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Master thesis

The effect of the New Silk Road on EU-China trade

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Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

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Abstract

The thesis tries to investigate which impact the new Silk Road announced 2013 by the Chinese president has on EU-China trade potentials. The so called OBOR initiative is an infrastructure project that aims to promote trade facilitation along the ancient Silk Road. The initiative includes more than 60 countries. The gravity model of trade will be applied to run a simulation exercise to estimate trade potentials from the EU to China and vice versa. The results suggest that China can increase its trade potential to the EU. Among the EU countries there are winners and losers. Those countries which participate in the initiative will benefit from an increased trade potential others will lose trade potential.

Keywords

EU-China trade, gravity model, OBOR, trade potential, infrastructure

JEL codes

F1, F14, F17

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Proposed topic	The effect of the New Silk Road on EU-China trade

Topic characteristic

The aim of the thesis is to analyze the impact of the so called "One Belt One Road" initiative on the trade relationship between the European Union and China. Announced in 2013 the OBOR project is planned to be an infrastructure project including more than 60 countries. This project could facilitate and change trade patterns around the globe. China as the biggest trading nation in the world has a huge impact on international trade. The project includes investments in infrastructure and ongoing trade negotiations with China and its partners. Despite the fact that the major European economies like the UK, France, Italy or Germany are not officially part of the initiative the consequences for the EU and its member states can be significant. An improvement of infrastructure could boost trade relations towards the East and China. In the background that the TTIP partnership with the US faces certain difficulties economic ties could get closer with China and Asia. The goal of the thesis is to estimate trade potentials that arise from an improvement of infrastructure along the New Silk Road. Transportation costs are an important factor in international trade and hence a reduction could lead to increasing trade between the EU and China which already form one of the biggest trading blocs in the world. The topic is relevant from a European perspective as this could influence Sino-EU political and economic relations, opens up opportunities for growth in the EU due to infrastructure investments and could have positive effects on European exports to Asia and China.

Working hypotheses:

1. H1: An improvement of infrastructure to China will lead to more EU exports to China
2. H2: Imports from China will grow less than exports to China
3. H3: The big EU economies will disproportionately benefit from the project
4. H4: The impact of infrastructure outweighs a possible FTA between the EU and China

Methodology:

I will apply the gravity model of international trade to estimate trade potential from an improvement of infrastructure. I will use different data sources like UN comtrade, WITS, Eurostat to form a comprehensive data set that includes not only countries along the Silk Road and the EU. I will use the STATA software to compute a simulation to estimate trade potentials. Besides the common variables that are standard in the gravity literature I will try to estimate the impact of transportation costs on trade. In a next step I will try to estimate what effect a reduction in transportation costs, ceteris paribus has on EU China trade volumes.

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Anderson, James E., and Eric Van Wincoop. "Gravity with gravitas: a solution to the border puzzle." *the american economic review* 93.1 (2003): 170-192.

Baier, Scott L., and Jeffrey H. Bergstrand. "The growth of world trade: tariffs, transport costs, and income similarity." *Journal of international Economics* 53.1 (2001): 1-27.

Baier, Scott L., and Jeffrey H. Bergstrand. "Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation." *Journal of International Economics* 77.1 (2009): 77-85.

Anderson, James E., and Eric Van Wincoop. "Trade costs." *Journal of Economic literature* 42.3 (2004): 691-751.

Garcia Herroro, Alicia, and Jianwei Xu. "China's Belt and Road initiative: can Europe expect trade gains? Bruegel Working Paper ISSUE 5/2016." (2016).

Minghao, Zhao. "China's New Silk Road Initiative." *Istituto Affari Internazionali, Rome* (2015).

1. Introduction

The Belt and Road initiative was officially announced in 2013 by the Chinese president Xi Jingping. The project is comprises more than 60 countries in Europe, Asia, Central Asia, the Middle East, South East Asia and Africa. The goal of the project is to promote and invest in infrastructure to facilitate trade infrastructure among all the participating countries. The EU and China are important trading partners for each other and therefore investments in infrastructure could help to further boost trade.

The thesis applies a gravity model of international trade firstly introduced by Tinbergen in 1962. The gravity model is a standard workhorse in trade analysis and proved to deliver robust estimations. The model allows conducting a simulation of trade potentials as reliable data on OBOR does not exist yet (Garcia-Herrero & Xu, 2016).

The goal of the thesis is to determine trade potentials between the European Union and China that could arise from this initiative. Trade potentials are calculated as the difference of predicted mean exports obtained by gravity estimations minus real exports. The project is just about to start and therefore reliable data on how the project will shape trade facilitation is not available. I will therefore apply a simulation assuming that OBOR improves different infrastructure indicators and reduces country specific trade costs. The gravity model allows predicting trade values based on the dataset which is used. I will estimate trade potentials under the status quo and then trade potentials are estimated under OBOR conditions. This implies that all infrastructure variables are improved by 10% and trade costs to export are reduced by 10%. The variation of the trade potentials then will be interpreted as the effect that OBOR has on EU-China trade.

The main motivation for the thesis is to better understand which impact infrastructure has on trade potentials between countries. The main question is how an improvement of infrastructure and a reduction of trade costs affect trade potentials between the EU and China and to find out if the countries trade potential will be affected by the OBOR initiative. The idea is to simulate a hypothetical scenario due to lack of reliable data to estimate the impact that OBOR could have on EU-China trade.

Section 2 contains three parts: First, a short summary of what OBOR is will be provided. Second, the trade relation between the EU and China will be summarized. Third, a comprehensive review of the relevant literature for the thesis will be given. Section 3 deals with common problems that arise when the gravity model is applied. Section 4 summarizes the data and methodology. Section 5 presents the estimation results and section 6 concludes. Section 7 gives the authors opinion and adds some critical remarks.

2. Literature Review

2.1.What is OBOR?

In September 2013 Xi Jingping announced during a visit in Kazakhstan the “Silk Road Economic Belt“ (SREB) and one month later in Brunei at the 16th ASEAN-China summit Premier Li Keqiang announced the complementary project knows as “21st-century maritime Silk Road” (MSR). Together they are formally known as “One Belt One Road” (OBOR). The ancient Silk Road which stretched from China to Rome with a length of more than 10 000 kilometres can be dated back to the Han Dynasty (206 BC-220 AD). Also a maritime route was established by the Song Dynasty (960-1279) to promote trade with Southeast Asian countries more than thousand years ago (Wong & Lye, 2014).

OBOR is a project which seeks to promote infrastructure to connect countries in Asia, Africa, the Middle East and Europe to support trade facilitation. President Xi Jingping centred the project as one of his key policy projects (Kennedy & Parker, 2015). Some sources indicate that 65 countries could participate including at least 18 European (Garcia-Herrero & Xu, 2016).

On the 28th of March in 2015 an official document was launched jointly by the Ministry of Foreign Affairs, the Ministry of Commerce of the People´s Republic of China and the National Development and Reform Commission in which the key objects were summarized. The document encompasses plans for the expansion of infrastructure, reduction in tariffs, increasing economic cooperation and trade, environmental cooperation, financial investment cooperation and many more layers of the economy and the society. The document determines five key objectives of the OBOR initiative: policy coordination, connectivity of facilities, unrestrained trade, financial integration and people to people bonds (Pop, 2016).

The project is supposed to cover 64 percent of world´s population and combines a share of 30 percent of world´s GDP (Garcia-Herrero & Xu, 2016). The full realization of the whole project is expected by the year of 2049which also marks the 100th birthday of the People´s republic of China (Bondaz, et al., 2015).

The main aspect of the OBOR project is the development of infrastructure to sustain trade facilitation with China as the centre. All routes on land and on sea start/end in China. China plans to establish five major routes which will comprise 6 economic corridors (HKTDC, 2016). The five routes are subdivided into the Economic Belt and the Maritime Silk Road. The Economic Belt will focus on three routes linking China with

(1) Europe Central Asia and Russia
(2) The Middle East Region through Central Asia
(3) Southeast Asia, South Asia and ports in the Indian Ocean

The Maritime Silk Road is supposed to link China with

(1) Europe by the South China Sea and Indian Ocean
(2) The Pacific Ocean region through South China Sea

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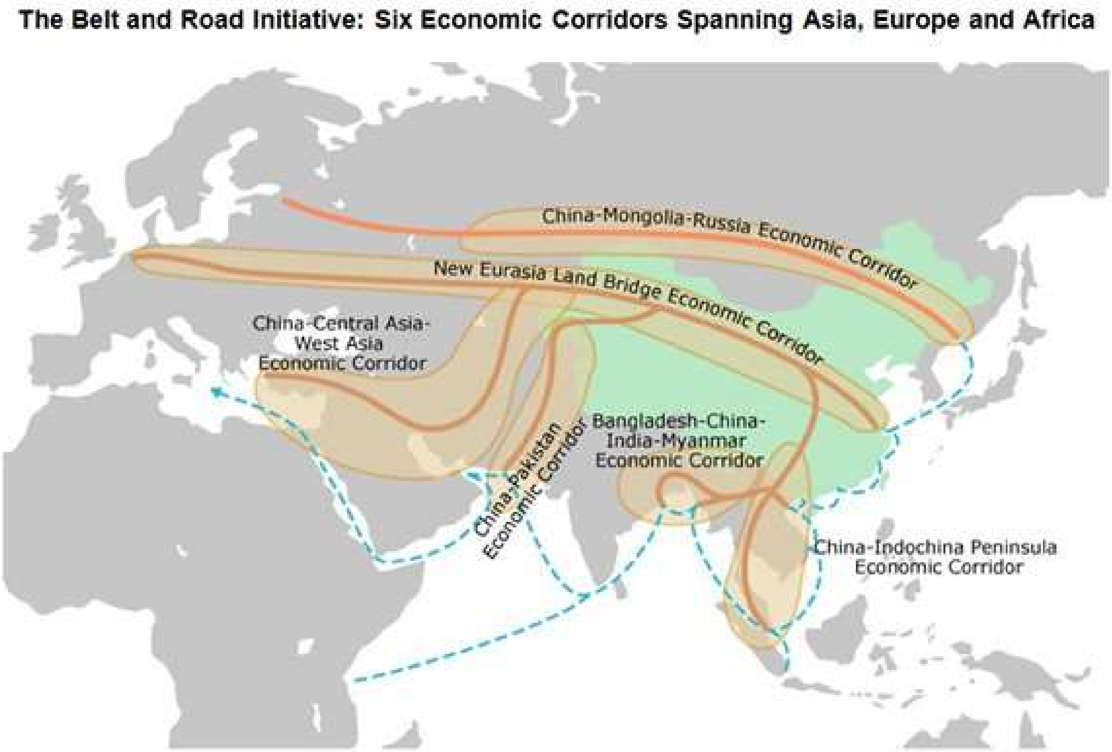
Figure 1 Source: HKTDC Research available at: http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/The-Belt-and-Road-Initiative/obor/en/1/1X000000/1X0A36B7.htm



The scope of the initiative is still vague and it is not clear how the project will be implemented. The "Visions and Actions" document which can be rather seen as a door opener and a promotion paper for the whole venture in order to attract potential partners and investors is the only official document but also does not give any concrete information about the implementation procedure (Aris, 2016). Therefore it is useful to take a look t projects that are already under construction to get an idea of the whole process.

China already targeted ports in the Mediterranean Sea and Railway networks in Southeast Europe. The port in Piraeus has financially benefitted the most so far by Chinese investments. The China Ocean Shipping Company (COSCO), a state owned shipping giant which is number 4 worldwide considering the shipping fleet, ensured in 2009 a 35 year concession for running the port (Pier 2, and construction of a third Pier 3) of Piraeus. The port will be linked to Central and Eastern European countries by railway (Casarini, 2015). This project has a volume of more than 2 billion Euros and is funded by the Chinese Import and Export Bank. The whole project will be realized by the China Railway and Construction Corporation which is also state-owned (Pavlićević, 2014). In 2016 COSCO took over the majority of the port and now holds a share of 51 % which is expected to expand up to 67% in the next 5 years. COSCO is willing to invest up to 500 million Euros in the purchased port (Reuters, 2016). The investments of COSCO already pay off in economic terms. In 2012 the Port of Piraeus was the fastest growing container port in the world according to the *Containerization International* magazine and since 2013 Piraeus is rated among the 10th biggest container ports in Europe (van der Putten & Meijnders, 2015).

