volume of goods shifted off the road	2100 Million tonne-kilometres (per year)
EU member states involved	Spain, France, Belgium,

Source: Compiled by Author

Most Successful Marco Polo II Project 17: Euro Reefer Rail Net

Figure 4.17. Overview of Project 17

Source: (EACI, 2009)

Euro Reefer Rail Net is a new rail freight network and with innovative muitimodal refrigerated containers. It aims to switch freight from 11 long distance road routes onto rail. These truck routes corss Europe from Finland in the north to Italy in the south and from Poland in the east to UK in the west. They are being replaced by a network of nine dedicated rail freight services with fixed routes and schedules. In additional to launching and operating the new rail network, Euro Reefer Rail Net also demonstrates and utilise innovative 45-foot reefer containers to transport products that needto be kept cool during transport. Most of the new rail routes are more than 1000 kilometres long, serving freight terminals in seven countries including Belgium, Italy, Germany, Hungary, Poland, Finland and Austria.

Table 4.24. Information of Project 17

Project name	Euro Reefer Rail Net
Lead partner	Modal shift
Volume of goods shifted off the road	363 Million tonne-kilometres (per year)
EU member states involved	UK, the Netherlands, Germany, Belgium, France, Italy, Poland, Czech, Austria, Hungary, Slovakia, Sweden, Denmark, Finland

Source: Compiled by Author

Most Successful Marco Polo II Project 18: ETS Elbe

Figure 4.18. Overview of Project 18

Source: (EACI, 2009)

ETS stands for ecological Transport service. The aim of ETS Elbe is to expand the potential for freight transport on the River Elbe between Germany and Czech Republic by introducing scheduled services using an integrated transport container system. The ETS Elbe project overcomes the problem by providing a scheduled inland waterway service connecting the deep-water system of the Mittellandkanal and the shallow-draught River Elbe system. The project uses inland waterways for the whole journey when possible, with local replacement road services when part of the river is not navigable. The use of containers allows a mix of modes.

Table 4.25. Information of Project 18

Project name	ETS Elbe
Lead partner	Catalyst action
Volume of goods shifted off the road	147 Million tonne-kilometres (per year)
EU member states involved	Germany, Czech

Source: Compiled by Author

According to the aforementioned formula (3), after compiling all 18 most successful Marco Polo II projects, the next step is to calculate the aggregate removed tonne-kilometres off the road of every EU member state involved in these projects. And the results of the calculation are shown in table 4.23 as follows. All the data of initial tonne-kilometres are from Eurostat, and the detailed data can be found in Appendix.

Table 4.26. Calculation of tonne-kilometres of all EU member states

Country	Initial Million TKM (tonne-kilometres)	Reduced Million TKM (tonne-kilometres)
Germany	307547	2304
France	173621	4679
The Netherlands	72675	1623
UK	139536	794
Italy	167627	1958
Belgium	36174	3775
Spain	211895	3919
Poland	180742	672
Austria	29075	1178
Sweden	35047	594
Czech Republic	44955	600
Hungary	35373	750
Denmark	16876	594
Finland	27805	363
Slovakia	27705	453
Croatia	9426	263
Bulgaria	17742	173
Cyprus	963	0
Estonia	5340	0
Greece	28585	0
Latvia	8115	219
Lithuania	17757	219
Luxemburg	8400	0
Malta	900	0
Portugal	35808	331
Romania	34269	387
Slovenia	14762	263
Ireland	11687	0
Rest of EU	193754	1855

Source: Compiled by Author

What should be noted is that the data of initial road transport in tonne-kilometres of Malta is missing in the database of Eurostat. Since the modal split rate of Malta is the same as the rate of Cyprus, and the total trade value of Malta is a little bit lower than

Cyprus, we assume the initial number of road transport in tonne-kilometres of Malta is 900, which is also a little bit lower than the number of Cyprus. Since the proportion in the total road transport in tonne-kilometres is very low, we believe that this assumption will not influence the outcome.

Besides the reduction of road transport in tonne-kilometres, the congestion index of every EU member state is also essential in calculating the final trade cost equivalent based on formula (3). Thus we present all the final congestion index after adjustment in the following table 4.26. The methodology of table 4.26 is shown in formula (2) in this chapter.

Table 4.26. Congestion index of all EU member states

Country	Average delay time per km (seconds)	Congestion Index
Average EU	3.0873	1
Germany	4.117	1.33
France	2.651	0.86
The Netherlands	4.503	1.46
UK	4.637	1.50
Italy	3.497	1.13
Belgium	4.722	1.53
Spain	2.132	0.69
Poland	3.233	1.05
Austria	3.097	1.00
Sweden	2.037	0.66
Czech Republic	3.058	0.99
Hungary	3.157	1.02
Denmark	2.653	0.86
Finland	1.788	0.58
Slovakia	3.188	1.03
Rest of EU	2.921	0.95

Source: Compiled by Author

From table 4.7, we can observe that the formula of road congestion index is reasonable. The congestion index of the most congested area, i.e. western of central Europe, including Germany, Belgium and the Netherlands are higher than the index of other EU member states. We believe that the congestion index can make the final output more accurate.

After calculating the congestion index, the last step of evaluating the final trade cost equivalent is to apply formula (3) and formula (4) separately in Scenario 1 and Scenario 2. The final result in both scenarios are shown in table 4.27 as follows.

Table 4.27. Final trade cost equivalent of EU member states

Country	Initial tariff equivalent	Final trade cost equivalent in Scenario 1	Final trade cost equivalent in Scenario 2
Germany	1.027	1.02678	1.02687
France	1.028	1.02748	1.02768
The Netherlands	1.014	1.01363	1.01378
UK	1.051	1.05065	1.05078
Italy	1.035	1.03463	1.03477
Belgium	1.01	1.00872	1.00920
Spain	1.017	1.01683	1.01689
Poland	1.022	1.02193	1.02196
Austria	1.015	1.01451	1.01470
Sweden	1.023	1.02279	1.02287
Czech Republic	1.005	1.00495	1.00497
Hungary	1.007	1.00688	1.00692
Denmark	1.015	1.01464	1.01477
Finland	1.024	1.02385	1.02390
Slovakia	1.004	1.00395	1.00397
Rest of EU	1.025	1.02482	1.02489

Source: Compiled by Author

Chapter 5 Results and Data Analysis

After collecting all the data needed in the matrices of the Global Simulation Model, we run the model in two different scenarios, and the result of the impact on the EU's economy with respect to the ease of road congestion which benefits from the Marco Polo II Programme will be presented in this chapter. We have defined economic impact in terms of output changes, trade changes, price changes and welfare effects. We will gauge the impact of the Marco Polo II programme regarding all these four economic impact indicators. The output of the GSIM simulations will be presented in graphs that contain the core information per variable in a clear and transparent manner. We note that the two scenarios will be analyzed separately and a comparison of both scenarios will be made at the end.

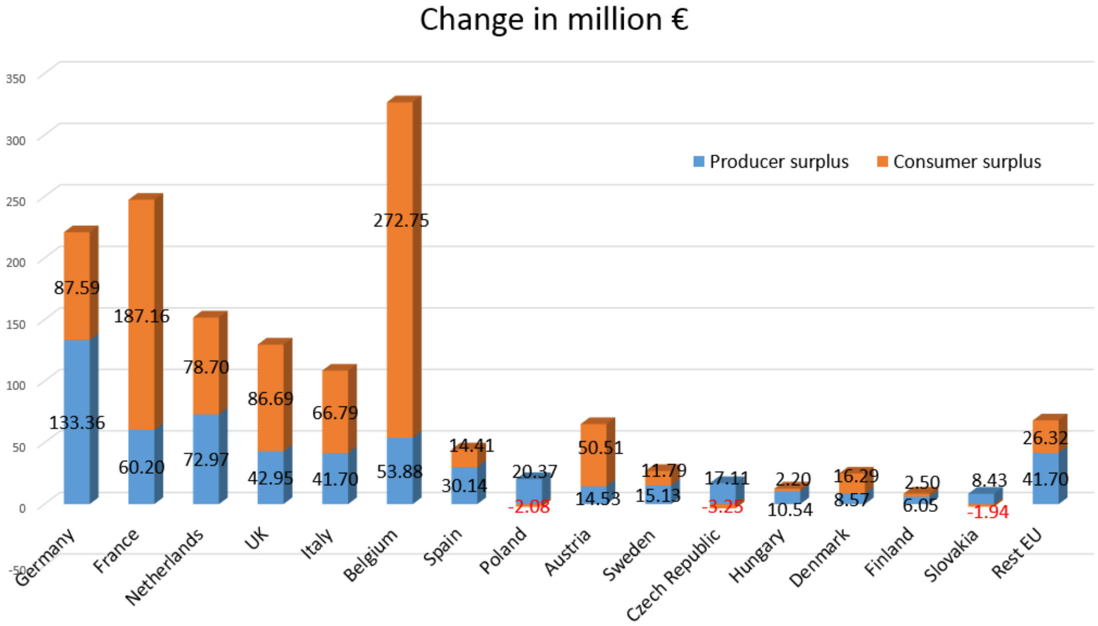
5.1 80 Percent achievement rate scenario

Under Scenario 1 – the ambitious scenario – that assumes that the actual achievement rate of the Marco Polo II Programme is 80 percent, the impact of the Marco Polo II Programme on the EU economy and its Member States is remarkable.

Welfare effects

From the Figure below, it becomes clear that in the ambitious Scenario 1, the EU and its Member States gain significantly in welfare. Especially Belgium, France, Germany, the UK, Italy and The Netherlands stand to gain.

Figure 5.1. Change in welfare effects: inside EU

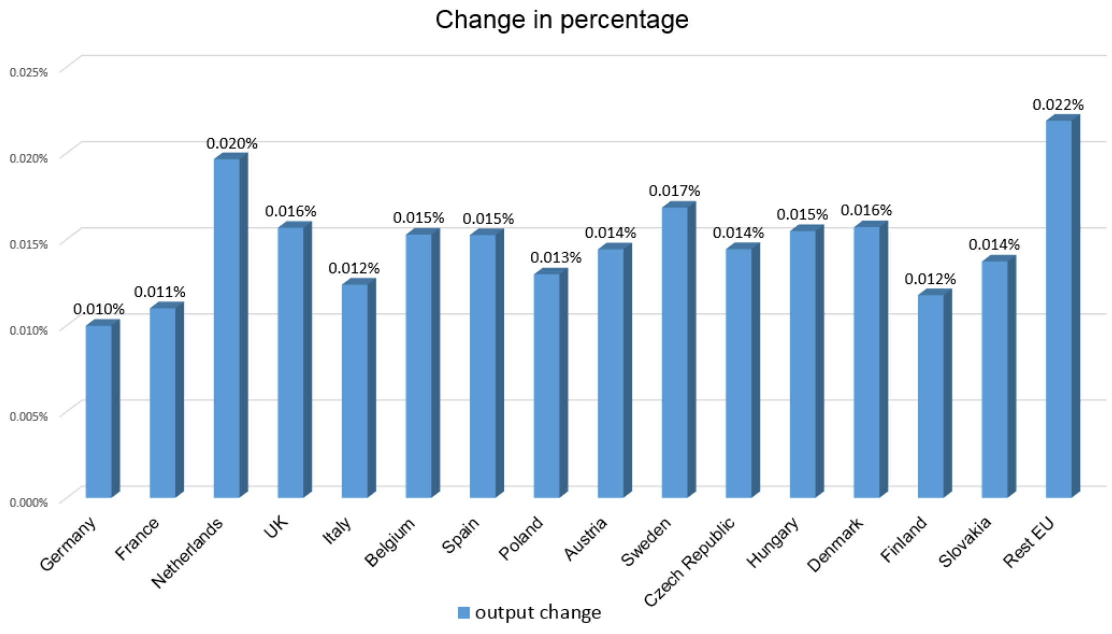


When disaggregating the effects between consumer and producer effects, we see that especially in Belgium, France, and the UK consumers are expected to gain from Marco Polo II. This is the case because transport costs drop and these prices are – given where how the trade patterns change – transferred to consumers. The reason for Belgium to stand out is that it is the most congested country of the sample and as such, Marco Polo II has the largest consumer effect there. The largest producer gains occur in Germany and The Netherlands. In these countries, producers (e.g. transport companies) benefit from Marco Polo II – for example through lower rates of congestion between the ports of Rotterdam and Antwerp.

Output effects

The second indicator to measure the potential impact of Marco Polo II on the EU economy is 'output'. From the below Figure we can deduce a few findings. First, we see that in relative (%) terms the EU and its Member States experience a boost in output from the ambitious Marco Polo II impact scenario. Second, we see that the output effects (GDP effects) are very small in percentage terms. However, they are still substantial in value terms. Third, if we look at the potential output effects in relative terms, we see that – interestingly – the largest relative output gains come to the 'Rest of EU' group of EU Member States; that is: the very small EU member states. However, also The Netherlands and Sweden benefit relatively a lot. For The Netherlands this clearly is linked to the relative importance of the transport and logistics sector in the country – the sector that is most directly affected by impact from Marco Polo II. These results are also in line with the relatively large producer surplus effects for The Netherlands presented above. In absolute terms the German producer surplus gains are higher, but relatively (as a share of the size of the economy) the Dutch gains stand out more.

Figure 5.2. Change in output effects: inside EU



Trade effects

The Figures below show in detail the potential trade effects of the ambitious Marco Polo II impact.

Figure 5.3. Absolute change in trade value: inside EU

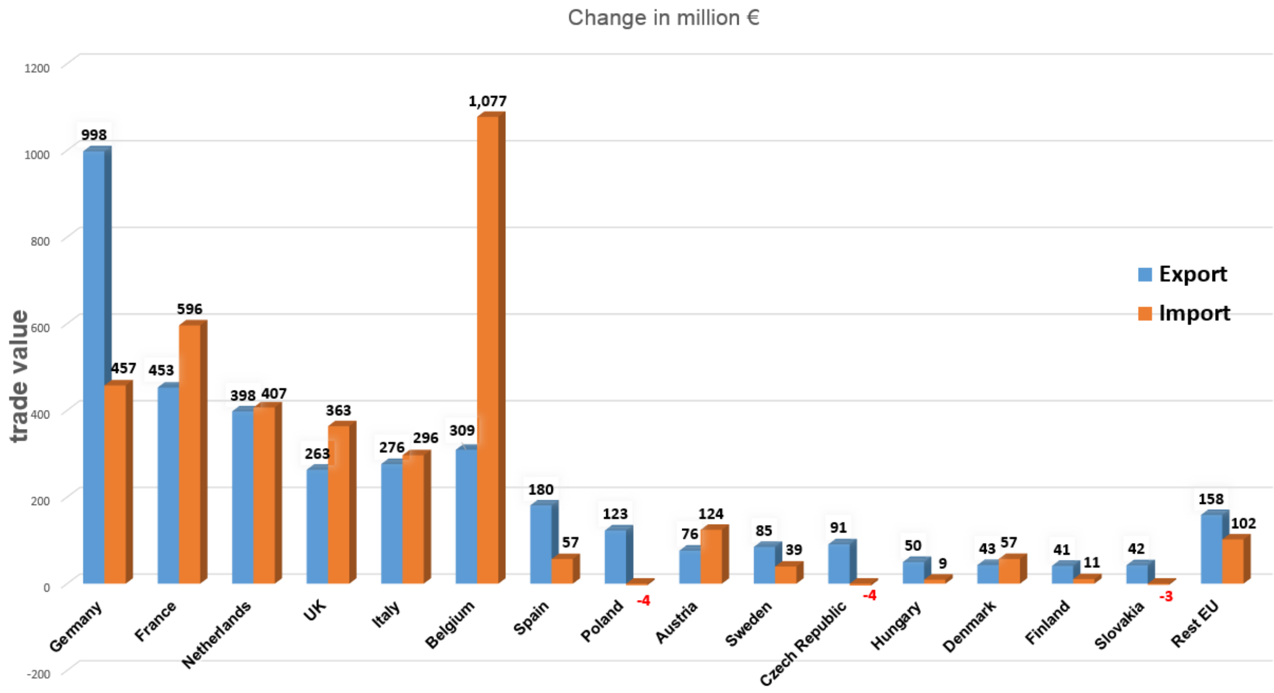


Figure 5.4. Absolute change in trade value: EU-US and EU-Rest of World

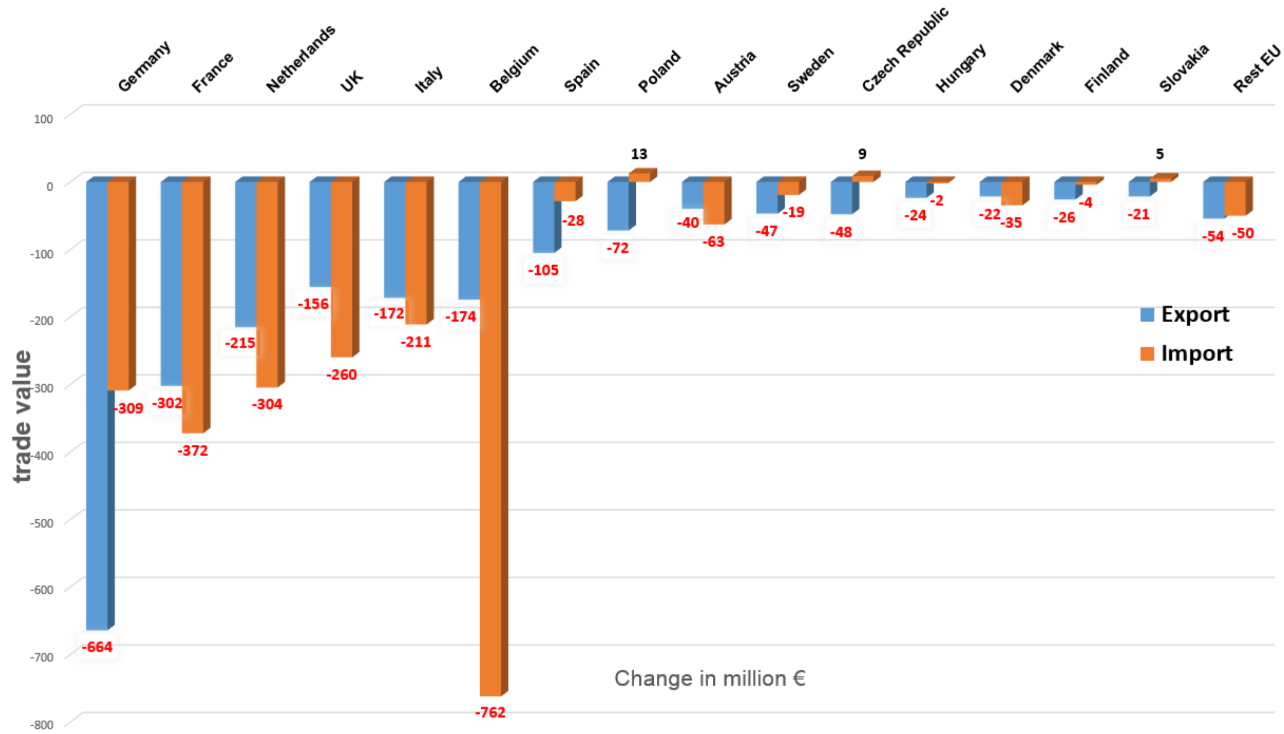


Figure 5.5. Absolute change in trade value: in total

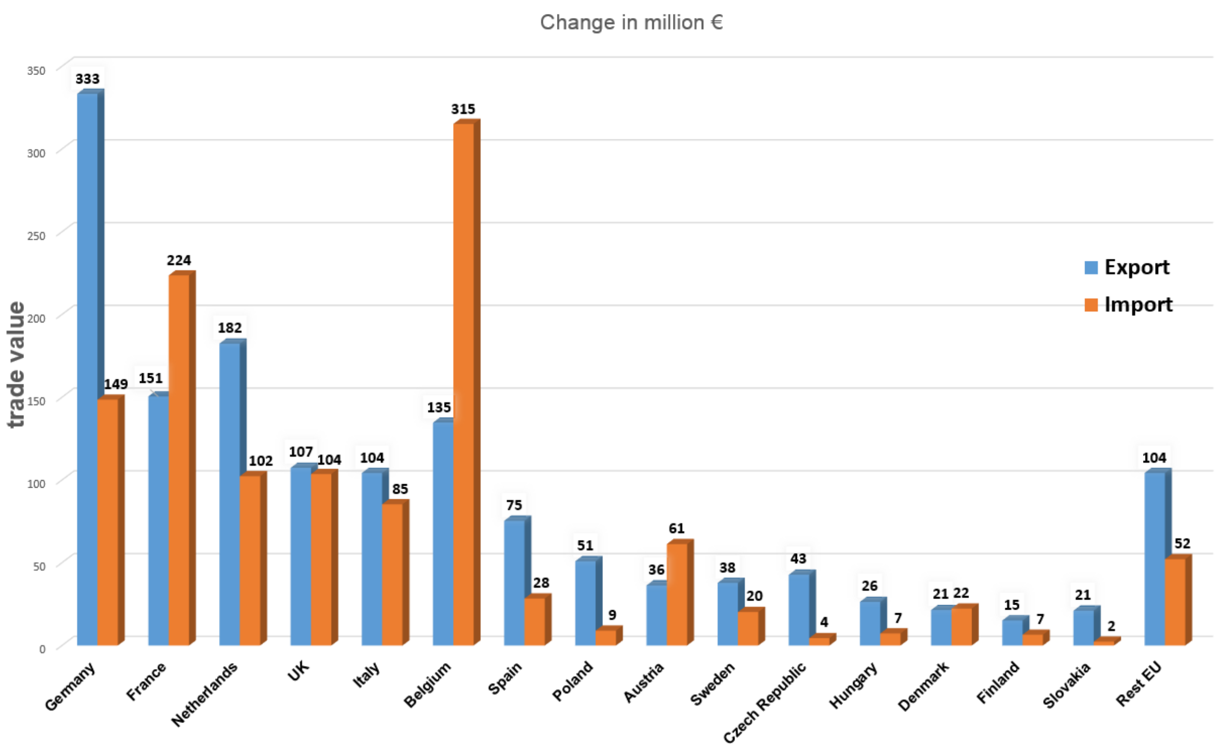


Figure 5.6. Percentage change in trade value: inside EU

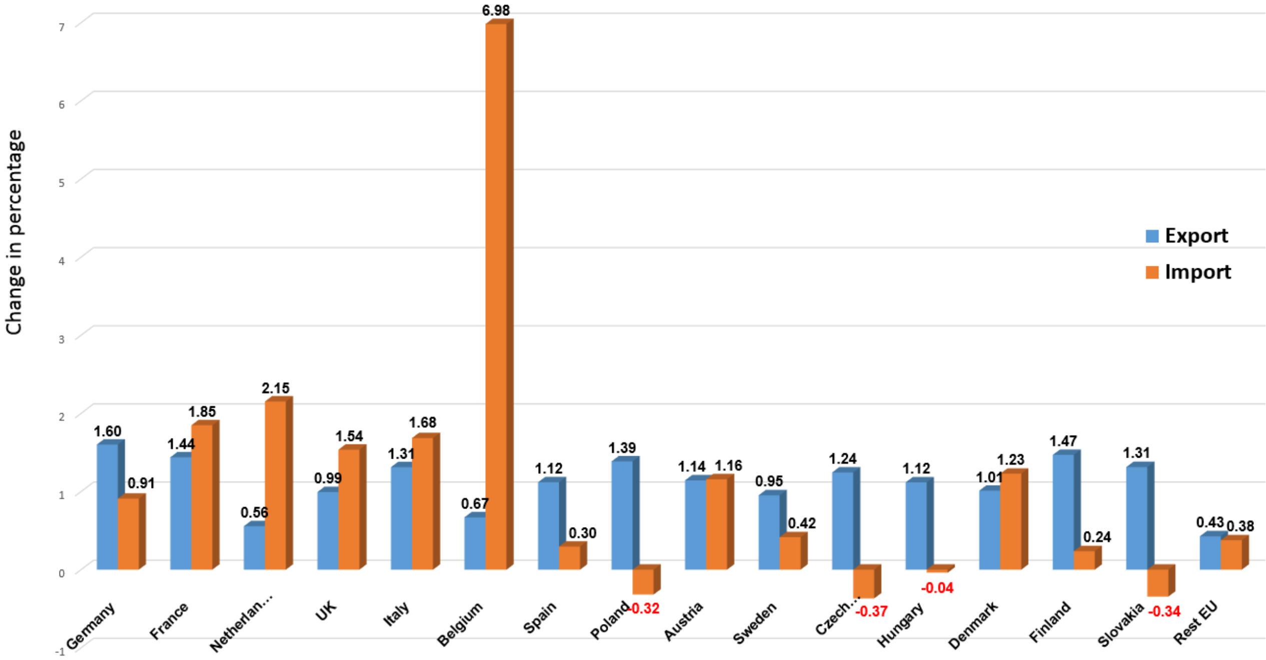


Figure 5.7. Percentage change in trade value: EU-US and EU-Rest of World

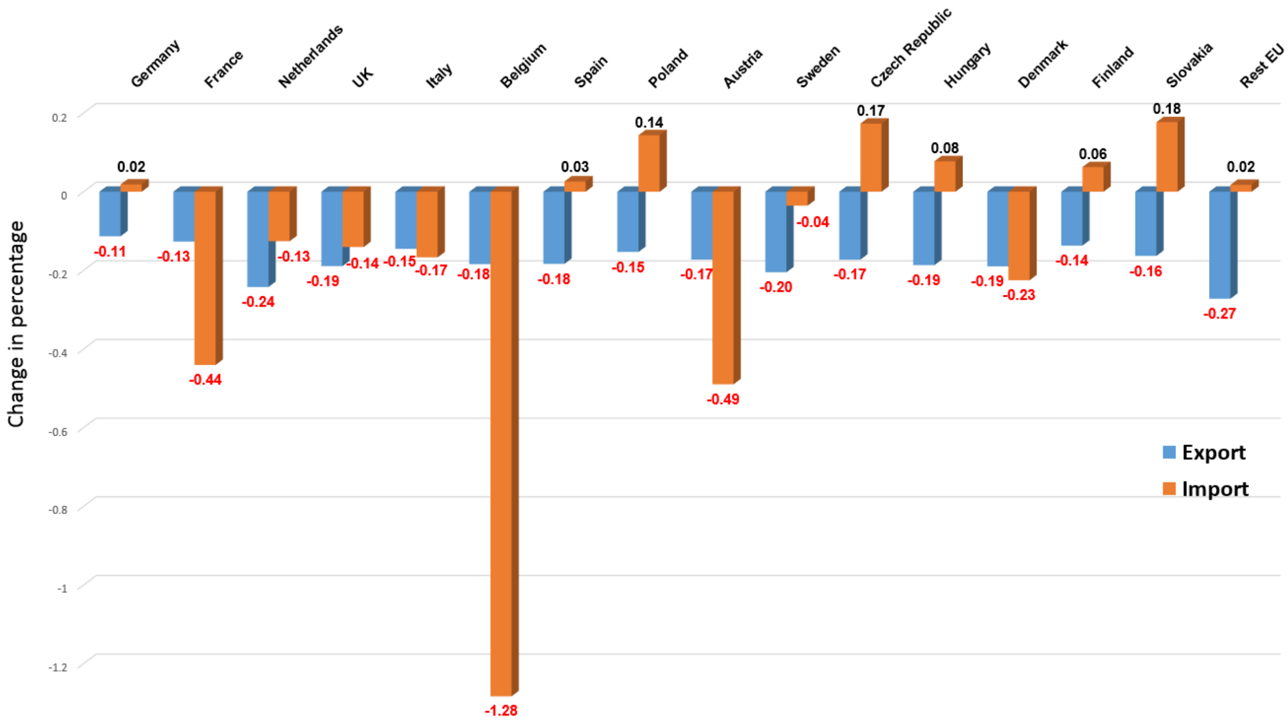
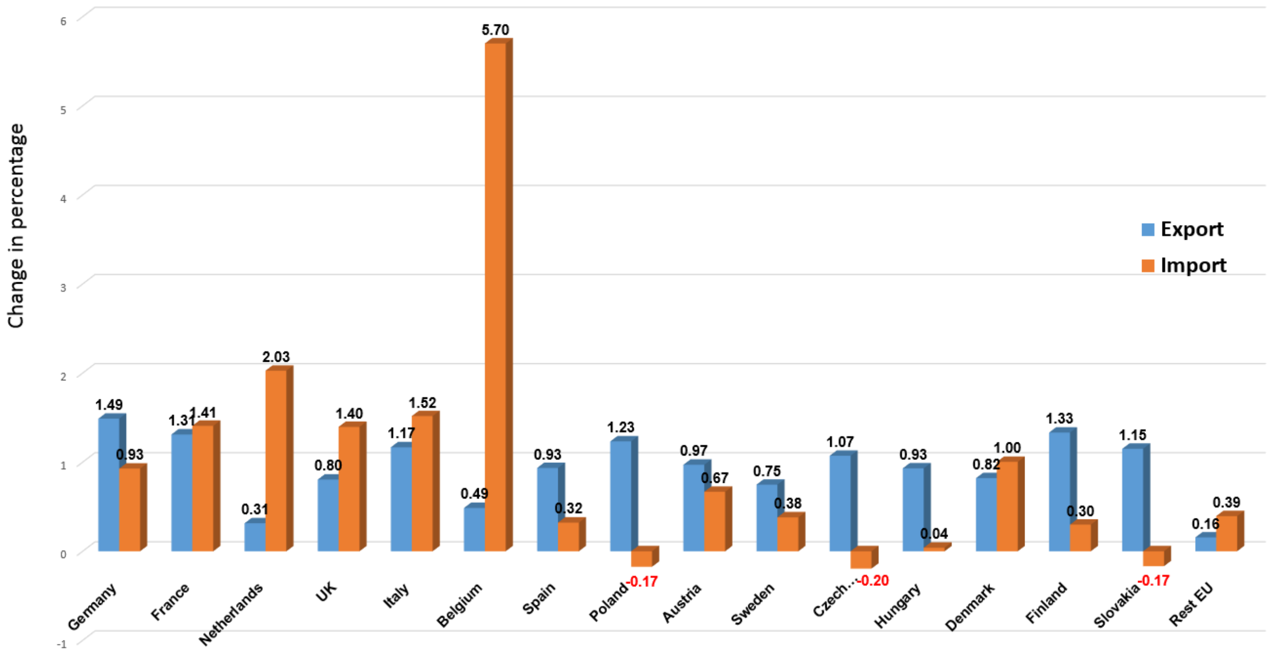