Additionally to the expansion of the Piraeus port China seeks to improve the infrastructure in the Balkans. Goods that arrive in Piraeus are supposed to continue their travel by train. China wants to develop railway infrastructure in Greece, Serbia, Montenegro and Hungary in order to reduce the travel duration for goods and passengers. The 370 km railway track between Belgrade and Budapest will experience a rapid reduction in travel time from now eight hours to possibly less than three hours. So far Chinese goods have been for the most part shipped through the Suez Canal to be then carried through the whole Mediterranean Sea and the English Channel, to arrive finally in one of the ports on the West coast of Europe like Rotterdam, Antwerp or Hamburg from where they are distributed to their final destination (Casarini, 2015).

Van der Putten & Meijnders (2015) give a comprehensive overview over the maritime investments and infrastructure projects of large Chinese corporations including Africa, South America, Europe, Asia and the Middle East (van der Putten & Meijnders, 2015).

Also outside of Europe China has become active in pushing OBOR. In Pakistan, with which China signed a bilateral Free Trade Agreement (FTA) in 2006, China committed an investment of 46 billion dollar in development deals to strengthen the China-Pakistan Economic Corridor (CPEC). About a quarter is dedicated to the transportation infrastructure (railway, roads, airports, ports) whereas the rest will be invested in the energy infrastructure (gas pipelines; coal, wind, hydro and solar energy plants). The investment in ports in Pakistan is as important as in Greece. The Gwadar port ensures China access to the Indian Ocean which guarantees access to two oceans (Irshad, 2015).

In 2014 Xi Jingping completed financial deals worth up to almost 50 billion dollars with Kazakhstan (30 bn.), Uzbekistan (15bn.), Kyrgyzstan (5bn.) and 1.4 bn. with Sri Lanka to modernize the port of Colombo (McBride, 2015).

For achieving these ambitious goals and to finance the initiative China started an initiative in fall 2013 for a new multilateral bank: the Asian Infrastructure Investment Bank (AIIB). The main purpose of the AIIB is to fund infrastructure projects in Asian countries and to supply financial resources for OBOR. Besides Asian countries 14 member states of the European Union belong to the founding members among others the Netherlands, Germany, Italy, France, Switzerland, Sweden and the United Kingdom (Renard, 2015). Another aspect is to counterbalance the importance of the World Bank (WB) and the International Monetary Fund (IMF) which are still dominated by American influence (Bondaz, et al., 2015)

Additionally to the AIIB the New Development Bank (NDB) was founded in 2014 by the 5 BRICS states: Brazil, Russia, India, China and South Africa. The NDB has a capital of 100 bn. USD such as the AIIB (Renard, 2015). Compared to the WB (250 bn. USD) and the ADB (150 bn. USD) the AIIB is still smaller with a capital of 100 bn. USD (Callaghan & Hubbard, 2016). The finance of OBOR however is not only based on the AIIB. It is based on 4 major pillars:

(1) Silk Road Fund: The SRF encompasses a capital of 40 bn. USD and is exclusively designed for funding projects related to OBOR. It is financed by the public Chinese institutions and foreign exchange reserves.
(2) Loans of state owned banks: The Chinese administration has access to capital through different banks that belong to the state as the China Development Bank, China Import Export Bank and the Agricultural Development Bank.
(3) AIIB: like described above this multilateral bank with a capital of 100 bn. is designed for the purpose of funding infrastructure projects in Asia. China contributes 30 bn. USD as founding capital. The rest is divided among the other members.
(4) New Development Bank: Like the AIIB the NDB has a capital of 100 bn. USD and its main purpose is as well the promotion of infrastructure projects.

(Aris, 2016).

A distinct example of how the project is going to be realized and what consequences can arise for participating countries can be observed in Pakistan. For example repayments of loans do not have to be repaid necessarily in cash but rather in commodities. Problematic however can be seen that there exist no clear standards of quality regarding the infrastructure projects surrounding OBOR. Furthermore there seem to be no transparent structure of bidding for projects, for instance favoring Chinese corporations, including payments of bribes and even constructions of unordered projects which have happened in Sri Lanka (Garcia-Herrero, 2015). This example may not serve as a template for the future of the whole project and it would be premature to extrapolate a single case onto the whole initiative but the case of Sri Lanka shows that the project might suffer from vulnerability of corruption and misusage.

One important aspect of the analysis of OBOR is to examine the Chinese interests that stand behind OBOR. Besides geopolitical interests (Rolland, 2015), promoting the Renmimbi to establish it as an international accepted currency (Liao & McDowell, 2015), counterbalance western trade blocs due to trade agreements like TTIP or CETA (Lo, 2015), prevention of domestic religious turmoil (Minghao, 2015), stability of energy supply (Fallon, 2015) the main focus however lies on the facilitation of trade infrastructure. Two important interest are outlined here. Firstly a domestic interest is to connect the well developed eastern part of China with the still underdeveloped western part. The connection to the west could create a domestic boom in infrastructure, trade and urbanization (Lo, 2015).

Secondly the problem of overcapacities could ba addressed by the initiative. The boom of the Chinese economy in the recent decades led to huge overcapacities in some sectors, specifically in the steel and cement industry (Djankov & Miner, 2016). This evolution led overall to negative implications for the Chinese economy due to shrinking producer´s prices. The international expansion of industries that suffer from overcapacities and low prices could find new export destinations given the vast scope of population and economic size of the initiative (Garcia-Herrero & Xu, 2016).

Reducing overcapacities could help stabilizing domestic demand and growth. China recent development indicates that the country is on the transition from a purely export orientated economy which mainly produces goods which require low technologies to an economy that is based on domestic demand and more sophisticated export goods (Lo, 2015).

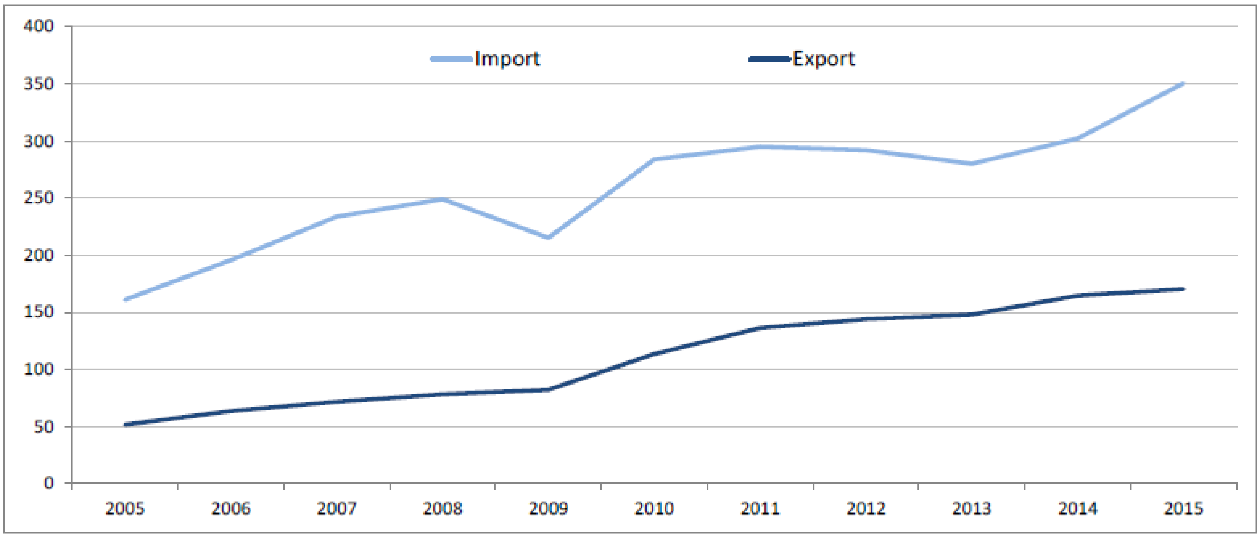
2.2. EU-China trade in a nutshell

China experienced massive changes after the death of Mao Zedong in 1976. Deng Xiaoping started to open up and liberalize the economy in 1978. Economic and fiscal decentralization combined with privatization measures were the first steps of reforming the economy. In 1975 the first diplomatic relations were established between China and Europe, at that time still referred as the European Community (EC). Already in 1978 a trade agreements was signed by both parties (Scott, 2007). In 1985 a trade and cooperation agreement followed and in 2003 as another milestone the so called "strategic partnership" was initiated (Stepan & Ostermann, 2011). During the 16th EU-China summit on 21.11.2013 which is held annually both parties officially announced the beginning of negotiations about a bilateral investment agreement. 12 rounds of negotiations were held so far. The date for a thirteenth round has not been announced yet (European Comission, 2017b).

Trade between the EU and China increased significantly over the past decades and both partners became important trading destinations for each other. While both entities had no significant trade volumes till the end of the 1970´s in 2015 both partners traded a total amount of 521 bn. € which accounts for approximately 15 % of total EU´s trade. Only the US with 619 € bn. € was a larger trading partner. China´s share of total EU trade rose from 7% in 2002 up to 15% in 2015. Furthermore China is EU´s second biggest export market again after the US. EU exports to China accounted for roughly 10% of total exports leaving the EU. Regarding imports China is the most important trading partner. In 2015 20% of all EU imports originated from China (Eurostat, 2015a). Compared to 2005 the structure of European trade changed noticeably and underlines the significance of China as a trading partner. In 2005 only 4.9 % of EU´s total exports were sent to China. The change in imports is even more significant. While in 2005 only 1.6 % of total extra EU imports originated from China the share increased up to roughly 20% in 2015 (Eurostat, 2016a).

Since 2005 exports to China more than tripled. Imports however only grew by 117%. The growth of trade can be considered as very stable. In the period between 2012 and 2016 imports and exports grew constantly by 4.2 % annually (European Comission, 2017c).

Figure 2 Source Eurostat



Trade is dominated by manufactured goods (chemicals, machinery & vehicles, other manufactured goods). In 2015 97% of imports from China were manufactured goods and alike 81% of EU exports (Eurostat, 2016b). Until 1997 the EU was running a trade surplus with China (Xin, 2014). Since then the situation changed dramatically. Since 1997 the trade balance shows a constant deficit from a European perspective. In 2015 the EU was running a deficit of 180.3 bn. € which was an all time record in trade with China. In 2016 the deficit decreased down to 174.5 bn. € due to reduced imports while keeping exports stable (European Comission, 2017d). Only Germany and Finland had a positive balance with China.

The most important trading partners of China within the EU are Germany, the United Kingdom (UK) and France. Together they exported 114.7 bn. € of goods to China. The share of total EU exports to China of these three countries is about 67%. For imports the picture is quite similar. The four most important importers are Germany, UK, Italy and France. Together these four account for 51% of total imports from China. The Netherlands report the second biggest volume of imports: 66.3 bn. €. Flows into the Netherlands are however overestimated due to the Rotterdam effect (quasi transit trade). Goods that arrive in the Dutch ports but have their final destination somewhere else in the EU need to be reported as imports into the Netherlands according to EU laws. The same effect can be observed in Belgium (Eurostat, 2016b).

The rapid growth of exports in the previous decade can be traced back to the fact that China experienced the emergence of a growing middle class. For products like French red wine, olive oil and automotive China is already the most important single market for European exporters (Hansakul, et al., 2014).

In the recent past trade in services emerged as an important field of trade. Nevertheless volumes of trade in services still remains small compared to trade in goods, only a volume of 1/10 of trade in goods are traded in services with China (European Comission, 2017e), its importance is increasing especially regarding China. In 2015 for example the EU imported services accounting to 25.7 bn. € while exporting 36 bn. € which led to a positive balance of 10.3 bn. € with China. The main trading partner for EU services is still the EU itself. 55%.