Figure 5.8. Percentage change in trade value: in total



The analysis starts from figure 5.1. Figure 5.1 shows the absolute value change of both import and export of every EU member state, and the import and export are only between EU member states. Almost all EU member states have a huge increase in both import and export trade values. Germany has the most enormous increase in export trade value of 998 million euro while Belgium has the highest increase in import trade value of 1077 million euro. The outcome is interesting but not surprising since Germany also has the highest total trade value among EU member states and Belgium is considered the most congested area in western Europe. Interestingly, compared with other areas, EU member states in western Europe including Germany, France, the Netherlands, the United Kingdom and Belgium all have higher value change in both import and export. Italy also shows considerable increase in both terms. All the aforementioned countries are considered more developed than other countries and also have higher GDP and total trade value, which means the higher the initial trade value, the higher increase in the final trade value after the Marco Polo II Programme.

Figure 5.2 looks similar to Figure 5.1 in a reversed view. Germany, France, the Netherlands, the United Kingdom, Italy and Belgium all have a huge decrease in both import and export trade value with the United States and the rest of world. Almost all the other EU member states also decrease their trade value with the United States and the rest of world, which means EU member states tend to trade with each other rather than with other partners in the world due to the Marco Polo II Programme.

The overall change of all EU member states are shown in Figure 5.3. The change in total trade value reveals that even the trade value between EU member states and other countries in the world drop a lot, the trade between EU member states cover the loss and still bring positive benefits to all EU member states.

Compared with the absolute change value, the percentage change of both import and export shown in figure 5.4 to figure 5.6 are relatively more balanced. Only Belgium has a much higher increase of import from EU member states and much higher decrease of import from the United States and the rest of world. Except Belgium, almost all the other EU member states have an increased rate around 1% of both import and export inside EU, and a decreased rate around 0.2% with the United States and the rest of world. Poland, Czech Republic, Hungary and Slovakia have a very low decrease in the change rate of import from EU member states. These countries plus Germany and the rest EU member states also have a small increase in import with the United States and the rest of world. The total change rate shown in Figure 5.6 proves that in accordance with the absolute value change, the total trade value of all EU member states has increased after the Marco Polo II Programme, and the impact on every EU member states are relatively balanced.

To get a more clear result, we aggregate all the information and data shown in figure 5.1 to figure 5.6 and compile them in figure 5.7 and figure 5.8 as follows.

Figure 5.9. Aggregate change in absolute trade value of all EU member states

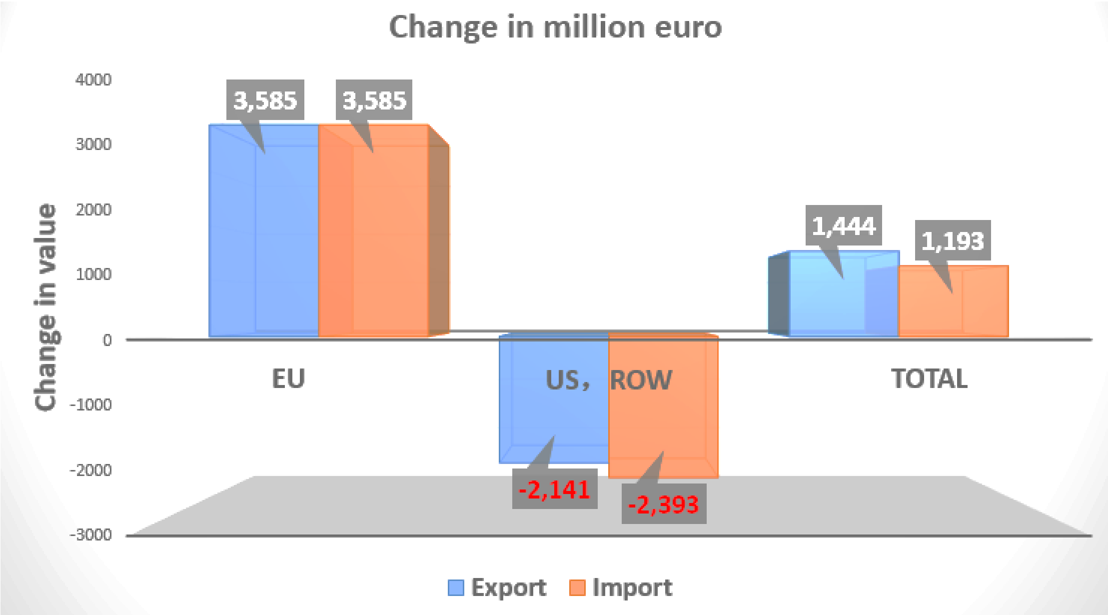
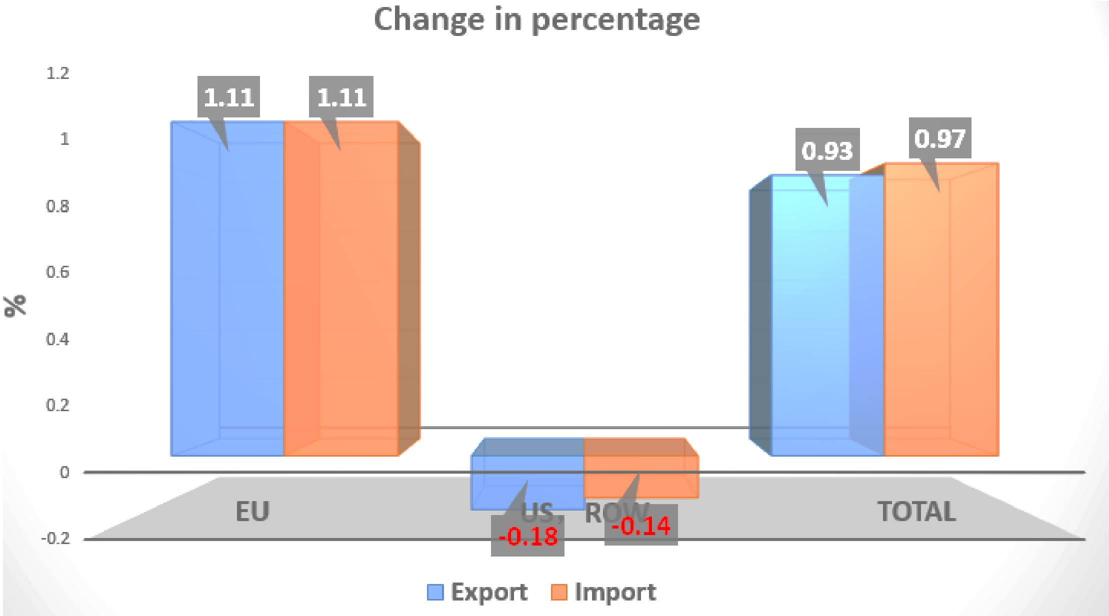


Figure 5.10 Average change rate of trade value of all EU member states



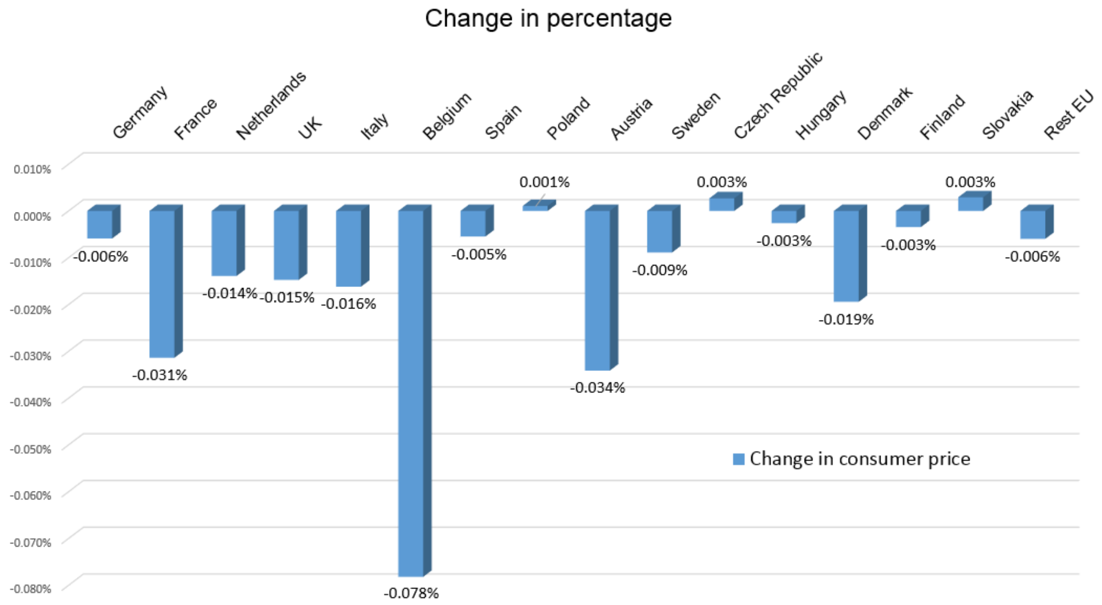
It is clearly shown in the above figures that the total trade value will increase due to the impact of the Marco Polo II Programme on road congestion especially the trade between EU member states. In other word, the EU internal market and the EU's economy will benefit from this ease of road congestion brought from the Marco Polo II Programme.

Price effects

Finally, we look at price effects. If the Marco Polo II programme is able to reduce the costs of congestion, we would also expect the macro-economic effects to show that consumer prices would decrease. Admittedly, the Marco Polo II programme has a partial impact on road congestion (i.e. we do not expect the Marco Polo II programme to eradicate congestion from one day to the other), and road congestion – through aforementioned channels – may have an upward effect on prices (e.g. of transport) – but we cannot expect that the Marco Polo II programme in itself will have a large impact on consumer prices across the EU. For that to happen the programme, and the problem it aims to tackle are too small in size. When we study the Figure below, this expectation is confirmed.

For Belgium, the expected decrease in consumer prices is largest – which matches exactly the fact that in terms of welfare, consumer surplus is expected to gain most. The fact that Belgium is the most congested country in north-west Europe is an important factor in this: if – as we do in Scenario 1 – the Marco Polo II programme is 80% effective – also in Belgium, the effect is relatively large. And with relatively large, we mean -0.078% price change – which is still rather small. Most EU Member States experience small consumer price declines. Poland, Czech Republic, Hungary, Finland, and Slovakia experience no consumer price changes from Marco Polo II (they are 0.00% rounded off – which is well within the error margin of the GSIM model). This can we caused for various reasons. First of all, in – for example – Finland, congestion – as also seen in the previous Chapters where congestion problems were visualized on the EU-map – is not a big issue. Hence the potential impact of Marco Polo II in Finland is bound to be limited. When we look at countries like Poland, Hungary, Slovakia and Czech Republic, the same argument holds as for Finland, but not because of the high quality of road infrastructure, but because road density is lower regarding car and trucks using that infrastructure. Hence also for those countries, the potential effect is lower. Also the choice of the 18 projects matters for these results: where more Marco Polo II projects are carried out, the impact is expected to be bigger, also consumer price decreases.

Figure 5.11. Change in consumer price: inside EU



Comparison of Marco Polo II costs related to GDP

Finally, we analyse the relative potential effect of the Marco Polo II Programme by comparing the GSIM simulation results to the total (disaggregated) budget of Marco Polo II – and calculate a general ratio. This is done in the Tables below.

Table 5.1 Comparison of the benefits and GDP

Total EU GDP 2013 (million euro)	Total benefit of MPII in terms of road congestion (million euro)	Percentage of the benefit in GDP
13520970	2637	0.02%

Table 5.2 Comparison of the benefits and the budget

Total budget of MPII (million euro)	Total benefit of MPII in terms of road congestion (million euro)
450	2637

According to the Tables, the EU can experience a +0.2% gain in its total Gross Domestic Product. As mentioned in Chapter 1, road congestion was estimated to cost 1% GDP annually on average for the European Union member states (European Commission, 2011). In table 5.2, we can also see that the total budget of the Marco Polo II Programme is 450 million euro. If the Marco Polo II Programme has the potential to generate 2637 million euro by reducing the road congestion, we believe that the Marco Polo II Programme has a positive return on investment – in the ambitious 80% achievement rate scenario.

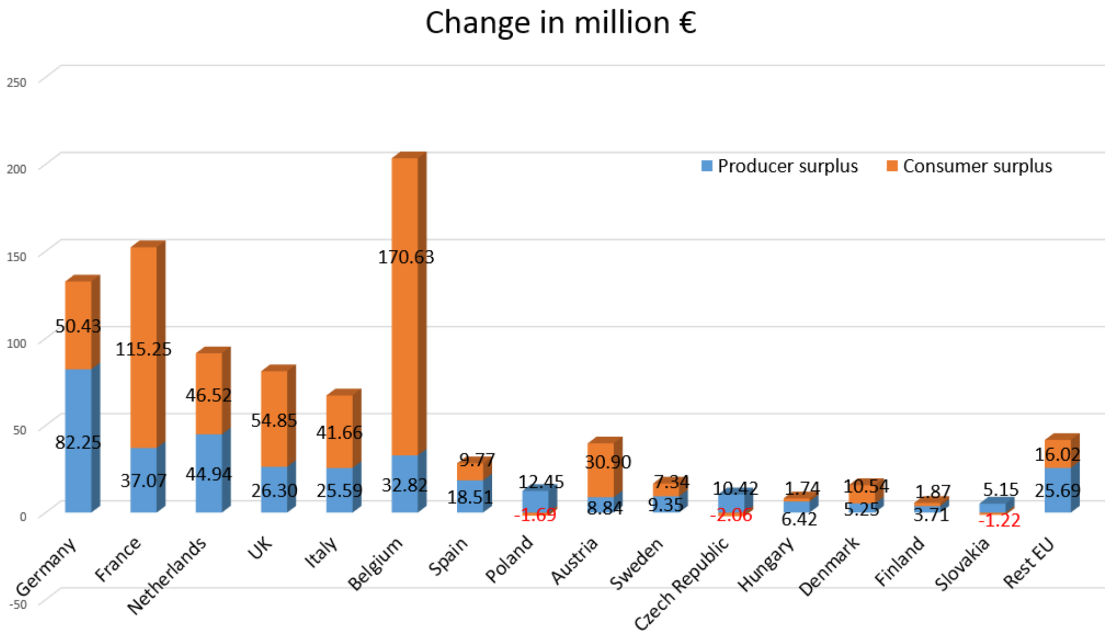
5.2 50 Percent achievement rate scenario

In the previous section we looked at the 80% achievement rate scenario of Marco Polo II. Based on experience with Marco Polo I – and policy making in general – that can be considered an ambitious scenario. In order to get an idea of the sensitivity of the economic impact results for the success rate of the Marco Polo II programme, we will now run a more modest 50% achievement rate scenario and discuss the results.

Welfare effects

The Figure below shows the consumer and producer surplus impact of Marco Polo II in the limited scenario. What we observe is that the relative effects not change by limiting the scenario compared to the ambitious one. This was to be expected, because we have reduced the achievement rate from 80% to 50% in going from the ambitious to the more modest effectiveness scenario and we have applied this reduction uniformly across the whole programme.

Figure 5.12. Change in welfare effects: inside EU



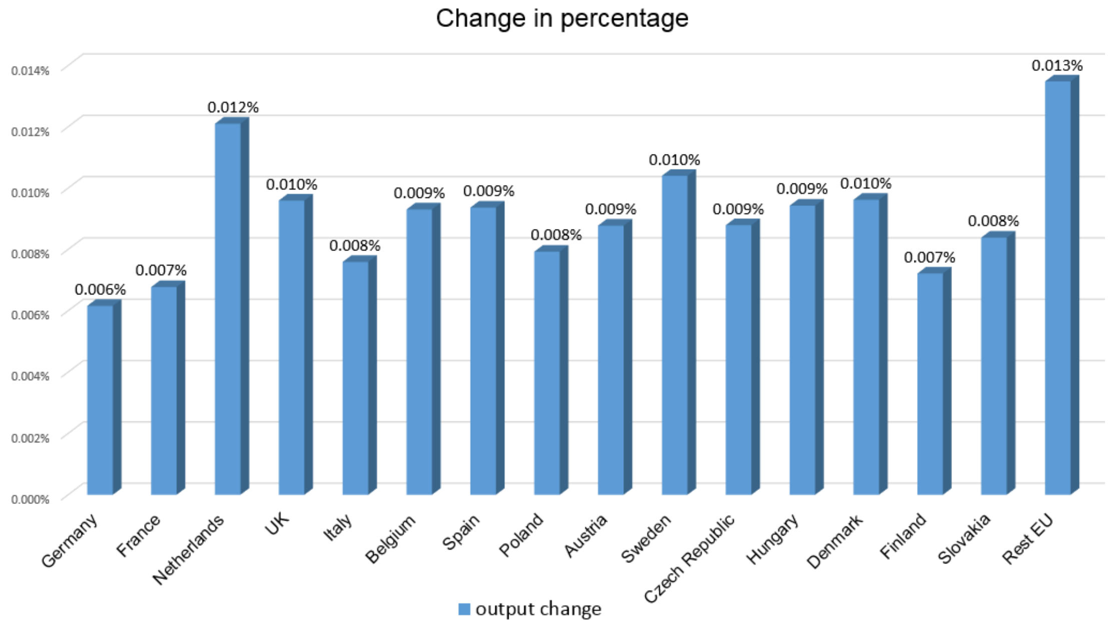
Clearly if we would model the reduction in effectiveness by – for example – cancelling some of the 18 Marco Polo II projects discussed, the effects would fall disproportionally across the EU and its Member States. This is an important point for further analysis when more data on Marco Polo II become known.

When disaggregating the effects between consumer and producer effects, we see that especially in Belgium, France, and the UK consumers are expected to gain from Marco Polo II. The largest producer gains – again – occur in Germany and The Netherlands.

Output effects

The second indicator to measure the potential impact of Marco Polo II on the EU economy is 'output'. From the below Figure we can deduce that also here, the effects are proportionally lower, but without a relative shift between countries: output increases because of Marco Polo II, also in the limited scenario; output effects are even smaller than in the ambitious scenario; output effects are still largest for 'Rest of the EU', and again The Netherlands and Sweden gain relatively most.

Figure 5.13. Change in output effects: inside EU



Trade effects

Compared with the first scenario with 80 percent actual achieve rate, the absolute value change inside EU, as shown in figure 5.9, is a little bit lower than the change in figure 5.1. On the other hand, the pattern of figure 5.9 is almost the same as figure 5.1. Germany still owns the highest increased value of export of 615 million euro while Belgium the highest decrease value of import of 674 million euro. **Figure 5.14. Absolute change in trade value: inside EU**