On average service exports to China increased per annum by 16 % between 2004 and 2012. This is more than double the export growth than to other destinations. Regarding imports the trend is similar. Yet the share of Chinese service imports was still comparatively low with 3.7 % in 2015, imports grew by 14% on average annually within the period 2004-2012 compared to only an average growth of imports of 6 % from other non EU states (Hansakul, et al., 2014). In 2010 the EU exported a share of 3.4 % of its services to China while 3.7 % was imported from there. The relative picture did not change significantly in 2015 compared to 2010. The share of total exports of services from the EU to China increased up to 4.4% and imports slightly grew up to 3.9% of all imported services into the EU. In absolute numbers however trade increased significantly. While in 2010 exports in services to China had a total value 19.5 bn. € in 2015 they amounted up to 36 bn. €. Within 5 years exports grew therefore by approximately 84 %. The volume of imports grew in the period from 2010 to 2015 by roughly 50% (Eurostat, 2016a).

The most important fields of service exports in 2014 for instance were transport (7.8 bn. €), travel (6.0 bn. €) and other business services (research & development, professional and management consulting services, technical, trade-related and other business services; 8.1 bn. €). They account for almost 70 % of service exports. The relative division among services is similar for the previous years. Considering imports the three mentioned categories sum up to more than 85% of imported services with only transport having a share of 42 % (Eurostat, 2015b).

The next subsection reviews the theoretical background of the gravity model and discusses important papers that are relevant for the thesis.

2.3. The gravity model

At first a short summary of the development and evolution of the gravity model will be given and its theoretical background. Afterwards papers are reviewed that contributed to the question which impact infrastructure and transport costs have on trade.

2.3.1. A short history of the gravity model of trade

The gravity model, which basic idea is that economic size and distance determine bilateral interactions, has a longstanding history in economic research. Firstly introduced by Tinbergen in 1962, a former physicist before he turned to economics, the model became one of the most applicable tools for trade research. Based on the idea of Newton´s law of gravitation, Tinbergen assumed that trade flows respond to economic size of the trading partners and that there is an inverse relationship of growing distance and trade. One of the reasons for its success is the ability to estimate relatively precise bilateral trade flows (Leamer & Levinsohn, 1995). In the basic form the model encompasses two key features. Firstly exports grow in proportion to the economic size of the country of destination. Corresponding to exports also imports grow in relation to the economic size of the country of origin. The economic size is usually represented by the countries' GDP. Secondly distance between two countries has a negative effect on bilateral trade the further away the countries are from each other.

Despite its success the gravity model has not been in vogue since it was firstly used in the early 60´s. Head & Mayer (2013) identified three main periods in the development of the gravity model.

The first phase lasted until 1995 which should be a turning point for the gravity model. Till 1995 the gravity model was not part of the mainstream research. Critics argued that the model rather shows an analogy to physics than to economic theory. The model lacked of theoretical foundations which were considered as necessary for trade economists. The two most important trade theories at the time, when the gravity model was purely considered as an econometric tool lacking of a theoretical basis, were the Heckscher-Ohlin (HO) model and the Ricardian model. The HO model assumes that while countries have identical technologies the distribution of resources determine trade patterns. The Ricardian model on the other hand assumes that an equal distribution of resources but the difference in technologies would determine trade between countries. Neither of these theories includes the countries´ GDP or its remoteness as a factor that has influence on trade. Anderson (1979) was probably the first to deliver a theory basis for the gravity equation.

In a paper published in 1995 Trefler introduced the so called "missing trade". Standard Heckscher-Ohlin models would predict higher trade than was in fact observed. Despite the fact that Tefler didn´t use distance as an explanation his work prepared the ground for future research. The second phase was characterized by the introduction of the "*multilateral resistance terms*" (MRT). One of the main critiques of the gravity model was still that it lacked of profound theoretical background. While Anderson in 1979 already attempted to provide solid theoretical foundations for the gravity model, the papers published by Anderson & van Wincoop in 2003 and Eaton & Kortum in 2002 ultimately dismissed the conventional opinion that model lacks of solid micro foundations. Further the application of importers and exporters fixed effects to estimate the multilateral resistance terms proposed by Redding & Venables (2004) were consistent with the underlying theory and simple to implement which led to a fast adjustment in economic research. The third phase was characterized by convergence with economic theories of heterogeneous firms. Papers by Helpman et.al (2008) and Chaney (2008) showed that the latest work on heterogeneous firms' models and the gravity model do not exclude each other (Head & Mayer, 2013).

2.3.2. The intuitive gravity model

As described the intuition behind the basic version of the gravity model follows the idea, that trade flows are affected by gravitational forces. The two key elements of gravitation are economic size, usually measured as GDP and distance. In its most basic version the equation can be expressed as:

$$\log X_{ij} = c + \beta_1 \log GDP_i + \beta_2 \log GDP_j + \beta_3 \log \tau_{ij} + e_{ij} \quad (1.1.)$$

$$\log \tau_{ij} = \log (distance_{ij}) \quad (1.2.)$$

with X_{ij} representing exports from country i to j, GDP is the respective gross national product of both countries, τ_{ij} is a indicator for trade costs between country i and j, distance, which is an observable proxy (geographical distance) for measuring trade costs between i and j and e_{ij} is the ranom error term including non observable characteristics. C functions as a constant in the equation and the β´s are the coefficients of interest. Exports from i to j are proportional to the GDP´s of i and j and considering the distance inversely proportional. In simple terms according to the gravity model countries that are larger are expected to trade more and in the case that they are further apart from each other they will trade less for instance because of increasing trade costs (Shepard, 2012).

The intuitive gravity model is a useful tool as a starting point. The fact that it only considers economic size and distance makes sure that it can be applied to measure trade flows between various countries. It does not discriminate between developing and industrialized countries. The two characteristics of GDP and distance can be applied all over the world. However the model exhibits some serious limitations once more advanced research wants to be conducted. There are two major drawbacks that have to be considered and that stand in conflict with standard economic theory. Firstly, it is not possible to estimate effects of trade creation and trade diversion. How will the trade between i and j be affected by a change in trade costs between j and country f? A reduction of transportation cost due to infrastructure investments or a FTA between j and f would also affect country i without being directly affected as a participant of these changes. A reduction in trade costs on any bilateral trade route would have no effect on other trade routes at all according to the intuitive gravity equation. We can easily see from the equation that there is no such effect taken into account: $\frac{\partial \log X_{ij}}{\partial \log \tau_{if}} = 0.$ Secondly, in case of a universally equal reduction of trade costs for all countries which could be for example a price drop of natural resources like coal or oil the model would show proportional increases among all bilateral trading routes even within domestic trade (X_{ii}). Even if we consider a drop in transport costs the relative price structure did not change. Assuming a constant demand and consumption when prices do not change relatively this again causes trouble with standard economic theory (Shepard, 2012).

2.3.3. The theoretical gravity model

Driven by the imperfections of the intuitive gravity model, researchers tried to improve the model by additional components to eradicate the shortcomings. Like mentioned above Anderson (1979) was the first who tried to deliver a more profound theoretical background of the gravity equation. In his work goods are differentiated depending on the country of origin. The preferences of the consumers are defined by all the differentiated products and have a "love of variety", which implies an increase in utility by either more consumption of a given product variety or consuming the same amount by a wider variety of products. These assumptions imply that irrespective of the price a country consumes a little bit from every other country at least. In this model there is no country which doesn´t trade and also all of the goods are traded. In equilibrium the national income sums up the foreign and domestic demand for the individual specific good that is produced by the respective countries. Following this logic, larger countries will trade more (imports and exports). Commodity prices depend on the trade costs which are called "iceberg costs" and represent transportation costs. With an increasing distance the value of the commodity "melts" like an iceberg. This theoretical attempt hence includes distance as well as "economic mass".

Another important contribution was made by Bergstrand (1985, 1989). They showed that he gravity model can be derived following a model of monopolistic competition made by Krugman (1980). Differentiated goods are traded among identical countries. Consumers have preferences of variety which leads to trade among the countries.

Anderson & van Wincoop (2003) in their pioneering paper "Gravity with gravitas" developed one of the most acknowledged gravity equations. The model is basically a demand function. Consumers preferences are defined as "love of variety" like described above. Considering the production side they follow assumptions developed by Krugman (1979). Firms produce under increasing returns to scale a unique single product variety. In equilibrium the fixed costs for entering the market is just covered enough by the gap between the marginal costs and the price the firm receives. Producers can offer their goods either in their home country or in any other country. Selling on the home market does not include transport costs. Consumers therefore pay an extra for goods from abroad. Nevertheless they can consume from all countries. This model includes domestic sales as well as exports. Summing up all the individual exports of the firms within an economy aggregates to the country´s total exports used as the dependent variable in the gravity equation.

Most importantly they show that the control of trade cost and a relative change is crucial for a correct specification of the gravity equation. They show that relative trade costs are determining for bilateral trade. For example, if country i imports goods from county j, the imports are determined by the relative trade cost structure of i to j compared to all other countries i is importing from (Anderson & Van Wincoop, 2003). These effects are estimated by the MRTs. The gravity equation after Anderson & van Wincoop looks like follows:

$$\log X_{ij}^{k} = \log Y_i^{k} + \log E_j^{k} - \log Y_j^{k} + (1 - \sigma_k)[\log\tau_{ij}^{k} - \log\Pi_i^{k} - \log P_j^{k}] \quad (1.3.)$$

The important additive variables here are the terms Π_i^k and P_j^k called outward and inward multilateral resistance. The first one catches the fact that exports from i to j are dependent on trade costs among all export markets. The second one catches equally this effect for imports into I from j dependent on the trade costs including all potential importers of i.

The MRTs solve one of the main issues in the intuitive gravity equation. A change of trade costs between j and f now has influence on the trade between i and j for which the intuitive model did not account for. In clear words every change on any bilateral trade route can have effects on all other routes due to changes in the relative price structure: $\frac{\partial \log X_{ij}}{\partial \log \tau_{if}} \neq 0$.

2.3.4. Empirical literature

As the aim of this thesis is to estimate the influence from an improvement of infrastructure and the change in transportation costs the reviewed literature here mainly focuses on the impact of distance and infrastructure on trade. Following a discussion of different methods used to model transport costs. Before the author turns to that a short description of trade costs in general will be given.

Trade costs play an important and undeniable role in determining international trade flows. Anderson & Van Wincoop estimate “by rule of thumb” for a developed country an equivalent of a trade barriers as an ad valorem tax of 170% including border related barriers, local distribution costs of the firms and transport costs (Anderson & Van Wincoop, 2004). Feenstra (1998) uses the example of a Barbie doll which has production costs of 1$ and which is sold for 10$. The tax equivalent corresponds to a 900% premium between the production price and the final consumers price (Feenstra, 1998). According to Anderson & Van Wincoop (2004) “*Trade costs, broadly defined, include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself: transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs (wholesale and retail)”* (Anderson & Van Wincoop, 2004, pp. 691-692)

Their estimation can be split into different shares of trade costs. 55% of these 170% are local distribution costs and 44% costs related to the border barriers (policy barriers including tariff and non-tariff barriers like for instance regulations). Transportation costs have with a share of 21% according to their estimation an important impact on trade flows. They subdivide transportation costs into direct and indirect transport costs. Direct ones include freight charges and insurances paid for the transport. Indirect ones comply with costs for the goods that are in transit and costs that are associated with the size of the shipment (for instance if a container is fully or just partially loaded).

Another definition is delivered by Spulber (2007) who divides trade costs into 4 subcategories. (a) Transaction costs that occur when businesses face different customs, political or legal environments or deviating business habits. (b) Tariff and non-tariff barriers as different regulations (environmental standards, anti-dumping regulations) and administrative issues that limit investments and trade. (c) Transport costs in the sense of transporting a good from its origin to its final place of consumption and (d) time costs due to communication burdens across manufacturing and distribution facilities which decelerate the adaption of new market conditions which makes the time of the goods in transit of high value (Spulber, 2007).

Transportation costs represent among the various types of trade costs one of the main components. Distance and infrastructure are both highly important in shaping and determining trade volumes and if trade occurs at all (Limao & Venables, 2001). They are of equal value as tariffs if not even have bigger impact on trade flows (Haveman, et al., 2005). Venables (2001) refers to distance costs as costs of moving commodities (direct costs), search costs (finding and identifying potential partners), management and control costs (contract enforcement) and finally time costs (duration of shipping). Transportation costs are usually expressed as an ad valorem tax equivalent which expresses the costs relative to the goods value. The price of a good is defined by a wedge that drives in between the price of origin and final destination (Hummels, 2007).