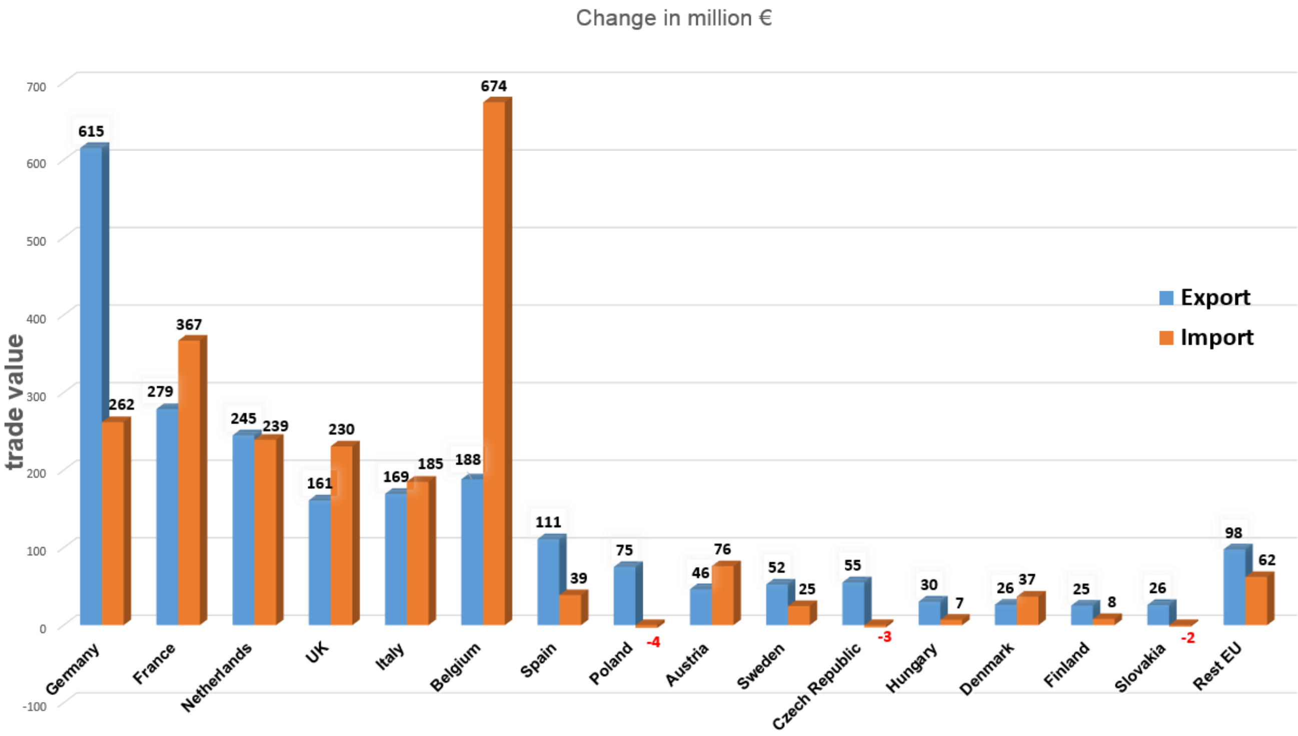


Figure 5.15. Absolute change in trade value: EU-US and EU-Rest of World

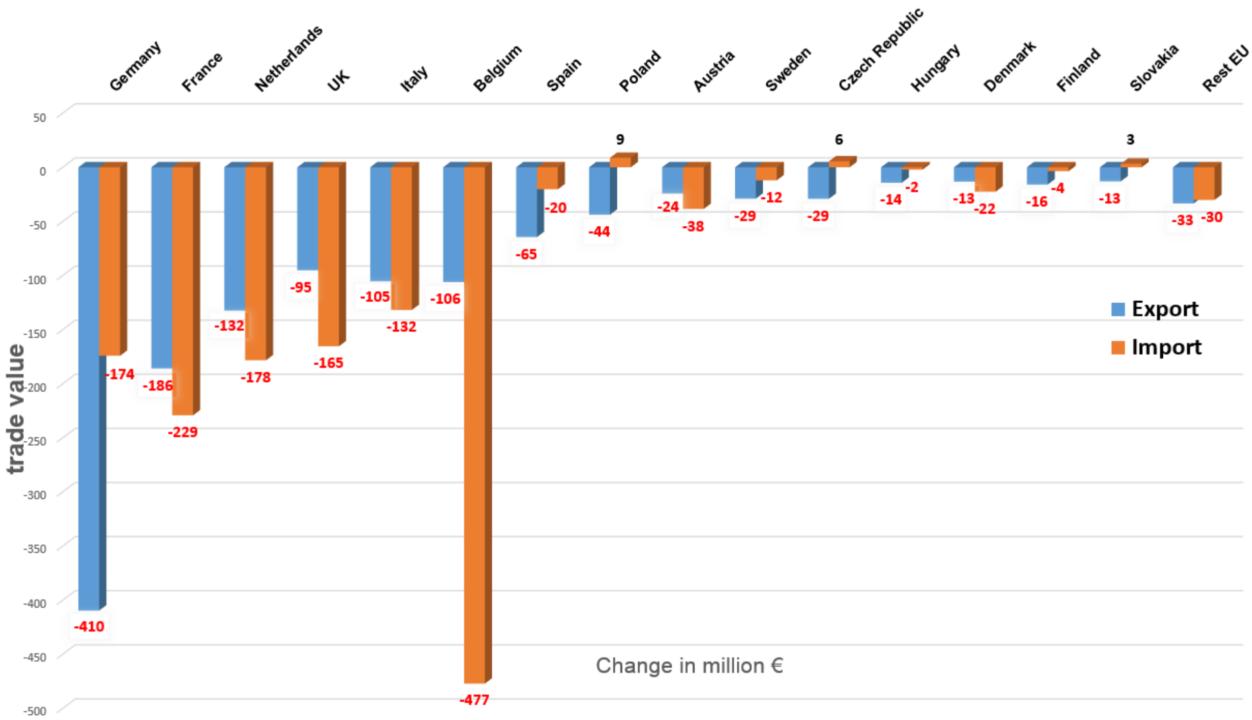


Figure 5.16. Absolute change in trade value: in total

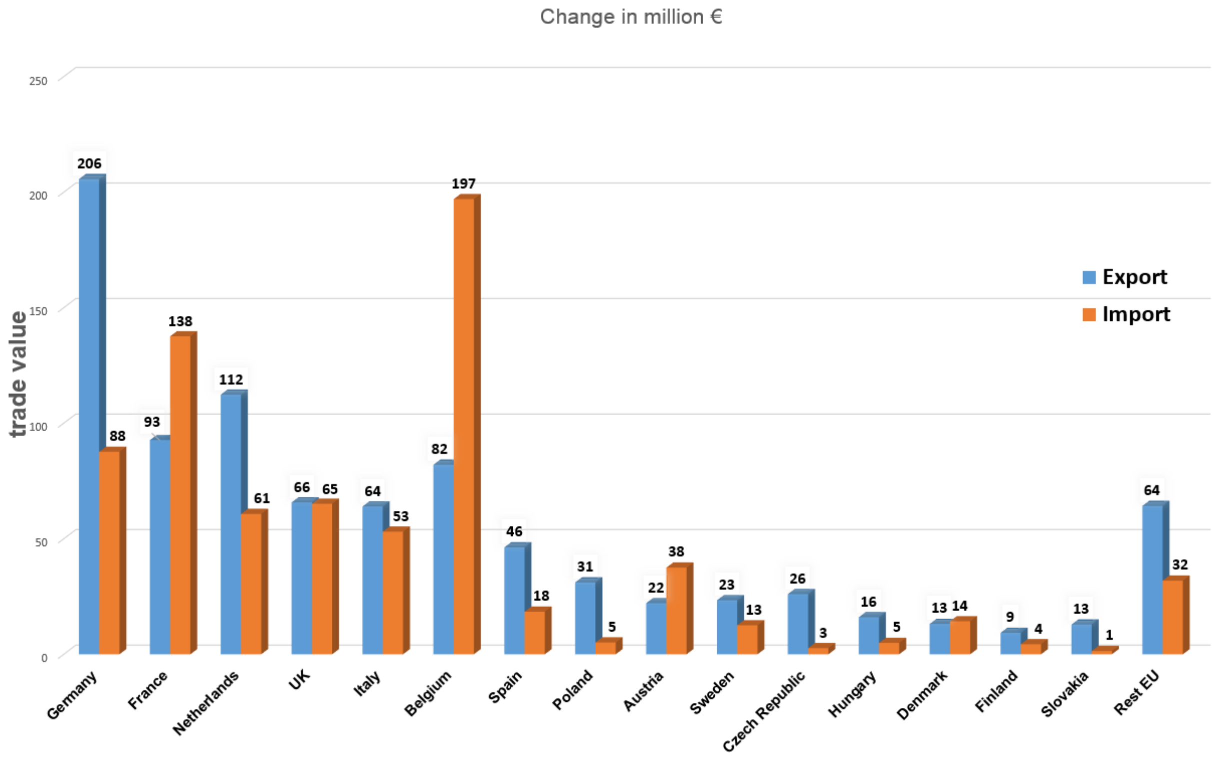


Figure 5.17. Percentage change in trade value: inside EU

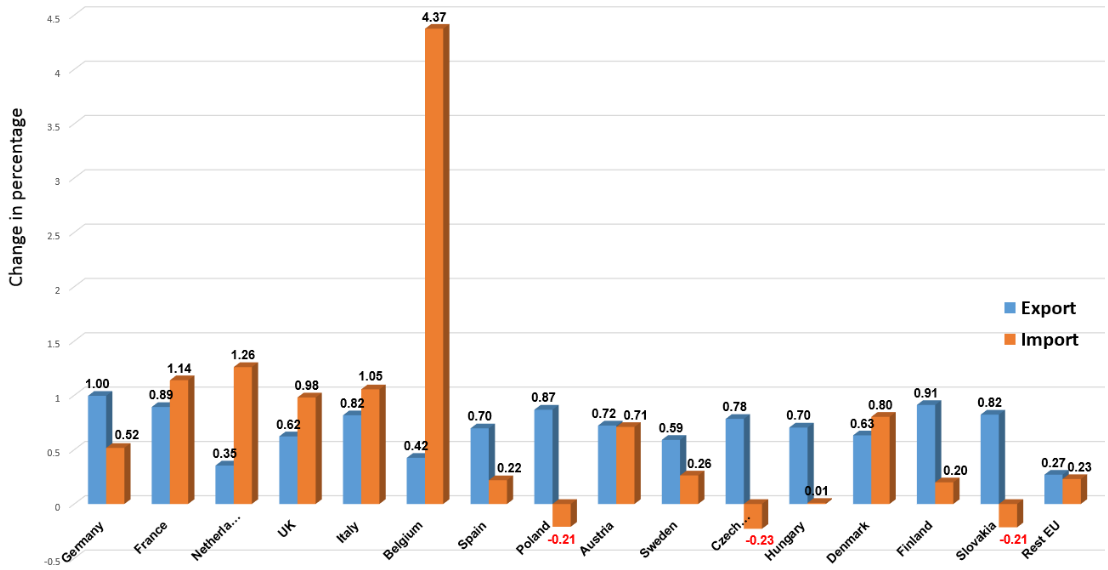


Figure 5.18. Percentage change in trade value: EU-US and EU-Rest of World

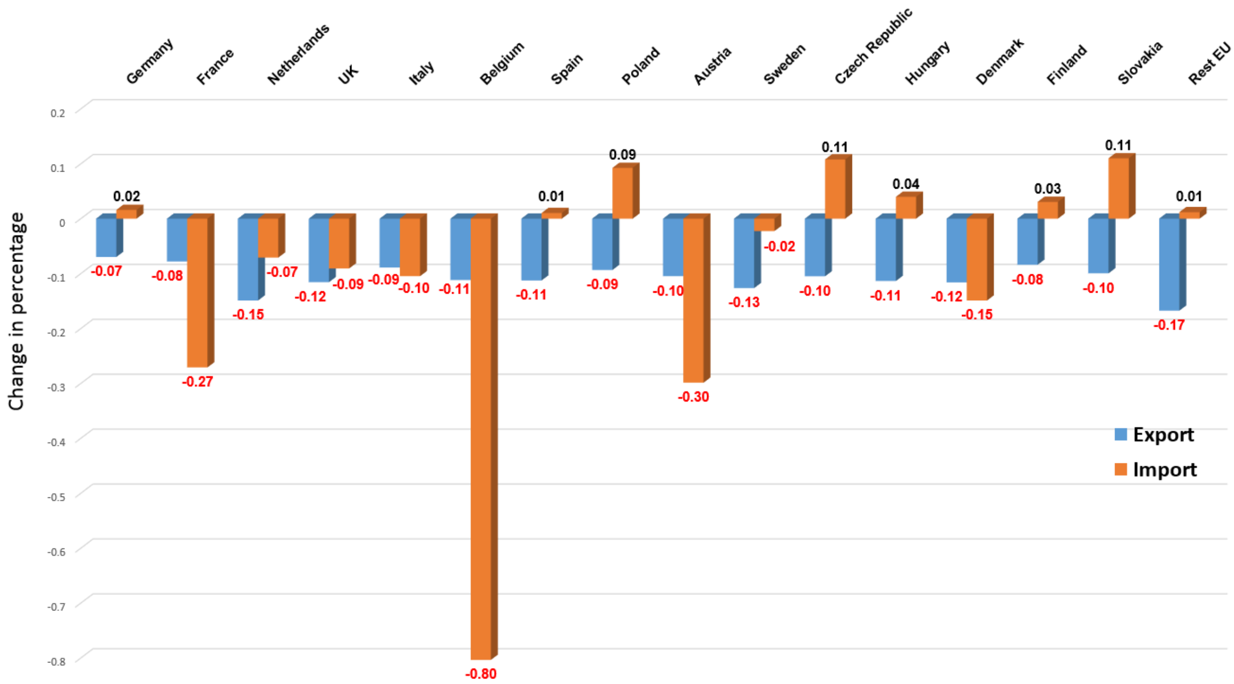
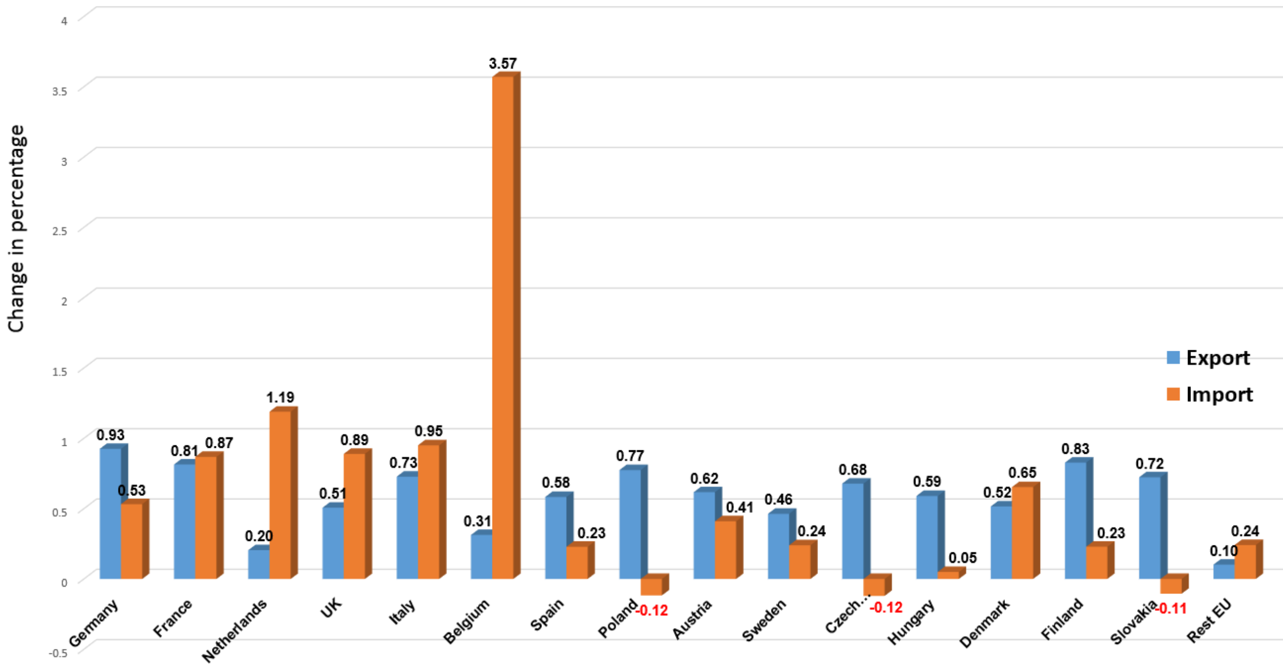


Figure 5.19. Percentage change in trade value: in total



In figure 5.10, Germany, France, the Netherlands, the United Kingdom, Belgium and Italy are seen to decrease import and export trade values with the United States and the rest of world faster than other EU member states. Moreover, under two different scenarios, almost all EU member states tend to trade with each other and with other partners worldwide.

The total change in trade value under scenario 2 is displayed in figure 5.11, the pattern is still almost the same as the pattern in figure 5.3. This similarity proves that the Marco Polo II Programme does have a great impact on the trade inside the European Union even the programme achieves 50 percent of the initial target on average.

Figure 5.12 to figure 5.14 displays the percentage change of trade value under scenario 2. As the same in scenario 1, Belgium still shows much higher increased percentage of import with EU member states as well as much higher decreased percentage of import with the United States and the rest of world. The other results are in accordance with the results under scenario 1 and the only difference is that the change rate is a little bit lower than the change rate in scenario 1.

We also compile the result of all EU member states and present in figure 5.15 and figure 5.16.

Figure 5.20. Aggregate change in absolute trade value of all EU member states

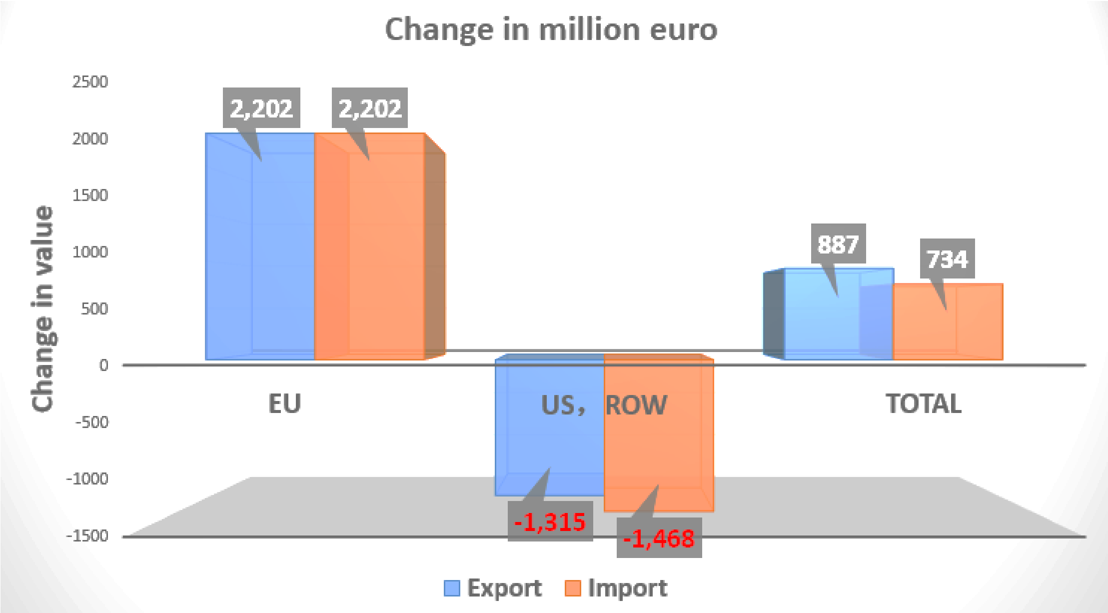
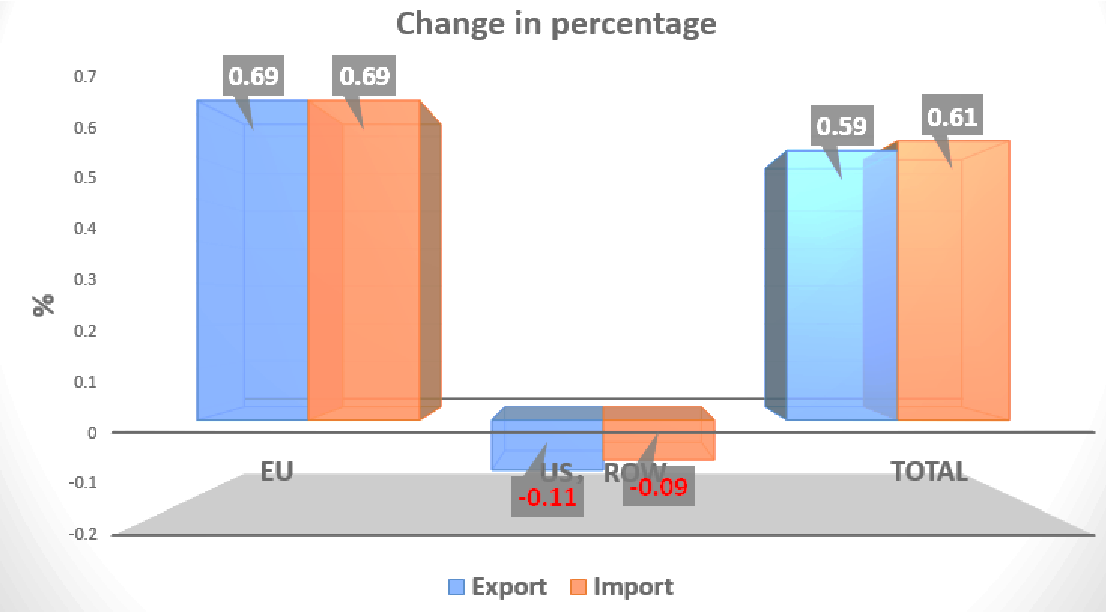


Figure 5.21. Average change rate of trade value of all EU member states



The pattern displayed in figure 5.15 and figure 5.16 are almost the same as the pattern in figure 5.7 and figure 5.8. The differences are that the increase in absolute trade value inside EU drops from 3585 million euro to 2202 million euro. On the other hand, the decrease in absolute trade value between EU member states and the United States and rest of world is 1315 million euro in export and 1468 million euro in import.