Among aggregated world trade countries that are neighbors account for up to roughly a quarter. The mode of transport between neighbors is dominated by rail, road or pipelines whereas the dominant international trade mode is by air and or ocean shipping. Trade by ocean however is dominating world trade. About 99% by weight and also the greater part of values that are transported are done by shipping (Hummels, 2007).

Bougheas et. al (1999) investigate the relationship between infrastructure, transport cost and trade. They assume, that transport costs decline through an improvement in infrastructure which has consequently positive impacts on trade volumes. They consider transport costs not exclusively as exogenous as one would expect when geographical determinants like access to sea, being landlocked or mountains between countries defined the extent of transport costs. They assume that these costs also depend on the actual development of infrastructure in telecommunication and transport. Their theoretical foundation is based on a Ricardian model with two countries following the Dornbusch-Fischer-Samuelson model (1977). They complement the model with a cost function for infrastructure. For their estimation they use an intuitive gravity model with hence they do not take third country effects which are captured by the MRTs into consideration as this technique was later introduced by Anderson & Van Wincoop (2003). The proxies for infrastructure they use are the motorway network length of countries i and j (MM_{ij}) and the product of the stocks of capital at time t ($GG_{ij,t}$). They estimate the equation using datasets including 6 or rather 9 European countries covering a data between 1970 and 1990. Their estimation shows that both proxies for infrastructure show a significant and positive sign. Their main contribution in this paper is that not only distance as a proxy for transport costs is considered and that transport costs should not be considered as exogenous purely depending on geographical factors but that transport costs and infrastructure have an endogenous relation (Bougheas, et al., 1999).

A similar study was provided by Martínez-Zarzoso & Suárez-Burguet (2005). They use data on transport costs from the International Transportation Data Base (BTI). They employ a gravity model on sectoral imports of 5 countries in South-America from the EU and estimate a transport cost equation. They explore the endogenous relationship between trade and transport costs. They estimate the relative role of determining transport costs of infrastructure, location, freight rates and economies of scale. Their results show that increased distance and a poor infrastructure of the partner country significantly increases transport costs. Trade volumes which are used as a proxy for economies of scale leads to a decrease of transport costs (Martínez-Zarzoso & Suárez-Burguet, 2005).

Another influential paper was delivered by Limao & Venables (2001). In their paper they try to investigate what determines transport costs and the consequences they have for trade volumes. Focusing on the distance they investigate which importance common border, the fact being an island and being landlocked has for countries. Additionally they use an average infrastructure measure that includes density of road networks, paved roads, railway networks and number of phone main lines per capita. As proxies for transport costs they use freight rates of a standard 40 foot container which has its origin in Baltimore (USA) and is sent to varying destination around the globe and cif/fob ratios. The concept of cif/fob ratios was criticized by Hummels (2001) for the fact that they do not give information about time-series variation

They use a gravity model to estimate the impacts of the mentioned variables to determine what influence the variables have on trade volumes and on transport costs.

They estimate additional transport costs as distance equivalents in km´s. A decline in the quality of infrastructure moving from the median to the 75th percentile increases the transport costs by an equivalent to additional 3,466 km of sea travel and for overland transport by 419 km. According to their estimations poor infrastructure explains 40% of transportation costs for coastal countries and up to 60% for countries that are landlocked. The effect of a worsening of infrastructure on trade volumes moving from the median to the 75th percentile reduces trade by 66%. Considering the fact being landlocked raises transport costs by 50% and reduces trade volumes by 60% compared to a representative economy which has access to the coast. Further their estimation shows, that increased distance on land has different implications than distance by ocean. Transport costs increase seven times more over land compared to ocean considering additional 1000 km distance (Limao & Venables, 2001).

Baier & Bergstrand (2001) investigate what has driven world trade growth between the late 1950´s and the late 1980´s. They try to estimate which factors contributed in which way to the real mean growth in bilateral trade flows. They estimate the relative impacts of transportation costs, tariff reductions, growth of incomes and convergence of incomes. They derive a gravity equation based on a general equilibrium model in final goods where GDPs of importers and exporters are interpreted as capacities of the production and absorption of the exporters and importers. They use gross cif/fob ratios as proxies for transportation costs and their change over time to estimate the impact of the costs on trade growth. They use data of 16 OECD countries averaged over the periods 1958-1960 and 1986-1988. Based in their sample the reduction of transport costs accounted to 8-9% of bilateral trade growth. The major influence according to their study comes from income growth which explains 67-69% and reduction of tariffs (23-26%). The main contribution of their paper is the dismantling of different factors on trade flows (Baier & Bergstrand, 2001).

Hummels (2001b) assumes that actors have a willingness to pay a premium for reduced time of goods in transit. In the case of manufactured goods an additional day has the value of an average equivalent of 0.8 % of the goods value. For an average ocean shipping transit this means an equivalent of an ad valorem tax of 16%. In his model the mode of transport switches from ocean to air when the total cost of shipping (freight costs + time) is bigger than shipment by air. A shipment by air takes 1 day no matter where in the world. For ocean shipping an average transit of 20 is assumed by Hummels. Based on U.S. import data the time costs are on average equal to a 9% tax equivalent. According to his estimations efficiency gains of faster ships and switching to air transport reduced the time costs between 1950 and1998 from a 32% to 9% tax equivalent (Hummels, 2001b).

Djankov et al. (2006) use data on time which is needed to transport a 20 foot container with identical goods from a factory to 89 countries. Their data represents answers given to a questionnaire by trade facilitators in 2005 developed by the World Bank. They apply a gravity equation regressing relative exports from similar countries (factor endowment, location and trade barriers faced abroad). According to their estimation on average an additional day of time delay trade is reduced by 1%. They estimate an equivalent of a reduction in distance of 70 km for each day that is saved due to efficient infrastructure.

Francois & Manchin (2007) estimate the effects of infrastructure and institutional quality on trade volumes. Using panel data covering a period from 1988 to 2002 including 284 049 bilateral trade flow observations they use a selection-based gravity model. Further they investigate the reasons for countries not to participate in trade. For infrastructure they use data provided by the World Bank Development Indicator database which includes various indicators for infrastructure including proxies for communication and transport (ie percentage of paved roads to total roads, fixed and mobile telephone users per 1000, etc.). Their results show that infrastructure and institutional quality have a significant effect on trade volumes and the propensity of countries to participate in trade at all. The effect of institutional quality is not straightforward but the role of infrastructure is. Variation in trade volumes also depend on the development of a country. While for least developed countries transport infrastructure is more important than communication infrastructure the opposite for developed countries is the case.

Li et al. (2016) investigate the influence of railway connections between the EU and China within the OBOR context. They estimate what impact an extension of the intercontinental railway system between China and Europe has on trade. They use panel data of 28 countries between 2005 and 2014. They apply a multiple regression analysis.

They find that Chinese exports increase disproportionately compared to imports into China.

Trade costs depend on numerous factors like infrastructure, geography, distance, trade volumes, language, institutional quality and so forth. The discussed papers investigated some of these relationships and how they affect trade flows. The next section discusses some of the main problems that arise when employing a theoretical gravity model.

3. Gravity model issues

The gravity model of trade has proven to be a reliable econometric tool to estimate trade flows and to model equations that include numerous variables of interest. Like every econometric model the gravity model has nevertheless certain difficulties and issues that have to be considered and dealt with when applying it to research. The efforts of deriving theoretical foundations on which the model is based on, classified three major mistakes. Baldwin & Taglioni (2006) label the three error gold, silver and bronze medal. Typically GDP and other variables are transformed into their logs. They are used as proxies for $\ln S_i$ and $\ln M_j$. This leads to an omission of the MRTs derived by Anderson & van Wincoop (2003). The MRTs exhibit correlation to the respective trade costs and omitting them leads to biased estimation results. The silver medal wins who averages the reciprocal trade flows. For the theoretical gravity model one should use unilateral trade flows so that exports from China to the EU and exports from the EU to China should be reported separately as single observations at time t. The third mistake deals with the question whether trade values are used in nominal terms or should be transformed into real terms. Researchers who transform the data with a deflator earn the bronze medal. The MRTs which function as price indices deflate the export values. Additional deflation creates biased estimations. By using country effects or time dummies to solve the gold medal mistake this problem is taken into account.

3.1. Zero trade flows

Another common issue is zero trade flows in the dataset. Zero trade flows occur when there is no trade between two countries in a given year. The problem of zero trade flows is far from being an unimportant issue. Helpman et. al (2008) found that 50% of the country pairs in their sample do not show any trade relation. Like mentioned above usually the logarithms are used to estimate the in a log-linear specification. Logarithms of zero are not defined and hence all the observations are dropped out. Three different methods have been typically used to deal with the problem of zero trade flows. At first, simple dropping all observations of zero trade flows. Secondly, replace the zero by a small imperceptible constant. Thirdly, an estimation of the model in levels can be used. Dropping zero trade flows should only be considered if the reasons are unreported hence missing values or rounding errors hence if they are distributed randomly.

If zeros are “true” or if they occur as rounding errors in a systematic way they should not be dropped as they can inhabit valuable information. If a country is just too small or does not trade because of excessive trade costs zero trade flows contain information which should not be ignored. If zero trade flows are kept in the data an appropriate method has to be chosen. The choice of the second and third method is flawed once an ordinary least squares (OLS) approach is applied as this method will produce inconsistent estimates (Bacchetta, et al., 2012).

The decision which estimation technique should be applied depends on the reasons behind the zero trade flows (rounding errors, missing values that are unreported or not correctly reported or decisions of firms not to export). One solution is to apply the Tobit estimator. Censored observations (unobservable) and recorded as zeros are used in this model. However this method is inappropriate to give a plausible explanation for missing trade flows (Linders & De Groot, 2006).

A more sophisticated approach is the Pseudo Poisson maximum likelihood estimator (PPML). The PPML estimator has the advantage that zero trade flows don´t need to be dropped out of the data (Bacchetta, et al., 2012). Santos Silva & Tenreyro (2006) show, that robust estimation result can be achieved also under heteroskedasticity, which is common in trade data. Under heteroskedasticity the estimation with OLS can lead to biased and inconsistent estimation results. Once heteroskedasticity is suspected the PPML technique is superior to the standard OLS (Santos Silva & Tenreyro, 2011). In the log-linearized form of the gravity equation also the error term is in logarithms. If there is there is heteroskedasticity in the data which is highly probable, the first assumption of OLS is violated and leads to inconsistent and biased results. OLS heteroskedastic robust standard errors cannot solve this issue as parameter estimations and standard errors are affected (Shepard, 2012).

3.2. Endogeneity

Besides zero trade flows endogeneity is another common issue using the gravity model. The problem typically arises when effects of trade policies are estimated. Endogeneity results from correlation between the independent (policy) variables with the error term. One example is FTAs which are improbable to be purely exogenous. Two countries that have already close trade relations are more likely to form a trade agreement. Therefore characteristics in the error term which are unobservable, but facilitate the trade relation between the two countries, are likely to be correlated with FTA dummies in the equation and make it more probable that these two countries agree on a trade agreement. The second reason for endogeneity besides reverse causality can be biases due to omitted variables. Countries that form a free trade area may have certain common characteristics which are omitted in the equation like legal institutional design of the countries, similar jurisdiction and bureaucracy or a peaceful relation.

Fixed effects (FE) can be used in a panel to limit the problem of endogeneity caused by omitted variable bias however time-varying omitted variables continue to be an issue. Another drawback of the FE method is that time-invariant (distance measure) will be dropped out of the equation hence their parameters cannot be estimated. One way of dealing with the problem is to apply an instrumental variable (IV) technique. Problematic with this approach is the proper choice of an instrument. It needs to be correlated with the replaced endogenous variable without being correlated with trade (Bacchetta, et al., 2012).