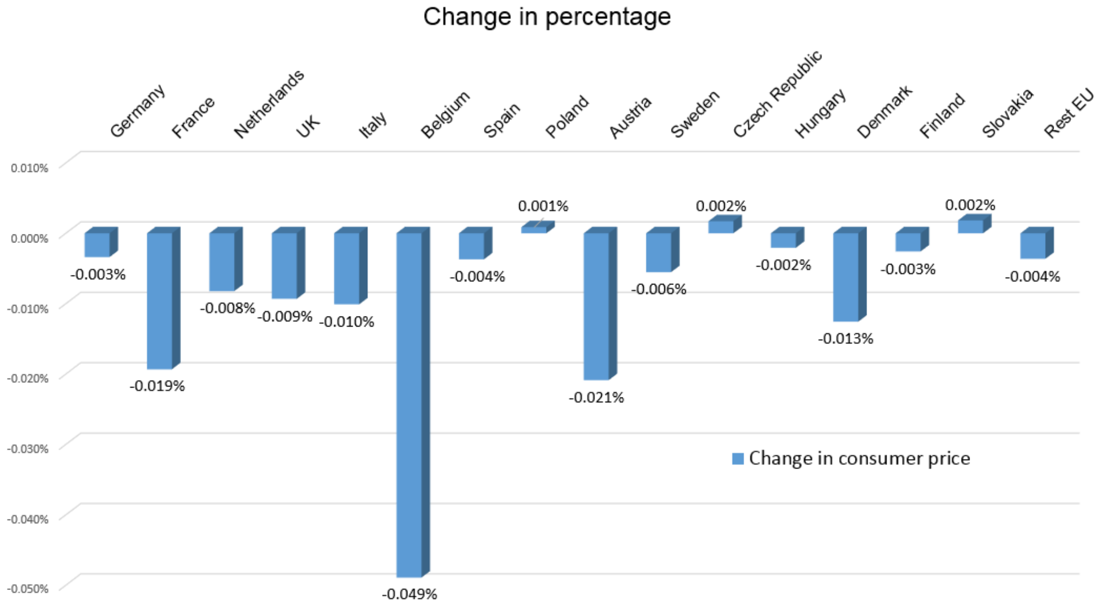
In figure 5.16, the average change rates of trade value of all EU member states are relatively lower than the rates shown is figure 5.6. But the outcome proves that even the Marco Polo Programme has 50 percent actual achieve rate, the ease of road congestion still has a positive impact on the EU's economy.

Price effects

Finally, we look at price effects. If the Marco Polo II programme is able to reduce the costs of congestion, we would also expect the macro-economic effects to show that consumer prices would decrease. In addition to the relatively small impact explained in the previous section, if we reduce the effectiveness of Marco Polo II in this scenario, the expected price effects are expected to become smaller still.

For Belgium, the expected decrease in consumer prices is largest – which matches exactly the fact that in terms of welfare, consumer surplus is expected to gain most. The fact that Belgium is the most congested country in north-west Europe is an important factor. In addition to Poland, Czech Republic, Hungary, Finland, and Slovakia – mentioned under the ambitious scenario, now also Germany, Spain and 'Rest of EU' are not expected to experience consumer price changes. Clearly the less effective Marco Polo II is expected to be, the lower the consumer price impact will be.

Figure 5.22. Change in consumer price: inside EU



Comparison of Marco Polo II costs related to GDP

As we did in the last section, we will compile other data in the following table 5.3 and table 5.4 to show the actual benefits brought from the Marco Polo II Programme in terms of road congestion.

Table 5.3 Comparison of the benefits and GDP

Total EU GDP 2013 (million euro)	Total benefit of MPII in terms of road congestion (million euro)	Percentage of the benefit in GDP
13520970	2637	0.012%

Table 5.4 Comparison of the benefits and the budget

Total budget of MPII (million euro)	Total benefit of MPII in terms of road congestion (million euro)
450	1621

Chapter 6 Conclusions and recommendation

This thesis aims to study the Marco Polo II Programme, which was initiated by the European Commission in order to ease road congestion and reduce the emissions caused by road congestion. Compared to other reports and evaluations, the main focus is on the road congestion problem in Europe and the impact of the Marco Polo II Programme on the EU economy in terms of the road congestion. Based on this focus, the main research question is identified as ***"What is the potential effect of the Marco Polo II Programme on EU road congestion and what are the economic effects for the EU economy?"***

By applying the Global Simulation Model and using the results of the road congestion model which is designed to assess the initial and final trade cost equivalents needed for GSIM, we accomplish the methodological approach to evaluate the impact of the Marco Polo II Programme on the EU's economy in terms of road congestion. In addition, two different scenarios are designed to fit the different actual achieve rate of the programme.

The outcomes of the GSIM model are described in the change of welfare for the EU and its Member States: all EU Member States gain, but Belgium and Germany are expected to gain most (more than 200 million euros) – in Belgium relatively the consumers, in Germany the producers. This is because of the very high rates of congestion in Belgium. Regarding output, we see that production increases for all EU Member States, albeit most in 'Rest of EU' in percentage terms (0.22%). However, also The Netherlands (0.20%) and Sweden (0.17%) gain relatively a lot. This can in part be attributed to the significant transport and logistics sector in the Netherlands that benefits from less congestion, as well as lowering of the congestion in general. Trade both in absolute and relative terms also changes. The ambitious results show that after the Marco Polo II Programme is completed, the impact of the ease in road congestion will lead to a remarkable increase in the trade value between EU member states, i.e. a huge impact on the EU internal market will be brought out. On the other hand, the tendency of trading within European Union leads to a decrease in the trade between EU and the rest of world as well as the United States. But the overall effect is still positive for the European Union. Under this scenario, the total benefits brought out by the ease of road congestion contribute 0.02% to the total GDP of European Union (2013) while the total cost of congestion is estimated as 1% of the total GDP of EU. (European Commission, 2011) In other words, the Marco Polo II Programme reduces 0.2% point of the total negative effect caused by road congestion. Considering the fact that the total budget of the Marco Polo II Programme is only 450 million euro and the expected benefits in the ambitious (80% effectiveness) scenario are estimated to be around 2637 million euro, the Marco Polo II Programme would be considered a success.

In the second scenario, the Marco Polo II Programme is assumed to have an actual achievement rate of 50 percent. This assumption is based on the actual achievement rate of the first Marco Polo Programme. The outcome of the second scenario is lower in absolute terms than the outcome of the first scenario but still shows great similarity with the first one. Welfare increases, and so does output. The EU internal market still benefits a lot from the ease of road congestion because all the EU member states will trade more with each other due to lower congestion problems (and less with third countries). The total benefits brought about in the second scenario is estimated as 1621 million euro. This is a contribution of 0.012% to the total GDP of the EU. This percentage shows that even if the Marco Polo II Programme is only as successful as Marco Polo I, in terms of GDP and National Income it is still a good return on EU budget investment.

Concluding the outcomes of the scenarios, the potential effects of the Marco Polo II Programme in terms of road congestion on the EU economy are positive. The total benefits are estimated at 2637 million euro under scenario 1 and 1621 million euro under scenario 2. Taking the limited budget of 450 million euro into account, the benefits generated are considerably higher than the costs for the programme. Moreover, besides the effect brought from the reduction in road congestion, the Marco Polo II Programme also contributes to the reduction in emissions, which also has a huge positive effect on the environment. That aspect was not discussed in this thesis.

Recommendations

Speaking of recommendations for future plans of European Commission, no matter whether it is going to be a brand new plan or the successor of the Marco Polo II Programme, improving the actual achieve rate is of the first priority. Observed from the comparison of two scenarios, the actual achievement rate directly influences the benefits brought from the ease of road congestion. On the other hand, even though there are more projects located in Western Europe where the most congested areas in EU are, and where the congestion index is already taken into consideration, the percentage change in trade value doesn’t show a big difference between Western Europe and other areas. This result reveals that there is no need to put the focus on the most congested area. Besides, the most congested areas are also relatively more developed than other areas, which means the projects located in the most congested areas might be costly and also hard to reach a high achieve rate.

Also, due to the lack of complete data and information, the assumptions about the elasticities used, and the tariff of the United States and the rest of world are based on the preliminary literature review. Thus the assumption might not be accurate enough and this leaves some spaces for the future research in this area.

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Appendix

7.1 Detailed data of the first matrix in GSIM model

trade at world prices: thousand euro

destination (columns); origin (rows)

	Germany	France	Netherlands	UK	Italy	Belgium	Spain	Poland	Austria	Sweden	Czech Repub	Hungary	Denmark	Finland	Slovakia	Rest EU	USA	ROW
Germany	0	117558940.8	80552779.9	84003124.95	62641927.3	49195881.4	37119151.3	50139098.8	65611282	24437484	36327351.8	20711489.92	18435071.7	9674662.77	12671807.17	55626926.8	119311365.9	1159018918
France	83300367.01	0	20708186.96	34756400	35952400.8	38876242.5	34267440.9	7993230.8	4271311.1	5521087.49	4040086.22	3410321.444	2915845.57	1802006.76	2506352.788	21241948.1	36530017.23	482835517.4
Netherlands	126649723.4	31330373.57	0	43075906.86	23383091.2	56545424.9	13238641.1	10865981.9	5865808.6	8984069.98	7148032.51	3017096.239	6382644.71	4883223.45	1678442.556	18096667.4	22165967.85	173612966.7
UK	42797003.65	49494635.1	33128325.55	0	11706528.4	18913958.1	11807642.3	5075497.32	2248053.5	7776618.11	2628157.35	1691926.691	4077097.2	2100739.87	649329.5768	33772281.9	63221188.98	120001531.8
Italy	57185256.54	49632831.44	10653731.78	22866045.04	0	13295500.8	20104024.7	11028530.7	10017096	4502258.73	4962904.68	4233563.096	2826672.78	1649159.02	2710460.86	29815325.3	36361260.93	223578641.8
Belgium	77531927.55	71192248.79	55858136.65	34589569.18	20359053.8	0	10832113.1	7444056.42	4453070.4	6370319.51	3518409.73	2245354.753	3176611.57	2524637.83	1203145.724	19187421.4	26462994.65	182097482.4
Spain	28029671.84	44659107.73	8065591.938	18641751.64	19522219.2	7256076.33	0	4527478.64	2250979.8	2235667.35	1921883.27	1582471.452	1404161.84	844294.115	780222.4585	28869506.2	11740134.05	114077172.7
Poland	44473219.2	10018134.34	7021687.929	11591357.26	7724298.96	3926673.02	4023868.93	0	3171762.4	4858037.04	10980773.5	4548390.563	2883573.38	1359527.28	4646557.526	11815937.8	4592195.018	97895668.66
Austria	43682746.35	6738452.23	2328375.877	4089896.214	9441139.77	1981241.3	2260815.08	4174397.37	0	1645875.27	5117475.46	4442204.538	774816.048	571028.765	2950834.176	9839999.59	8904110.845	42141685.51
Sweden	14542984.32	6642613.319	7811290.341	9536221.018	3438381.15	7171047.8	2451964.74	3987172.13	1267147.6	0	1100639.63	613725.3589	10041649.2	10472476.1	251999.3996	4824897.97	9652568.008	40993408.58
Czech Republic	45196283.62	7127544.867	4022684.924	6952291.588	5127358.94	3636167.88	3108785.44	8595521.15	6582196.9	2166171.34	0	3767975.147	1189679.44	695427.088	12936508.4	5902324.63	3495349.946	57314832.65
Hungary	24884971.33	4259110.101	2731831.865	3726082.854	4568069.48	1459254.61	2396389.23	3763582.99	5390710	937614.556	3649213.57	0	716757.282	308330.653	5207229.896	10382379.1	3316420.821	24429736.89
Denmark	15156534.62	2907468.889	4000251.71	7913199.132	2065353.44	1493230.33	1517560.63	2244114.51	587418.92	11593372.5	554425.47	516720.8627	0	2663017.57	235610.2314	3215228.86	5815896.654	19348068.52
Finland	6183778.675	2129658.194	3990125.472	3245800.082	1526086.82	2141918.08	887789.582	1599866.59	358645.28	7628391.47	281226.762	245692.0474	1216519.51	0	115313.6007	4005917.86	4430629.823	37114987.08
Slovakia	16170595.68	3863400.812	1776085.187	3533071.248	3464131.23	1170621.52	1417495.69	6345295.87	4669378.4	1082800.42	10458697	4801131.499	682004.598	192675.331	0	3899107.51	1586014.914	27073837.15
Rest EU	44467501.97	21854402.55	12594660.81	27364127.74	22398931	19940607.3	20241327	8110066.29	6264542.8	6922399.2	3934732.26	5113838.64	3371244.04	4206841.09	2339517.843	31572834	33288060.89	11806828.8
USA	50807171.42	36790525.21	45864128.17	50862376.18	17810188.8	34249102.4	10977724.9	4204516.79	3829416	4662058.65	2109406.86	1883478.53	2399934.26	2552549.88	318973.9767	15141356	0	119278872.5
ROW	714429493.9	111170428.2	248245094.6	194607255	145965208	79889436.6	80273943.5	49859310.4	18354784	27676317.4	20088746.5	19880310.23	19530464	24009307.7	14671532.43	121608166	1397884275	12064950122
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	1435489231	577369876.1	549352969.7	561354475.9	397094368	341142385	256926678	189957719	145193603	129000543	118822163	82705691.01	82024747.2	70509905.3	65873838.61	428818226	1788758452	14997570280

7.2 Initial trade cost equivalent matrix in scenario 1 & scenario 2

initial bilateral import tariffs

destination (columns); origin (rows)

	Germany	France	Netherlands	UK	Italy	Belgium	Spain	Poland	Austria	Sweden	Czech Repub	Hungary	Denmark	Finland	Slovakia	Rest EU	USA	ROW
Germany	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
France	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Netherlands	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
UK	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Italy	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Belgium	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Spain	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Poland	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Austria	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Sweden	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Czech Republic	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Hungary	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Denmark	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Finland	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Slovakia	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
Rest EU	1.027	1.028	1.014	1.051	1.035	1.01	1.017	1.022	1.015	1.023	1.005	1.007	1.015	1.024	1.004	1.025	1.0375	1.0629
USA	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1	1.0738
ROW	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0665

7.3 Final trade cost equivalent matrix in scenario 1

final bilateral import tariffs

destination (columns); origin (rows)

	Germany	France	Netherlands	UK	Italy	Belgium	Spain	Poland	Austria	Sweden	Czech Repub	Hungary	Denmark	Finland	Slovakia	Rest EU	USA
Germany	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
France	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Netherlands	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
UK	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Italy	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Belgium	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Spain	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Poland	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Austria	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Sweden	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Czech Republic	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Hungary	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Denmark	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Finland	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Slovakia	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
Rest EU	1.02678	1.02748	1.01363	1.05065	1.03463	1.00872	1.01683	1.02193	1.01451	1.02279	1.00495	1.00688	1.01464	1.02385	1.00395	1.02482	1.0375
USA	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1
ROW	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441

7.4 Final trade cost equivalent matrix in scenario 2

final bilateral import tariffs

destination (columns); origin (rows)

	Germany	France	Netherlands	UK	Italy	Belgium	Spain	Poland	Austria	Sweden	Czech Repub	Hungary	Denmark	Finland	Slovakia	Rest EU	USA	ROW
Germany	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
France	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Netherlands	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
UK	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Italy	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Belgium	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Spain	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Poland	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Austria	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Sweden	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Czech Republic	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Hungary	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Denmark	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Finland	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Slovakia	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
Rest EU	1.02687	1.02768	1.01378	1.05078	1.03477	1.0092	1.01689	1.02196	1.0147	1.02287	1.00497	1.00692	1.01477	1.0239	1.00397	1.02489	1.0375	1.0629
USA	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1.052	1	1.0738
ROW	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0441	1.0665

7.5 Elasticity matrix in scenario 1 & scenario 2

	Elasticities:	Germany	France	Netherlands	UK	Italy	Belgium	Spain	Poland	Austria	Sweden	Czech Reput	Hungary	Denmark	Finland	Slovakia	Rest EU	USA	ROW
Em	Composite Demand	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1.7	-1.7
Ex	Industry Supply	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Es	Substitution	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

7.6 Data of tonne-kilometre derived from Eurostat

Goods transport by road
Million TKM (tonne-kilometre)

geo \ time	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU (28 countries)	:	:	:	:	:	:	:	:	:	1,743,604	1,692,329	1,719,199
EU (27 countries)	:	:	:	:	:	:	:	:	:	1,734,678	1,683,680	1,710,065
Euro area (18 countries)	:	:	:	:	:	:	:	:	:	:	:	:
Euro area (17 countries)	:	:	:	:	:	:	:	:	:	:	:	:
Belgium	52,889	50,542	47,878	43,847	43,017	42,085	38,356	36,174	35,002	33,107	32,105	32,796
Bulgaria	:	:	:	:	13,765	14,624	15,322	17,742	19,433	21,214	24,372	27,097
Czech Republic	43,674	46,535	46,011	43,447	50,376	48,141	50,877	44,955	51,832	54,830	51,228	54,893
Denmark	22,516	23,009	23,114	23,299	21,254	20,960	19,480	16,876	15,018	16,120	16,679	16,072
Germany	285,214	290,745	303,752	310,103	330,016	343,447	341,532	307,547	313,104	323,833	307,009	305,744
Estonia	:	3,974	5,099	5,824	5,548	6,417	7,354	5,340	5,614	5,912	5,791	5,986
Ireland	14,275	15,650	17,144	17,910	17,454	19,020	17,402	11,687	10,939	10,108	9,976	9,215
Greece	:	19,340	36,773	23,761	34,002	27,791	28,850	28,585	29,815	20,597	20,839	18,970
Spain	184,549	192,596	220,822	233,230	241,788	258,875	242,983	211,895	210,068	206,843	199,209	192,597
France	204,359	203,608	212,201	205,284	211,445	219,212	206,304	173,621	182,193	185,685	172,445	171,472
Croatia	:	:	:	:	:	:	11,042	9,426	8,780	8,926	8,649	9,133
Italy	192,681	174,088	196,980	211,804	187,065	179,411	180,461	167,627	175,775	142,843	124,015	127,241
Cyprus	1,322	1,401	1,119	1,393	1,165	1,202	1,308	963	1,087	941	896	634
Latvia	6,200	6,808	7,381	8,394	10,753	13,204	12,344	8,115	10,590	12,131	12,178	12,816
Lithuania	:	11,462	12,279	15,908	18,134	20,278	20,419	17,757	19,398	21,512	23,449	26,338
Luxembourg	9,179	9,645	9,575	8,803	8,807	9,562	8,965	8,400	8,694	8,835	7,950	8,606
Hungary	17,913	18,208	20,608	25,152	30,479	35,805	35,759	35,373	33,721	34,529	33,736	35,818
Malta	:	:	:	:	:	:	:	:	:	:	:	:
Netherlands	77,418	79,765	89,695	84,163	83,193	77,921	78,159	72,675	75,783	73,713	67,804	70,184
Austria	38,498	39,557	39,186	37,044	39,187	37,402	34,313	29,075	28,659	28,542	26,089	24,213
Poland	:	:	102,807	111,826	128,315	150,879	164,930	180,742	202,308	207,651	222,332	247,594
Portugal	29,724	27,425	40,819	42,607	44,835	46,203	39,091	35,808	35,368	36,453	32,935	36,555
Romania	:	:	:	:	57,288	59,524	56,386	34,269	25,889	26,349	29,662	34,026
Slovenia	6,609	7,040	9,007	11,032	12,112	13,734	16,261	14,762	15,931	16,439	15,888	15,905
Slovakia	:	16,748	18,527	22,566	22,212	27,159	29,276	27,705	27,575	29,179	29,693	30,147
Finland	31,967	30,926	32,290	31,857	29,715	29,819	31,036	27,805	29,532	26,863	25,460	24,429
Sweden	36,652	36,638	36,949	38,575	39,918	40,540	42,370	35,047	36,268	36,932	33,481	33,529
United Kingdom	164,035	167,143	162,654	161,285	165,479	170,991	160,296	139,536	146,685	153,517	158,461	147,188
Iceland	:	:	:	:	:	:	:	:	:	:	:	:
Liechtenstein	:	:	:	390	339	339	328	263	303	312	280	317
Norway	15,426	16,590	17,460	18,247	19,387	19,375	20,595	18,447	19,751	19,188	20,171	21,317
Switzerland	:	:	:	:	:	:	13,911	13,174	13,237	13,567	12,966	12,817
Montenegro	:	:	:	:	:	:	:	:	:	:	:	:
Former Yugoslav Republic of Macedonia, the	:	:	:	:	:	:	:	:	:	:	:	:
Serbia	:	:	:	:	:	:	:	:	:	:	:	:
Turkey	:	:	:	:	:	:	:	:	:	:	:	:

:=not available

Source of Data: Eurostat
Last update: 30.07.2015
Date of extraction: 17 Aug 2015 18:21:28 CEST

7.7 Modal split rate derived from Eurostat

Modal split of freight transport
% in total inland freight tonne-km
Roads

geo \ time	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU (28 countries)	:	:	:	:	:	:	:	:	:	:	:	74.8	75.5	76	76.1	76.4	76.3	76.3	76.3	77.5	76.2	75.6	75.2	75.4
EU (27 countries)	:	:	:	:	:	:	:	:	:	:	73.7	74.8	75.5	75.9	76.1	76.4	76.3	76.3	76.3	77.5	76.2	75.6	75.3	75.4
Belgium	:	73.2	73.1	75.4	76.7	77.4	76.4	76.7	75.1	73.1	77.4	78.3	77.5	76.5	74.9	72.4	70.1	69.7	68.5	72.9	67.9	66.3	64.2 (e)	64.5 (e)
Bulgaria	:	:	:	:	:	:	:	:	:	:	52.3 (b)	60.2	62.9	61.7	66.9	70.8	69	70.1	66.9	67.4	68.1	73.6	74.7	75.9
Czech Republic	:	:	:	:	50.3	57.5	57.1	65.8	64.3	68.8	68	69.7	73.3	74.5	75.2	74.4	76.1	74.7	76.7	77.8	79	79.2	78.2	79.7
Denmark	91	90.8	91.2	91.9	91.5	91.8	92.3	91.5	91.2 (e)	92.2	92.1	91.8	92.1	92.1	90.9	92.2	91.8	92.2	91.3	90.8	87	86	88	86.8
Germany	:	58.6	60.6	61.8	61.6	63.9	64.3	64.4	65	66.6	65.3	66.5	66.3	68	66.9	66	65.9	65.7	65.5	67	64.9	65.8	64.6	63.9
Estonia	:	:	:	20.9	28.3	28.7	31.1	30.4 (b)	32.7	32.3	37.3	31.2	30.3	29.1	32.7	35.4	34.7	43.2	55.3	47.3	45.8	48.5	53	55.9
Ireland	89.7	89.5	89.1	89.9	90.2	90.1	91.7	93.1	94.6	95.1	96.2	96	97.1	97.5	97.7	98.3	98.8	99.3	99.4	99.3	99.2	99	99.1	98.9
Greece	:	95.8	96	96.8	98.1	97.7	97.8 (e)	98.2	98.5 (e)	98.4 (e)	97.9 (e)	98.1 (e)	98.4 (e)	97.7	98.4	97.5	98.1	97.1	97.3	98.1	98	98.3	98.7	98.8
Spain	:	89.3	90.7	92.2	91.5	90.3	90.2 (e)	89.7 (e)	91.7 (e)	92.1	92.8	93.2	94.1	94.3	94.7	95.3	95.4	95.8	95.7	96.4	95.9	95.6	95.5	95.4
France	:	73.3	73.9	75.3	75.3	76.5	76.4	74.9	75.3	76.8	76	77.9	77.7	78.8	79.9	80.5	80.8	80.9	80.7	81	82.2	81.1	80.6	80.6
Croatia	:	:	:	:	:	38.4	:	:	:	:	:	78 (b)	78	77.6	78.1	75.9	74.8 (e)	74 (e)	72.7	73.7	71.2	74	73.6	76.2
Italy	:	87.1	88	88.1	87.1	88.2	89.2	88.3 (e)	89.1 (e)	89.1	89	89.3	90.4	89.5	89.8	90.3	88.5	87.6	88.3	90.4	90.4	87.8	85.9	86.9
Cyprus	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Latvia	:	22.4	19.8	11.3	12.8	15.8	15.1	19.4	24	25.4	26.5	27.4	29.2	27.5	28.4	29.8	39	41.9	38.7	30.2	38.1	36.2	35.8	39.6
Lithuania	27.4	28.2	30.5	41	36.3	41.6	34.1	37.4	40.4	49.6	46.6	51.7	52.3	50	51.3	56.1	58.4	58.5	58	59.9	59.1	58.8	62.3	66.4
Luxembourg	74.9	75.2	80	81.4	79.7	85.9	79.7	81.9	83.3	86.2	87.8	89.6	90.7	92	91.2	92.3	91.5	91.2	93.3	94.6	92.7	93.7	93.9 (e)	94.2 (e)
Hungary	:	:	:	58.9	60 (e)	58.3 (e)	61.3 (e)	60.8 (e)	65.8	68.2	68.1	67.7	66.2	66.6	65.9	69.2	71.6	74.5	74.7	78.8	75.1	75.9	75.1	75.5
Malta	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Netherlands	:	60.2	62.7	64.1	62.2	63.6	64.2	61.4	63.8	64.8	63.4	63	63.3	64.6	64.7	63.6	63.1	59.4	59.9	63.8	59.1	58.2	55.8	56.2
Austria	49	49.6	51.3	52.7	50.8 (e)	63.5 (e)	64.3 (e)	63.7	64 (e)	66.3	64.8	65.9	65.8	67.4	65.6	64.1	63.2	60.9	58.6	59.5	56.3	56	54.6	52.8
Poland	32.8	37.6	41.8	39	40.9	42.6	45.3	48.1	52.9	55.7	57.3	61.6	62.6	64.3	66.1 (b)	69	70.4	73.5	75.9	80.5	80.6	79.4	81.9	82.9
Portugal	:	91.8	90.7	90.5	91.9	90.3	92.6	91.7	92.5	92.3	92.4	93.3	93.1	93	94.7 (b)	94.6	94.9	94.7	93.9	94.3	93.9	94	93.2	94.1
Romania	36.2	37.4	37.4	39.4	44	42	41.4	45.1	43.1	43.5	42.9	49.6	57.3	62.4	60.8	67.3	70.5	71.3	70.2	60	49.2	50.2	53.3	57.5
Slovenia	53.8	57.3	64.4	67	67.6 (e)	64.9 (e)	71.7 (e)	69.6 (e)	70.6 (e)	71.6 (e)	71.9 (e)	73	70	70	74.1	77.3	78.2	79.2	82.2	84	82.3	81.4	82.1	80.7
Slovakia	:	:	:	31.2	47.7	63.7	53.8	52.5	57.8	61.6	53 (b)	53.6	58.7	62.1	65.4	70.3	68.8	71.8	73.8	77.9	74.8	76.6	77.6	76
Finland	74.9	76.2	75.8	72.8	71.9	72.3 (e)	73.7	72.1 (e)	73.8	75	75.8	75.4	76.6	75.3	76	76.5	72.8	73.9	74.1	75.7	75	73.9	73	71.8
Sweden	58.1	57.4	55.8	58.2	58.6 (e)	62	63.9	64.6 (e)	63.5 (e)	63.5 (e)	64.7	64.3	65.6	64.5	63.9	64	64.2	63.6	64.9	63.2	60.7	61.8	60.3	61.8
United Kingdom	:	90	89.6	91.2	92.2	92.3	91.6	90.8	90.8	90.1	90	89.3	89.7	89.8	87.8	88.2	88.2	88.9	88.3	87.8	88.7	87.9	88	86.7
Iceland	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Liechtenstein	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	95.8	95	95	95.1	96.3	96.5	96.9	96.6	97.2
Norway	:	:	:	:	:	78	81.7	82.4	83.6	83.7	83.5	84	85.1	86.3	86	85.2	85.3	84.7	85	84	85	84.3	85.3	86.3
Switzerland	:	:	:	:	:	:	:	:	:	:	55.1	56	57.5	58.6	57.8	57.5	56.7 (e)	58.7 (e)	53.1	55.5	54.4	54.1	54	52
Former Yugoslav Republic of Macedonia, the	:	:	:	:	:	:	:	:	:	:	86.9	87.1 (b)	91.7	93.6	92.6	91.3	93.1 (e)	88.4 (e)	84.3 (e)	89	89	94.9 (b)	95.5	94.7
Turkey	:	:	:	92.1	92.1	93	93.8	93.6	94.8	94.8	94.2	95.2	95.4	94.6	94.4	94.8	94.9	94.9	94.5	94.6	94.4	94.7	95.1	95.4