The most common technique using an IV approach is the two stage least squares (2SLS). With this technique regressions are run twice. Firstly the endogenous variable functions as the dependent variable. On the right hand side of the equation all exogenous variable are included plus the potential instruments. In the second regression the values estimated in the first one are used to plug in as a substitute for the endogenous variable. To make the technique work properly there has to be the same number of instruments as the number of replaced endogenous variables. Secondly like mentioned above the instruments need to exhibit a strong correlation with the endogenous variables. Last but not least the instruments must be excluded from the second regression without having an effect on the dependent variable except through the problematic variable (Shepard, 2012).

An alternative to the 2SLS method is the Generalized Method of Moments (GMM) technique. This method uses lagged levels as instruments. Arrelano & Bond (1991) for instance developed a GMM estimator where the model is a system of equations. The lags of the dependent variable are used as instruments. (Arrelano & Bond, 1991). However one problem regarding the GMM estimator is the sensitivity to the number of lags that are used (Bacchetta, et al., 2012).

3.3. Disaggregated data in the gravity model

Using disaggregated data when the gravity model is applied has advantages as well as disadvantages. Aggregated data simply sums up all the sectors to one value which implies a huge loss of information. One of the main advantages of disaggregated data is that the effects of certain trade policies or barriers of specific sectors can deliver useful information about the degree of efficiency of these policies. Even if policies are negotiated on an aggregate level like FTAs it can be useful to analyze the consequences on disaggregated data as the impact on the different sectors can be disparate (Yotov, et al., 2016). Aggregating trade barriers into single indices limits the information of the estimation (Bacchetta, et al., 2012). Even if gravity trade analysis is done at the aggregate level it should always be done at the product level and then the estimation results should be reaggregated. Another issue regarding disaggregated data is the specification of the model. According to French (2011), there is a misspecification in the Anderson & van Wincoop (2003) aggregate model. He shows that disaggregated gravity models covering all sectors do not coalesce due to a misspecification of the outward MRT (French, 2011).

Despite the fact that a sectoral analysis can provide more detailed information on the effects of trade policies and the respective trade it also shows certain drawbacks in the process of estimation. Sectoral data is likely to show a higher share of zero trade flows. Secondly, disaggregated flows are most likely more heterogeneous than aggregated flows. This increases the risk of heteroskedasticity (Bacchetta, et al., 2012).

To deal with the problem of increasing zero trade flows and heteroskedasticity Prehn & Brümmer (2011) propose the usage of Poisson Quasi likelihood (PQL) estimator and the Gamma Two Part Model (G2PM) as alternative estimation techniques. Both estimators handle the problems of zero trade flows, model misspecifications and heteroskedasticity.

4. Data & Methodology

4.1. Data

One of the major challenges of this thesis is how to measure the impact of an improvement of infrastructure has on trade between China and the EU. As data on the total rail line kilometers was very limited and fragmentary for the countries I decided not to include it. Data on paved roads would have been very valuable but the access is only provided by the International Road Federation against payment of a fee (International Road Federation, 2017). I interpret the combination of communication infrastructure (fixed broadband and fixed telephone subscriptions), regulatory infrastructure (burden of customs procedures) and transport infrastructure (quality of port infrastructure, registered air transport carriage, trade cost to export) as proxies for trade costs. I expect all of these variables to have an impact on exports.

For measuring infrastructure I focus therefore on indicators that were available at the World Bank database. I collected different World Bank Development indicators which proxy for infrastructure. Table 1 summarizes the variables and their source.

I use a cross-section dataset including 120 reporting and 145 partner countries for 2015. Unilateral export flows for the year 2015 was extracted from the UN

Comtrade database (for a complete list of reporting and partner countries see the appendix).

Table 1

Variable	Description	Source
Exports (exports)	Unilateral export flows from 120 exporting countries to 145 partner countries (17280 observations)	UN Comtrade database
GDP Exporter (gdp_ex)	Gross domestic product of the exporting country	World Bank Group
GDP Partner (gdp_p)	Gross domestic product of the partner country	World Bank Group
distance (dist)	Distance measures the distance between two countries applying the great circle formula which takes into account the most important cities and their population size.	CEPII Geodist database
contiguity(contig)	Contiguity is a dummy which is equal to 1 if two countries share a common border and 0 otherwise.	CEPII Geodist database
common language ethno (comlang_ethno)	Common language ethno is a dummy that takes the vaule 1 if in two countries at least 9% of the population speak the same language and 0 otherwise	CEPII Geodist database
colony (colony)	Colony is a dummy that takes the value 1 if there was any colonial relationship between two countries and 0 otherwise.	CEPII Geodist database
landlocked (landlocked)	Landlocked is a dummy that takes the value 1 if a country is landlocked and 0 otherwise	CEPII Geodist database
Burden of customs procedure (BCP)	Burden of customs procedure indicates how businesses perceive the customs procedures in their country on a scale from 1 to 7 with a higher score indicating increasing efficiency.	World Bank Group

Fixed telephone subscriptions (FTS)	Fixed telephone subscriptions represent the sum of fixed analogue telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones	World Bank Group
Fixed broadband subscriptions (FBS)	Fixed broadband subscriptions represent fixed subscriptions to high-speed access to public Internet (TCP/IP connection)	World Bank Group
Quality of port infrastructure (QPI)	Quality of port infrastructure is measured based on the perception of business executives and how they evaluate the facilities. The index ranges from 1 (low quality) to 7 (high quality)	World Bank Group
Air transport (AT)	Air transport: Registered carrier departures worldwide are domestic takeoffs and takeoffs abroad of air carriers that were registered in the country.	World Bank Group
Trade cost to export (TCX)	Trade cost to export measures the costs associated with exporting a 20 foot container including fees for administration and custom clearance, documents, technical control and other charges and inland transport.	World Bank Group

4.2 Methodology

I decided to use a cross-section dataset as my focus of interest lies on the possible improvement of the respective variables. An effect of the OBOR initiative cannot be measured over a longer period as the project just started in 2013. The idea is therefore to simulate an improvement due to the OBOR project of infrastructure variables and to estimate their impact on exports through trade potentials. The decision to choose a simulation to estimate trade potentials stems from the fact that almost all OBOR projects are either under construction or are still purely hypothetical. Information about the initiative is still scarce and as the initiative just started officially in 2013 no data is available to measure any changes in trade due to OBOR projects over time (Garcia-Herrero & Xu, 2016). I therefore decided to use a simulation exercise assuming that all infrastructure variables that were included in the gravity specification will improve by 10%. The base year is 2015 which functions as a benchmark. The OBOR simulation assumes that all countries improve their infrastructure to the previous period (2015). The results from 2015 and the results of the simulation will then be compared and the variation is interpreted as the effect of OBOR on trade potential. How infrastructure will change in the near future and to what extent the respective countries will be affected by these changes is complicated to estimate. I therefore chose a conservative intuitive improvement of 10% to estimate the effect on trade potential between the EU countries and China.

I apply the gravity model of trade and extend the basic model which includes the GDPs of exporter and partners, bilateral distance, common gravity dummies with variables of infrastructure that are summarized in Table 1. The trade potential (TP) between country i and country j is calculated as the difference of the exports predicted by the gravity model from i to j minus the real exports from country i to j (De Benedictis & Vicarelli, 2005).

$$\text{Trade potential}_{ij} = \text{Predicted exports}_{ij} - \text{real exports}_{ij} \qquad (2.1.)$$

In case of $TP_{ij}>0$ there is less exports than predicted by the model from country i to j. A country therefore does not fulfill the full trade potential with its partner. If $TP_{ij}<0$ than a country i exports more to country j than predicted by the model and hence its exports exceed the expected volume.

The trade potential will be calculated twice. Firstly under the status quo (TP_{ij1}) and secondly under the assumptions of OBOR (TP_{ij2}) meaning that infrastructure improves by 10% and trade costs to export decline by 10%. The effect that OBOR has on EU-China trade will then be interpreted based on the change of trade potential (Δ TP). Index 1 stands for the estimation under status quo and index 2 represents the estimation under the simulation circumstances. Real exports do not change.

TP_{ij1} = predicted exports $_{ij1}$ – real exports (2.2.)

TP_{ij2} = predicted exports $_{ij2}$ – real exports (2.3.)

From TP_{ij1} and TP_{ij2} we can easily calculate the absolute difference between the trade potentials of the status quo and under the OBOR simulation. This variation is interpreted as the effect that OBOR has on trade potential.

$$TP_{ij2} - TP_{ij1} = \Delta\ TP \quad (2.4.)$$

In case Δ TP < 0 a country loses trade potential because of the changes due to OBOR. In case Δ TP > 0 a country gains trade potential due to OBOR. The percentage change of trade potential can be calculated from the absolute change:

$$\frac{\Delta\ TP}{TPij1} = \%\ \text{change of TP due to OBOR} \quad (2.5.)$$

One difficulty was the choice of the appropriate estimation technique. As in trade data heteroskedasticity is quite common estimation results can be biased when using OLS. The PPML estimation provides robust estimations and can be applied in presence of zero trade flows and under heteroskedasticity (Santos Silva & Tenreyro, 2006). I nevertheless perform both OLS and PPML to complement the estimation results.

First I consider the status quo. One of the main difficulties is to estimate how OBOR will change bilateral trade. I therefore assume that the initiative will improve all infrastructure variables by 10% like mentioned above. The variable that measures trade cost to exports (TCX) will be reduced by 10% assuming that higher TCX reduce exports. The improvements of infrastructure and the reduction of TCX are applied to all official OBOR countries (a list of OBOR countries was obtained from the Hong Kong Trade Development Council). (Hong Kong Trade Development Council, 2016)

Before starting the estimations a correlation matrix is helpful to detect possible problems of multicollinearity. FTS and FBS show a very strong correlation. I therefore decided to exclude FTS and only use FBS.

The working hypothesis will be solved by the interpretation of the estimation results.

5. H1: An improvement of infrastructure along the OBOR countries will lead to an increase of trade potential from the EU to China
6. H2: China´s trade potential to the EU will grow less compared to trade potential from EU to China
7. H3: The big EU economies will increase their trade potential to China due to OBOR

I expect to increase the trade potential from the EU to China (H1). Exports grew faster from EU to China than vice versa in the recent decade (see figure 1) (H2). According to the gravity model GDP is an important determinant of bilateral trade. I therefore expect that the big 5 economies (UK, Germany, France, Italy, Spain) will increase their trade potential to China.

Table 2

	ln_exports	ln_gdpex	ln_gdpp	ln_dist	contig	Comlang_ ethno	colony
ln_exports	1.0000						
ln_gdpex	0.5331	1.0000					
ln_gdpp	0.4614	-0.0918	1.0000				
ln_dist	-0.2508	0.1042	0.0080	1.0000			
contig	0.1994	0.0180	0.371	-0.3833	1.0000		
comlang_ ethno	0.0708	0.0031	-0.0279	-0.0742	0.1423	1.0000	
colony	0.1393	0.0867	0.0576	-0.0748	0.1227	0.1733	1.0000
landlocked	-0.1530	-0.2504	0.0419	-0.0920	0.0326	-0.0436	-0.0305
BCP	0.2149	0.2306	-0.0453	-0.0478	-0.0308	0.0107	-0.0391
QPI	0.3000	0.3971	-0.0608	0.0280	-0.0395	0.0334	0.0556
ln_FTS	0.4985	0.9180	-0.0809	0.0826	0.0235	-0.0377	0.0871
ln_FBS	0.5149	0.9022	-0.0854	0.0547	0.0220	-0.0734	-0.0829
ln_AT	0.4382	0.8193	-0.0673	0.1457	0.0108	0.0279	0.0720
ln_TCX	-0.1598	-0.1160	0.0468	-0.0348	0.0504	-0.0077	0.0105

	landlocked	BCP	QPI	ln_FTS	ln_FBS	ln_AT	ln_TCX
landlocked	1.0000						
BCP	-0.0641	1.0000					
QPI	-0.5025	0.7236	1.0000				
ln_FTS	-0.2643	0.0666	0.2333	1.0000			
ln_FBS	-0.2558	0.1611	0.3079	0.9500	1.0000		
ln_AT	-0.2936	0.2305	0.4534	0.7440	0.7256	1.0000	
ln_TCX	0.5556	-0.3396	-0.5362	-0.537	-0.1062	-0.1671	1.0000

Secondly a Breusch-Pagan test was performed to detect possible heteroskedasticity which is common in trade data.

Table 3

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
H0: Constant variance
Variables: fitted values for ln_exports

$chi^2(1)$	1497.21
Prob > chi^2	0.0000

The null hypothesis states that the error term has a constant variance and is homoskedastic. The test result shows that we have to reject H0. The dataset therefore is heteroskedastic. Under heteroskedasticity the PPML estimator is an appropriate alternative. Heteroskedasticity does not necessarily lead to biased estimates however it is not efficient (Wooldridge, 2010).

As famously demonstrated by Anderson & Van Wincoop (2003) third country effects have to be taken into account to control for the multilateral trade resistance. As the primary interest of this study is on country specific variables the methodology that was chosen to control for multilateral trade resistance follows Baier & Bergstrand (2009). They use a first order Taylor approximation:

$$\log \tau_{ij}{*}= \log \tau_{ij} - \sum_{i=1}^{N} \theta_j^k \log \tau_{ij} - \sum_{i=1}^{N} \theta_i^k \log \tau_{ji} + \sum_{i=1}^{N} \sum_{i=1}^{N} \theta_i^k \theta_j^k \log \tau_{ij} \quad (2.6.)$$

where θ_i^k and θ_j^k represent the weight of GDPs. They however recommend using only simple averages to avoid possible problems of endogeneity (Baier & Bergstrand, 2009). The controlled trade cost variables take the form:

$$ln\_\tau_{ij}{*}= ln\_\tau_{ij} - \sum_{j=1}^{N} ln\_\tau_{ij} - \sum_{i=1}^{N} ln\_\tau_{ji} + \sum_{j=1}^{N} \sum_{i=1}^{N} ln\_\tau_{ij} \quad (2.7.)$$

The methodology for controlling for MTR was applied to the distance variable and all infrastructure variables but not for the dummies (Garcia-Herrero & Xu, 2016).

Using country specific dummy variables for MTR is not meaningful to apply for the purpose of this thesis. Any country specific variables would be perfect collinear with the dummies which does not allow estimating their coefficients (Shepard, 2012).

Therefore the baseline equation will look like following:

$$\ln(\text{exports}) = c + \beta_1 \, ln\_gdp\_ex + \beta_2 \, ln\_gdp\_p + \beta_3 \, ln\_dist_{ij} + \beta_4 \, contig_{ij} \quad (2.8.)$$

$$+ \beta_5 \, comlang\_ethno_{ij} + \beta_6 \, colony_{ij} + \beta_7 \, landlocked + \beta_8 \, BCP$$

$$+ \beta_9 \, ln\_FBS + \beta_{10} \, QPI + \beta_{11} \, ln\_AT + \beta_{12} \, ln\_TCX + \varepsilon_{ij}$$

GDPs, distance, FBS, AT and TCX are in logarithms. The control dummies and BCP and QPI are not in logarithms. For the PPML estimation Santos Silva & Tenreyro (2006) suggest not using the logarithm of exports. The equation above will be adjusted respectively for the estimation with PPML. The error term includes unobservable disturbances.

The next section discusses the estimation results.

5. Estimation Results

The gravity model allows estimating the predicted mean trade between countries based on the data. The idea is to use the predicted exports based on the status quo and to compare it with the prediction from the OBOR simulation to detect potential changes in exports from China to the EU and vice versa. The real export value does not change for the simulation and hence the variation in the predicted mean exports from the status quo compared to the simulation will provide the results for the interpretation which the OBOR initiative has on EU-China trade. At first the results from the OLS and PPML regressions are presented:

Table 4

VARIABLES	(1) OLS	(2) PPML
ln_gdpex	0.823***	0.444***
	(0.0367)	(0.0596)
ln_gdpp	0.997***	0.767***
	(0.00972)	(0.0226)
ln_dist	-0.770***	-0.340***
	(0.0154)	(0.0283)
Contig	0.999***	0.613***
	(0.133)	(0.178)
comlang_ethno	0.518***	0.235*
	(0.0663)	(0.121)
Colony	0.699***	-0.0522
	(0.125)	(0.162)
Landlocked	0.619***	0.561***
	(0.0820)	(0.128)
BCP	0.0777	-0.0381
	(0.0484)	(0.0667)
QPI	0.283***	0.184***
	(0.0448)	(0.0588)
ln_FBS	0.388***	0.380***
	(0.0295)	(0.0596)
ln_AT	-0.0273	-0.0426
	(0.0170)	(0.0327)
ln_TCX	-0.898***	-0.558***
	(0.0570)	(0.0898)
Constant	-30.49***	-12.80***
	(0.974)	(1.582)
Observations	11,825	13,344
R-squared	0.679	0.745

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The OLS regression shows the expected sign for GDPs close to unity (Yotov, et al., 2016). Both are significant at the 1% level. Distance also shows the expected negative sign and is also highly significant at the 1% level. The control dummies are also all significant at the 1% level. Sharing a common border (contig) increases exports by 171.5 %. If 9% of the population in two countries share a common language (comlang_ethno) exports increase by 67.8 %. Also the fact having a colonial relationship (colony) has a strong impact on trade. Exports increase by 101.2 % in this case. Landlocked does not show the expected negative sign. According to the estimation result being landlocked increases exports by 85.7 %. From intuition one would expect that being landlocked increases transport costs and therefore exports are lower compared to countries that have access to the ocean.

The infrastructure variables have all positive impacts except TCX and ln_AT. BCP have no significant impact on exports. QPI is highly significant at the 1% level. If QPI increases by 1 unit, exports increase respectively by 28%. ln_FBS also has a positive and highly significant impact on exports. If FBS increases by 1% exports grow by 0.38% ln_AT is negative but also is insignificant. TCX has a negative impact on exports and is highly significant. If TCX increase by 1% exports are reduced by 0.89 %.

The second column repots the results from the PPML estimation. At first it is striking that R^2 rose from 0.679 to 0.745. Under OLS zero trade flows are dropped as the natural logarithm of zero is not defined. The coefficients for GDPs are much lower compared to the OLS estimation and not anymore close to unity but remain significant at the 1% level. Also the coefficient for distance reacts similar. Its impact is lower compared to OLS but still highly significant. This indicates that OLS overestimates the impact of GDP and distance which was aready shown by Santos Silva & Tenreyro (2006). Sharing a common border (contig) is still significant at the 1% level however its impact is also lower compared to OLS. Sharing a common language (comlang_ethno) is with the PPML estimation still positive but only significant at the 10% level. The colony dummy becomes negative but insignificant under PPML estimation. Landlocked remains significant at the 1% level but is also lower compared to OLS.

BCP is also with the PPML method insignificant however turns negative. The impact of QPI is lower compared to OLS but remains highly significant. ln_FBS does only slightly change compared to OLS. ln_AT is still negative and insignificant. ln_TCX is also still significant at the 1% level , its coefficient is compared to OLS however lower.

The next step was to calculate the trade potential between the EU and China. The trade potentials will be calculated with the PPML estimator. I chose the PPML method to estimate the trade potentials for two reasons. Firstly, like discussed above under heteroskedasticity PPML is the more appropriate choice. Secondly, the PPML method also includes zero trade flows which are dropped when using the OLS technique. In a first step the trade potential under status quo (not manipulated data) was calculated. Trade potential was calculated as the real exports subtracted from the predicted trade based on equation 2.6.. The predicted trade can be easily calculated with the Stata command *predict*. The second step considered the simulation (manipulated data) with an improvement of infrastructure variables by 10% and a reduction for trade costs to export by 10%. The variation between the predicted exports between step 1 and step 2 makes it possible to calculate the change in trade potentials. The variations of the trade potentials based on the simulation exercise can then be interpreted as the effect that OBOR has on EU-China trade.

At first the change in trade potentials from the EU to China are analyzed. Table 4 show the percentage change of trade potential from EU to China. The percentage change is the variation between trade potential under the status quo and the OBOR simulation. Table 4 is organized from countries that will have the biggest gain of trade potential to countries whose trade potential declines the most due to the OBOR simulation. Trade potential from Denmark and Sweden to China was dropped from the sample because of missing values in the dataset.

According to the simulation exercise 11 countries will benefit from the initiative, one country is not affected and 12 countries will lose potential to export to China. The winners are all among the official countries that are part of the initiative. The only country not being official member of OBOR but which also can increase the potential to export is Ireland. The biggest beneficiary is Slovakia. The predicted exports under the OBO simulation increase by 10% which leads to an increase of its export potential to China by 15% followed by Estonia (+11%), Croatia (+10%), Poland (+9%), Slovenia (+8%), Rumania (+6%), Bulgaria (+6%), Czech Republic (+4%), Lithuania (+4%), Latvia(+2%) and Ireland (+1%). For Luxemburg there is no change in trade potential observable.

The most disadvantaged country within the EU would be Italy with a reduction of trade potential by -17 % followed by Austria (-13%); Malta (-13%), Portugal (-12%), Greece (-11%), UK (-11%), France (-9%), Cyprus (-7%), Finland (-7%), Hungary (-6%), Spain (-5%), Germany (-5%), Netherlands (-5%) and Belgium (-4%).

Hungary with a loss of -6% of its trade potential to China is among the disadvantaged despite the fact that it is official member of the initiative and was included in the simulation exercise. This result indicates that being part of OBOR does not necessarily lead to an increase of exports to China. Even though 11 countries benefit the major European economies are not among the beneficiaries. The simulation suggests that countries can benefit in case that infrastructure experienced improvements. For example Slovakia shows that trade potential can be increased significantly when countries are able to reduce their trade costs.

Table 5

	Exporter	Partner	Δ Trade Potential (%)
1	Slovakia	China	0.146
2	Estonia	China	0.111
3	Croatia	China	0.100
4	Poland	China	0.085
5	Slovenia	China	0.078
6	Rumania	China	0.059
7	Bulgaria	China	0.057
8	Czech Republic	China	0.043
9	Lithuania	China	0.041
10	Latvia	China	0.020
11	Ireland	China	0.006
12	Luxemburg	China	0.000
13	Belgium	China	-0.043
14	Netherlands	China	-0.046
15	Germany	China	-0.050
16	Spain	China	-0.054
17	Hungary	China	-0.060
18	Finland	China	-0.067
19	Cyprus	China	-0.075
20	France	China	-0.092
21	UK	China	-0.113
22	Greece	China	-0.113
23	Portugal	China	-0.117
24	Malta	China	-0.126
25	Austria	China	-0.129
26	Italy	China	-0.166
27	Sweden	China	
28	Denmark	China	

Next I consider the opposite direction from China to the EU. Table 5 shows the relative change of trade potential of exports from China to the EU. Like above the percentage change is the variation between trade potential under the status quo and the OBOR simulation

The first striking difference of trade potentials from China to EU compared to EU-China trade potentials based on the OBOR simulation is that all trade potentials to export increase to all EU economies. According to the estimation China´s export potential to Luxemburg increases by approximately 170%. However the difference between mean predicted exports under status quo and the OBOR simulation only increase about 2%. Another important finding is that compared to table 3 the countries that are affected by the OBOR simulation are not necessarily part of the initiative. Among the first 10 countries which would be mostly affected by increased Chinese imports into these countries 5 are not part of the initiative. China´s trade potential increases to Luxemburg (+170.5%), Spain (+24.3%), Italy (+12.7%), UK (+10.8%) and Germany (+9.9%). Spain, Italy, UK and Germany belong to the big five European economies. China therefore could increase its exports therefore to the, measured in GDP, most important economies. Trade potential to France which is also part of the big five however only grows by +5.8%. China´s trade potential to a country within the EU which is part of OBOR mostly increases to Poland (+28 %) followed by Slovenia (21%) and Slovakia (14.3%). Other EU economies which are part of OBOR would be less affected. Chinese trade potential to Estonia (+7.5%), Latvia (+6.7%), Czech Republic (+6.4%), Lithuania (+5.3%), Rumania (+4.8%), Croatia (+4.5%) and Bulgaria (+4.2%) all increase however more moderate below 10% than Poland, Slovenia and Slovakia. He trade potential to the Netherlands only increases by 1%. Despite the fact that the Netherlands are one of the biggest EU economies and has important harbors the change in trade potential is quite moderate.