:=not available e=estimated b=break in time series z=not applicable p=provisional n=not significant

Source of Data: Eurostat
Last update: 30.07.2015
Date of extraction: 17 Aug 2015 18:24:02 CEST

7.8 Marco Polo Annex 2013 Page 1

ANNEX

Projects selected for funding as a result of the 2013 selection procedure under the "Marco Polo II" Regulation 1692/2006 as amended by Regulation 923/2009

Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/002	MOD	**AIT MARE** Shifting the transportation of automotive inbound industries from road to a new intermodal Short Sea Shipping service between Italy (Turin- port Savona) and Spain (two ports Barcelona/Valencia).	- **Arcese Trasporti S.p.A. (IT)**	€ 13,826,765	€ 1,495,948
MPII-2013/004	MOD	**ALBA.IT** Developing a new port-to-port dedicated freight service between Durres (Albania) and Trieste (Italy) with a regular Ro-Ro Short Sea ferry connection shifting freight off the road (Italy, Slovenia, Croatia, Montenegro, Albania coast).	- **AFH S.P.A. (IT)** - Frittelli Maritime Group S.p.A. (IT)	€ 24,741,903	€ 2,238,606
MPII-2013/005	MOD	**NORNED** Establishing a regular and direct intermodal rail connection between Norway/Denmark and Netherlands.	**TX Logistik AG (DE)**	€29,172,605	€ 3,392,091
MPII-2013/007	MOD	**Logport** Shifting the transportation of freight between the Duisburg port logistic centre 'Logport' and the ports of Antwerp and Zeebrugge off the roads and on to a rail or barge connection.	- **Duisburger Hafen AG (DE)** - Duisport agency GmbH (DE)	€23,101,500	€1,284,993
MPII-2013/008	MOD	**LHT Intermodal** Developing new rail services dedicated to chemical product transports between chemical product traders in the Antwerp port area and their customers/suppliers in Germany, France and the Netherlands.	- **Naamloze Vennootschap Antwerp Distribution and Product operations (BE) (ADPO nv)**	€ 24,596,815	€ 737,755
MPII-2013/009	MOS	**ATLANTICA** Developing a Motorway of the Sea between the Spanish port of Vigo and the French port of Nantes-St.Nazaire. This motorway aims to high frequencies and high volumes of cargo.	- **Grupo Logistico Suardiaz S.L. (ES)**	€ 77,008,066	€ 3,000,000
MPII-2013/010	MOD	**Biolinks** Establishing a regular Danube waterway transport service for renewable resources and wood-based biomass between Romania/Bulgaria and Austria.	- **B2S Consulting & Trading GmbH (AT)** - PETROLINKS Handels GmbH (AT)	€ 5,860,419	€ 1,147,953

[4] mod = modal shift action, mos= motorways of the sea action, cat = catalyst action, cla = common learning action

7.9 Marco Polo Annex Page 2

Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/014	MOD	**ECO COMBI** Starting up a new rail freight service from southern France to Northern Italy, between the terminals of Miramas (in France) and Mortara and Castelgueifo (in Italy).	- **VFLI (FR)** - Fuorimuro Servizi Portuali e Ferroviari S.r.l. (IT) - Régie Département ale des Bouches du Rhône -RDT 13 (FR)	€ 20,516,545	€ 1,790,000
MPII-2013/016	MOD	**EcoWoodExpress** Shifting transport flows from the road to railway between Slovakia - Italy. The goods transported will be pellets on westbound ways and solid recovered fuel (SRF) eastbound.	- **Express Slovakia "Medzinárodná preprava a.s." (SK)**	€ 5,800,389	€ 786,011
MPII-2013/017	MOD	**WagRoro** Developing of an unaccompanied new roll-on roll-off liner service between the ports of Eemshaven (NL) and Göteborg (SE). The liner service will run directly between Eemshaven (The Netherlands) and Göteborg (Sweden).	- **Wagenborg Stevedoring B.V. (NL)**	€ 41,430,296	€ 3,904,061
MPII-2013/018	MOD	**B2UK** Implementing a door-to door intermodal rail service for the transportation of industrial and consumer goods from Bulgaria to the UK, via Belgium (Genk). The modally shifted route will go from Sofia (Bulgaria) to Zeebrugge (Belgium), with onward transport by short-sea shipping to Killingholme (UK) followed by road-based delivery to Doncaster (UK).	- **Gopet Trans Eood (BG)**	€ 17,243,083	€ 2,380,561
MPII-2013/025	MOD	**B2S** Transporting vans, produced in Düsseldorf for the Turkish market. The vehicles will be shipped by vessel to the Port of Antwerp for on-forwarding by barge instead of road.	- **Horst Mosolf Internationale Spedition GmbH & Co KG (DE)**	€ 4,684,831	€ 492,520

7.10 Marco Polo Annex Page 3

Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/028	MOD	**Binderholz Goes Rail** Shifting the transport of wood and sawn timber from road to rail. The following origin and destination countries are involved: Austria, Germany, France, Croatia, Bulgaria, Hungary, Romania, Poland, Latvia, Lithuania, Czech Republic, Slovakia, Slovenia, Italy, Switzerland, Ukraine, Bosnia-Herzegovina and Russia.	- **Binderholz GmbH (AT)** -Binderholz Bausysteme GmbH (AT) -Binderholz Deutschland GmbH (DE)	€ 77,112,497	€ 4,271,190
MPII-2013/029	MOD	**FFCL** Shifting containerized truck freight to inland waterways, from the sea ports of Antwerp and Rotterdam to the Northern French hinterland.	- **Danser Group BV (NL)**	€ 5,747,183	€ 363,413
MPII-2013/031	MOD	**N.E.S.T.L.E.** "Networking in the European Supply chain Through Logistic Evolution" (N.E.S.T.L.E.) aims to establish a complete train link using scheduled rail services between Italy, France, Germany and Slovakia shifting from road to rail.	- **NESTLÉ ITALIANA S.p.A. (IT)** - TRENITALIA S.p.A. (IT)	€ 14,415,638	€ 827,590
MPII-2013/032	MOD	**CONTRAST** Implementing a single wagon load (SWL) service along the international route from the Port of Rostock (DE) to Sopron (HU), via Wustermark/Berlinn (DE), Dresden (DE), Breclav (CZ) and Vienna (AT), including the combination of rail and IWW transport solutions.	- **VTG Rail Logistics Deutschland GmbH (DE)**	€ 27,811,223	€ 1,945,150

7.11 Marco Polo Annex Page 4

Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/033	CLA	**eKnow IT** Sharing best practices and success stories of modal shift in Europe between stakeholders (Universities, Transport Institutes and Professional Associations) , identifying real examples of European Modal Shifts, developing Case Studies with scientific value recognized by the academic community and including them as training tools in University Courses, seminars, Associations' workshops and International fairs.	- **Centro de Estudos de Gestão do Instituto Superior de Economia e Gestão (PT)** - Universidad de Oviedo (ES) -Autoridad Portuaria de Gijón (ES) - Institute of Shipping Economics and Logistics (Institut für Seeverkerswirtschaft und Logistik) (DE))	€ 570,666	€ 285,235
MPII-2013/035	CLA	**On the Mosway Network** Promoting the use of LNG as alternative marine fuel in the maritime industry thanks to: a set of professional trainings on LNG handling, bunkering and safety issues, a number of cross fertilization on site dedicated visits related to LNG bunkering best practice, an extension of the web portal onthemosway.eu., clustering meetings and final conference and the creation of a formal association of stakeholders for the promotion of MoS in Europe.	- **University of Strathclyde (UK)** - City of Glasgow College(UK) -University of study of Genova - (Università degli Studi di Genova) -(IT) - Circle slr (IT) - La Spezia Port Authority (IT) - Fondazione Accademia Italiana della Marina Mercantile (IT) - Ocean Finance (GR) -	€ 1,424,500	€ 712,250

7.12 Marco Polo Annex Page 5

Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/036	MOD	**Flipper** Providing a new intermodal transport service between Germany and Greece as well as Turkey. It is composed of a new shuttle train service Frankfurt/Ludwigshafen – Trieste (Italy) vv which is synchronised with existing ferry connections Trieste – Patras (Greece) and Trieste – Istanbul (Turkey).	**Kombiverkehr Deutsche Gesellschaft für kombinierten Güterverkehr mbH & Co. KG (DE)**	€ 14,949,021	€ 1,493,657
MPII-2013/041	MOD	**T.R.E.N.D.** "Towards new Rail freight transport in the European Network in respect to market Demand" (T.R.E.N.D.) aims to shift road traffic onto rail with a new service for steel products in the following Member States: Italy, France and Spain.	- **EUROLOGISTIC S.r.l. (IT)** - TRENITALIA S.p.A. (IT)	€ 7,065,179	€ 823,160
MPII-2013/048	MOD	**GRAIN TRAIN** Establishing a new intermodal link between the regions of Debrecen (Hungary) and Schleswig Holstein (Germany) primarily for the transport of grain products in bulk containers over a distance of about 1.500 km. The GrainTrain project involves both the implementation of a new transport service between Debrecen (Hungary) and Budapest (Hungary) and the enhancement of an existing intermodal rail shuttle between Budapest and the Port of Hamburg (Germany).	**- EUROGATE Intermodal GmbH (DE)**	€ 7,338,466	€ 923,748
MPII-2013/051	MOD	**TRANSPYRENAEI RAIL** Achieving a modal shift of freight transport from road to rail between Spain and France. Offering a rail connection between Tarragona - Barcelona – Perpignan.	- **Transportes Portuarios, S.A. (ES)** - Autoritat Portuària de Barcelona (ES) - Autoritat Portuària de Tarragona, Spain (ES)	€11,632,328	€1,107,119
MPII-2013/052	MOD	**Paper rail** Shifting road freight to rail. Including two different services: on one side, the enhancement of an already existing service between Spain and Portugal by adding 1 more roundtrip per week; and, on the other side, the implementation of a new service between Spain and France	- **Sociedad Industrias Celulosa Aragonesa (SAICA) (ES)**	€ 12,646,694	€1,253,038

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Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/053	MOD	**WOODRAIL II** Establishing a new rail freight service in order to transport goods of wood producers and suppliers of Galicia (North West Spain) to the Portuguese paper and pulp industry. This new service will provide additional routes to the existing ones already linking Lugo (ES) and A Coruña (ES) to Leirosa (PT).	- **COMSA Rail Transport, S.A (ES)** - IBERCARGO RAIL, S.A (ES)	€ 10,627,754	€ 437,953
MPII-2013/054	MOD	**STEEL IBER EXPRESS** Providing a new rail freight service transporting steel products between Spanish and Portuguese Megasa's plants. The freight is exclusively steel products (steel scrap and steel rods).	**TRANSPORTES FERROVIARIOS ESPECIALES S.A. (TRANSFESA) (ES)**	€ 9,284,342	€ 1,131,218
MPII-2013/057	MOD	**KAMEL** Establishing a new shuttle train service between the terminals of Melzo (Italy) and Karlsruhe (Germany). The service includes rail connections to Karlsruhe via Melzo from/to Prato and Pescara (by new train services), and Frosinone, Padova and the Ligurian Ports (by existing train connections).	**- Hannibal S.p.A. (IT)**	€ 8,652,153	€ 1,185,055

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Prop. No. (DGMOVE/ D1/SUB/ 283-2013)	Action type[4]	**Project Acronym** Short Description	Companies Benefiting **(Lead Company in bold)**	Total maximum eligible costs [€]	Maximum EU contribution [€]
MPII-2013/060	MOD	**Mars Goes International** Starting and expanding sustainable means of transport of goods to Western European distribution centres and to final customers. Creating an integrated distribution network of Mars' products produced on the 'outskirts' of Europe to Mars' distribution centres (mainly) in North Western Europe.	- **Mars Magyarország Kisállateledel Gyárto Kft (Mars Petcare Production Hungary Ltd) (HU)** - Mars GmbH (DE) - Mars Austria OG (AT) - UAB Mars Lietuva (LT) - Mars Polska Sp. Z o.o. (PL) - Wrigley Confections ČR kom.spol. (CZ) - Mars Nederland B.V. (NL)	€ 66,220,001	€3,280,977

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