The simulation shows that China benefits from increased trade potential to European economies. The simulation suggests that China´s trade potential to the EU is independent from the fact if a country is part of the initiative or not. Considering the trade potential from EU to China all EU economies that are part of OBOR benefit. Only Ireland as a country not being part of the initiative can increase its trade potential to China. This suggests that being part of OBOR increases trade potential for EU economies to China.

Table 6

	Exporter	Partner	Δ Trade Potential (%)
1	China	Luxemburg	1.705
2	China	Poland	0.280
3	China	Spain	0.243
4	China	Slovenia	0.210
5	China	Slovakia	0.143
6	China	Italy	0.127
7	China	Hungary	0.112
8	China	UK	0.108
9	China	Germany	0.099
10	China	Estonia	0.075
11	China	Latvia	0.067
12	China	Denkmark	0.065
13	China	Czech Republic	0.064
14	China	Belgium	0.059
15	China	France	0.058
16	China	Lithuania	0.053
17	China	Greece	0.048
18	China	Rumania	0.048
19	China	Sweden	0.046
20	China	Cyprus	0.045
21	China	Croatia	0.045
22	China	Bulgaria	0.042
23	China	Portugal	0.041
24	China	Finland	0.040
25	China	Ireland	0.033
26	China	Austria	0.028
27	China	Malta	0.011
28	China	Netherlands	0.010

The relative change of trade potential provides useful information about the relative importance for particular countries. Now also the absolute changes of the simulation are analyzed starting with EU trade potential to China. The results from the simulation for absolute changes of trade potential from the EU to China are reported in table 6. Like in the previous tables 4 & 5 the variation shows the impact that OBOR has on trade potential.

The picture for the absolute change of trade potential is slightly different compared than the relative changes. In absolute volumes Poland can increase its potential to export to China based on the OBOR simulation by +580 million USD followed by Slovakia

(+310 million USD) and Czech Republic (+170 million USD). Similar to the relative change of trade potential also in absolute volumes all EU economies that are part of OBOR benefit the most in the simulation. Only Ireland can increase the trade potential by 10 million USD. The biggest losers are the big 5 EU economies Spain (-600 million USD), France (-660 million USD), UK (-790 million USD), Italy (-1.05 billion USD) and Germany (-1.9 billion USD). The sum of all trade potentials from the EU to China amount to -5.79 billion USD. Therefore OBOR would lead to a reduction of trade potential due to OBOR considering the whole EU. The EU economies that participate in the initiative however can increase their trade potential all together by +1.57 billion USD.

Table 7

	Exporter	Partner	Δ Trade Potential
1	Poland	China	5.80E+08
2	Slovakia	China	3.10E+08
3	Czech Republic	China	1.70E+08
4	Rumania	China	1.70E+08
5	Estonia	China	1.30E+08
6	Croatia	China	1.30E+08
7	Slovenia	China	1.10E+08
8	Lithuania	China	8.00E+07
9	Bulgaria	China	5.70E+07
10	Latvia	China	3.00E+07
11	Ireland	China	1.00E+07
12	Luxemburg	China	0.00E+00
13	Belgium	China	-4.20E+07
14	Malta	China	-5.60E+07
15	Cyprus	China	-6.40E+07
16	Hungary	China	-2.00E+08
17	Netherlands	China	-3.10E+08
18	Finland	China	-3.50E+08
19	Greece	China	-4.90E+08
20	Portugal	China	-5.20E+08
21	Austria	China	-5.30E+08
22	Spain	China	-6.00E+08
23	France	China	-6.60E+08
24	UK	China	-7.90E+08
25	Italy	China	-1.05E+09
26	Germany	China	-1.90E+09
27	Denmark	China	
28	Sweden	China	

We can however reject H1. On average the EU would not increase its trade potential to China. H3 stated that the big 5 European economies would increase their trade potential to China. According to the simulation results we can reject H3. All of the big 5 EU economies lose trade potential to China.

Table 6 reports the absolute change of trade potential from China into the EU. China can increase its absolute trade potential in total to the EU by 7.76 billion USD. We can therefore reject H2 which stated that China´s trade potential grows less than trade potential from EU to China.

Table 8

	Exporter	Partner	Δ Trade Potential
1	China	Germany	1.30E+09
2	China	UK	1.10E+09
3	China	France	9.00E+08
4	China	Italy	7.30E+08
5	China	Spain	5.30E+08
6	China	Netherlands	4.00E+08
7	China	Sweden	3.40E+08
8	China	Poland	3.08E+08
9	China	Belgium	2.60E+08
10	China	Austria	2.20E+08
11	China	Denmark	2.10E+08
12	China	Finland	2.00E+08
13	China	Ireland	1.90E+08
14	China	Czech Republic	1.40E+08
15	China	Rumania	1.40E+08
16	China	Greece	1.30E+08
17	China	Portugal	1.30E+08
18	China	Hungary	9.60E+07
19	China	Slovakia	7.80E+07
20	China	Luxemburg	5.20E+07
21	China	Bulgaria	5.00E+07
22	China	Croatia	5.00E+07
23	China	Lithuania	4.90E+07
24	China	Slovenia	4.20E+07
25	China	Latvia	3.60E+07
26	China	Estonia	3.30E+07
27	China	Cyprus	2.60E+07
28	China	Malta	2.00E+07

Chinas trade potential increases the most with the big European economies in absolute terms. Germany (+1.3 billion USD), UK (+1.1 billion USD), France (+900 million USD), Italy (+730 million USD) and Spain (+530 million USD) would be affected the most. These five economies therefore represent 58% of the total increase of trade potential from China to the EU. Chinas trade potential to the EU countries being part of OBOR increases in total by 1.02 billion USD which represents 13% of the total increase of trade potential.

The simulation exercise compared the trade potentials from the status quo with the non-manipulated data and trade potentials from the manipulated scenario where all infrastructure variables were improved by 10% and trade costs to export were reduced by 10%. The manipulation was performed for all countries that are officially part of OBOR. The trade potentials were calculated for China to all economies of the European Union and vice versa.

The simulation suggests that countries that are part of the initiative can increase their potential to export to China compared to countries that are not part of the initiative which would lose trade potential to China. On average the total volume of trade potential is negative for the EU to China. China however can increase its trade potential to the EU in total volumes. The countries that would be affected the most by increasing Chinese trade potential however are not the EU economies being part of OBOR. China can increase its trade potential mostly to the big EU economies Germany, UK, France, Italy and Spain.

The analysis suggests that small European economies can benefit from an active participation and cooperation with China.

6. Conclusion

The main goal of the thesis was to analyze changes of trade potentials between China and the EU due to the One Belt One Road (OBOR) initiative. A simulation exercise was chosen to estimate which impact an improvement of infrastructure along the OBOR countries has on the trade potential between China and the EU.

OBOR is planned as a global infrastructure project that includes construction of transport and communication infrastructure, improvement of trade relations, cooperation of social and environmental policies, prevention of terrorism and wars mainly through the facilitation of trade infrastructure (National Development and Reform Commision, et al., 2015). The project includes more than 60 countries based in Europe, Central Asia, the Middle East, South East Asia, Asia and Africa. The European Union and China form together the biggest single trading bloc in the world. China is the biggest importer for the EU as a whole and also China as an export destination became increasingly important for the EU in the recent decades.

This thesis tried to analyze with a simulation exercise which impact OBOR could have on EU-China trade. A gravity model of international trade was applied to estimate trade potentials under normal circumstances and trade potentials under a hypothetical scenario. Trade potential was calculated as the difference between predicted exports by the gravity model minus the real export from country i to j. The scenario assumes that OBOR will lead to a 10% improvement of infrastructure and simultaneously to a 10% reduction of trade costs. Infrastructure was measured with different indicators obtained from the World Bank including burden of customs procedures, quality of port infrastructure, fixed broadband subscriptions and registered air carriage. Further trade costs to export a 20 foot container were used as a proxy for transport infrastructure as this indicator includes inland transport. The resulting trade potentials from both estimations were compared and analyzed. The variation between the trade potentials under the conditions of status quo and the simulation were interpreted as the effect that OBOR has on EU-China trade potentials.

The results of the simulations suggest that European economies can benefit from an increase of trade potential when they participate in OBOR. All European economies that are part of OBOR could increase their trade potential to China according to the results of the estimation. The largest impact would be experienced by Slovakia which could increase its trade potential to China by +14.6% followed by Estonia (+11.1%), Croatia (+10%). Only Ireland as a country not being part of the initiative could increase its trade potential by 0.6%. All other European economies would lose trade potential to China. The results for trade potentials from China to the EU suggest that not only countries that are part of OBOR are affected. Within the 10 countries that are affected the most by increasing Chinese trade potential 5 are not part of OBOR (Luxemburg (+170.5%), Spain (+24.3%), Italy (+12.7%), UK (+10.8%) and Germany (9.9%).

The main contribution of the thesis consists of the estimation of trade potentials between China and the EU based on a simulation exercise with the specific scenario of the OBOR initiative. As the project was announced only 4 years ago its impacts are not properly studied yet. Garcia-Herrero & XU (2016) and Li et al. (2016) are two of the few studies that apply a gravity model to estimate which impact OBOR has on trade volumes.

Further research could deal with the question how the initiative affects trade with other important economic partners like the United States. Also the loss of trade potential of European economies could be analyzed further. The initiative includes more than 60 countries. A question therefore could be if European exports are relocated to other countries in Central Asia, Asia and the Middle East due to an improvement of infrastructure which could explain that the trade potential to China declines. It could happen that other countries along OBOR absorb trade and increase their importance as trading partners for the EU. In addition the estimation of trade potentials between the EU and China could be estimated with a different set of indicators. Due to limited data availability I chose to concentrate on country specific variables. Another approach could more focus on bilateral determinants of trade costs.

7. Critical Remarks

Despite the fact that China seems to have no doubts about their ambitious project they face major obstacles. The vast number of countries that should be part of it and their different interests, the fact that some countries are members of the EU, wars and terrorism in participating countries, religious turmoil, persisting poverty and many other issues that could hinder the implementation of the initiative seem to be underestimated by the Chinese leadership. Still information is scarce about how all these measures and all the projects are going to be realized. Especially connections of railways that pass several countries seem to make it very complicated regarding tax and customs regulations, ensuring the security of goods on the travel. As the project is planned as an inclusive approach with no single authority questions arise who or which regulatory power will enforce contracts, ensure stability and safety along the routes, prevents corruption and so on. Some of the participating countries perform very poorly regarding corruption, poverty internal stability and it is not clear how exactly the OBOR initiative is able to stabilize these regions and solve the existing problems purely by promoting infrastructure.

The fact that China still is not recognized as a market economy or that a free trade agreement is highly improbable in the next few years is clearly a chance for OBOR. If "traditional" ways of trade facilitation are most likely not achievable in the near future other measures can promote peaceful trade relations. In my opinion the main question is whether the EU as a whole will actively participate in such an infrastructure project and consequentially if China would accept active participation. One of the main problems of China is that Chinese companies have built massive overcapacities in key industries like the steel and concrete sector. A boom for their demand fired by orders abroad along the Silk Road could lift some pressure from the Chinese economy. One very important question however is if all these countries really want Chinese interference and participation to that amount within their borders. This initiative seems to have clearly 2 sides of a medal. On the one hand China is willing to invest and develop modern infrastructure in countries that suffer from political and economic instability like the Middle East or Central Asia. On the other hand he price seems to be increasing dependence for these countries from China. If these countries are not able to develop their own economy and simply let Chinese companies do the work a boom could be of very short term. The chance that they could be reduced to simple transit nations without any own development of industry is quite high in my opinion. If this solves their major problems like poverty, corruption or ethnic turmoil seems to be rather unlikely.

From a European perspective the project could have massive impacts in the future for EU-China relations. China and the EU are already trading intensively with each other and China is still in a transition period. Products are getting more advanced, a growing middle class fires demand for foreign but also domestic products. Additionally the EU faces at least in the coming years difficulties in the transatlantic relations. The negotiations about the TTIP agreement with the US are frozen and therefore there could be a vacuum established that China might use to pull the EU towards the east. It will be interesting to observe how the EU will balance the interests of increasing trade towards the East and China and the relations with the United States. Europe still suffers from the financial crisis. High unemployment and highly indebted state budgets are an ongoing problem of many European economies. The initiative could open a chance for the EU to spread into new markets along the Silk Road. Like mentioned above the success of the project seems to be highly questionable in the way presented by the Chinese leadership of an open and wealth enhancing multilateral project and reasonable doubts about the successful implementation are justified. Nevertheless the EU should not underestimate possible consequences.

Bibliography

Anderson, J., 1979. A theoretical foundation for the gravity equation. *The American Economic Review*, 69(1), pp. 106-116.

Anderson, J. & Van Wincoop, E., 2003. Gravity with gravitas: a solution to the border puzzle. *The American Economic Review*, 93(1), pp. 170-192.

Anderson, J. & Van Wincoop, E., 2004. Trade Costs. *Journal of Economic literature*, 42(3), pp. 691-751.

Aris, S., 2016. "One Belt One Road": Chinas Vision von Konnektivität. *CSS Analysen*.

Arrelano, M. & Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations.". *The Review of Economic Studies*, 58(2), pp. 277-297.

Asian Development Bank, 2017. *adb.org.* [Online]
Available at: https://www.adb.org/news/asia-infrastructure-needs-exceed-17-trillion-year-double-previous-estimates
[Accessed April 2017].

Bacchetta, M. et al., 2012. *A practical guide to trade policy analysis.* s.l.:World Trade Organization.

Baier, S. & Bergstrand, J., 2001. The growth of world trade: tariffs, transport costs, and income similarity. *Journal of International Economics*, 53(1), pp. 1-27.

Baier, S. & Bergstrand, J., 2009. Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics*, 77(1), pp. 77-85.

Baldwin, R. & Taglioni, D., 2006. Gravity for dummies and dummies for gravity equations. *National Bureau of Economic Research*.

Bendini, R. & Barone, B., 2014. Trade and economic relations with China 2014. *Directorate-General for External Policies*.

Bergstrand, J. H., 1985. The gravity equation in international trade: some microeconomic foundations and empirical evidence. *The Review of Economics and Statistics*, pp. 474-481.

Bergstrand, J. H., 1989. The generalized gravity equation, monopolistic competition, and the factor-proportions theory in international trade. *The Review of Economics and Statistics*, pp. 143-153.

Blomkvist, K. & Drogendijk, R., 2016. Chinese outward foreign direct investments in Europe. *European Journal of International Management*, 10(3), pp. 343-358.

Bondaz, A. et al., 2015. "ONE BELT, ONE ROAD": CHINA´S GREAT LEAP OUTWARD.

Bougheas, S., Demetriades, P. & Morgenroth, E., 1999. Infrastructure, transport costs and trade. *Journal of International Economics*, 47(1), pp. 169-189.

Buszynski, L., 2012. The South China Sea: oil, maritime claims, and US–China strategic rivalry. *The Washington Quarterly*, 35(2), pp. 139-156.

Callaghan, M. & Hubbard, P., 2016. The Asian Infrastructure Investment Bank: Multilateralism on the Silk Road. *China Economic Journal*, 9(2), pp. 116-139.

Casarini, N., 2015. Is Europe to Benefit from China's Belt and Road Initiative?. *IAI working papers*, 15(40).

Channey, T., 2008. Distorted Gravity: The Intensive and Extensive Margins of International. *The American Economic Review*, 98(4), pp. 1707-1721.

Costello, M., 2016. *China's Market Economy Status: A Political Issue.* s.l.:The Institute of International and European Affairs.

De Benedictis, L. & Vicarelli, C., 2005. Trade potentials in gravity panel data models. *The BE Journal of Economic Analysis & Policy*, 5(1).

Djankov, S., Freund, C. & Pham, C., 2010. Trading on Time. *The Review of Economics and Statistics*, 92(1), pp. 166-173.

Djankov, S. & Miner, S., 2016. *China's Belt and Road Initiative: motives, scope, and challenges.* s.l.:Peterson Institute for International Economics.

Dornbusch, R., Fischer, S. & Samuelson, P., 1977. Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods. *The American Economic Review*, 67(5), pp. 823-839.

Eaton, J. & Kortum, S., 2002. Technology, geography, and trade. *Econometrica*, 70(5), pp. 1741-1779.

European Comission, 2017a. *http://trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/doclib/press/index.cfm?id=1613
[Accessed April 2017].

European Comission, 2017b. *trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/doclib/docs/2006/december/tradoc_118238.pdf
[Accessed March 2017].

European Comission, 2017c. *trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/doclib/docs/2012/march/tradoc_149251.pdf
[Accessed March 2017].

European Comission, 2017d. *trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_113366.pdf
[Accessed March 2017].

European Comission, 2017e. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/trade/policy/countries-and-regions/countries/china/
[Accessed April 2017].

European Comission, 2017f. *trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/doclib/docs/2006/december/tradoc_118238.pdf
[Accessed April 2017].

European Comission, 2017g. *trade.ec.europa.eu.* [Online]
Available at: http://trade.ec.europa.eu/tdi/
[Accessed May 2017].

European External Action Service, 2014. *eeas.europa.eu.* [Online]
Available at: https://eeas.europa.eu/sites/eeas/files/tradoc_144591.pdf
[Accessed April 2017].

Eurostat, 2015a. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_ports_freight_and_passenger_statistics
[Accessed April 2017].

Eurostat, 2015b. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/documents/2995521/6893875/6-26062015-AP-EN.pdf/44d4c87c-98dd-4061-bdf6-b292884a5073
[Accessed April 2017].

Eurostat, 2016a. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/documents/2995521/7224424/6-31032016-BP-DE.pdf
[Accessed April 2017].

Eurostat, 2016b. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/documents/2995521/7553974/6-12072016-BP-EN.pdf/67bbb626-d55f-4032-8c24-48e4c9f78c3a
[Accessed April 2017].

Eurostat, 2017a. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Top_10_countries_as_extra_EU-28_partners_for_FDI_stocks,_EU-28,_end_2012%E2%80%932015_(billion_EUR)_YB17.png
[Accessed May 2017].

Eurostat, 2017b. *ec.europa.eu.* [Online]
Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Foreign_direct_investment,_EU-28,_2012%E2%80%932015_YB17.png
[Accessed May 2017].

Ewert, I., 2016. The EU-China Bilateral Investment Agreement: Between High Hopes and Real Challenges. *Security Policy Brief*, Issue 68.

Fallon, T., 2015. The New Silk Road: Xi Jinping's Grand Strategy for Eurasia. *American Foreign Policy Interests*, 37(3), pp. 140-147.

Feenstra, R., 1998. Integration of trade and disintegration of production in the global economy. *The journal of economic perspectives*, 12(4), pp. 31-50.

Francois, J. & Manchin, M., 2007. Institutions, Infrastructure, and Trade.

French, S., 2011. The composition of exports and gravity. *Working Paper* .

Garcia-Herrero, A., 2015. *nikkei.com.* [Online]
Available at: http://asia.nikkei.com/Viewpoints-archive/Perspectives/China-pushing-build-now-pay-later-model-to-emerging-world?page=1
[Accessed April 2017].

Garcia-Herrero, A., 2017. *bruegel.org.* [Online]
Available at: http://bruegel.org/wp-content/uploads/2017/02/presentation.pdf
[Accessed April 2017].

Garcia-Herrero, A. & Xu, J., 2016. China's Belt and Road initiative: Can Europe expect trade gains?. *Working Paper*, Issue Issue 5.

Hanemann, T. & Huotari, M., 2016. *A New Record Year for Chinese Outbound Investment in Europe.* s.l.:Mercator Institute for China Studies.

Hansakul, S., Levinger, H. & Lanzeni, M.-L., 2014. China-EU relations: Gearing up for growth. *Deutsche Bank Research*, Volume 31.

Haveman, J., Ardelean, A. & Thornberg, C., 2005. Trade infrastructure and trade costs: a study of selected Asian ports . In: D. Brooks & D. Hummels, eds. *Infrastructure's Role In Lowering Asia's Trade Costs.* s.l.:s.n.

Head, K. & Mayer, T., 2013. *Gravity equations: Workhorse, toolkit, and cookbook.* s.l.:s.n.

Helpman, E., Melitz, M. & Rubinstein, Y., 2008. Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2), pp. 441-487.

HKTDC, R., 2016. *http://china-trade-research.hktdc.com.* [Online]
Available at: http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/The-Belt-and-Road-Initiative/obor/en/1/1X000000/1X0A36B7.htm
[Accessed April 2017].

Hong Kong Trade Development Council, 2016. [Online]
Available at: http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/The-Belt-and-Road-Initiative-Country-Profiles/obor/en/1/1X000000/1X0A36I0.htm
[Accessed 17 April 2017].

Hummels, D., 2001b. Time as a trade barrier. *Working paper*.

Hummels, D., 2001. Have International Transport Costs Declined?. *Journal of International Economics*, 54(1), pp. 75-96.

Hummels, D., 2007. Transportation costs and international trade in the second era of globalization. *The Journal of Economic Perspectives*, 21(3), pp. 131-154.

International Road Federation, 2017. [Online]
Available at: https://worldroadstatistics.org/

Irshad, M. S., 2015. One Belt and One Road: Dose China-Pakistan Economic Corridor Benefit for Pakistan's Economy?. *Journal of Economics and Sustainable Development*, 6(24).

Kennedy, S. & Parker, D., 2015. *Building China"s "one Belt One Road".* [Online]
Available at: https://www.csis.org/analysis/building-china%E2%80%99s-%E2%80%9Cone-belt-one-road%E2%80%9D
[Accessed April 2017].

Kolstad, I. & Wiig, A., 2012. What determines Chinese outward FDI?. *Journal of World Business*, 47(1), pp. 26-34.

Krugman, P., 1979. Increasing returns, monopolistic competition, and international trade. *Journal of International Economics*, 9(4), pp. 469-479.

Krugman, P., 1980. Scale economies, product differentiation, and the pattern of trade. *The American Economic Review*, 70(5), pp. 950-959.

Krugman, P., 1995. Increasing returns, imperfect competition and the positive theory of international trade. In: *Handbook of international economics.* s.l.:s.n., pp. 1243-1277.

Leamer, E. & Levinsohn, J., 1995. International trade theory: the evidence. In: *Handbook of international economics* . s.l.:s.n., pp. 1339-1394.

Liao, S. & McDowell, D., 2015. Redback rising: China's bilateral swap agreements and renminbi internationalization. *International Studies Quarterly*, 59(3), pp. 401-422.

Limao, N. & Venables, A., 2001. Infrastructure, geographical disadvantage, transport costs, and trade. *The World Bank Economic Review*, 15(3), pp. 451-479.

Linders, G.-J. & De Groot, H. L., 2006. Estimation of the gravity equation in the presence of zero flows.

Li, Y., Bolton, K. & Westphal, T., 2016. The effect of the New Silk Road railways on aggregate trade volumes between China and Europe. *Duisburger Arbeitspapiere Ostasienwissenschaften*.

Lo, C., 2015. China´s New Silk Road Strategy. *The International Economy*, 29(4).

Martínez-Zarzoso, I. & Suárez-Burguet, C., 2005. Transport costs and trade: empirical evidence for Latin American imports from the European Union. *Journal of International Trade & Economic Development*, 14(3), pp. 353-371.

McBride, J., 2015. *Building the New Silk Road.* [Online]
Available at: https://www.files.ethz.ch/isn/190994/The%20New%20Silk%20Road%20-%20Council%20on%20Foreign%20Relations.pdf
[Accessed April 2017].

Minghao, Z., 2015. China´s New Slik Road Initiative.

National Development and Reform Commision, Ministry of Foreign Affairs & Ministry of Commerce of the People´s Republic of China, 2015. *Vision and Actions on Jointly Building Silk Road Economic Belt and 21stCentury.* [Online]
Available at: http://en.ndrc.gov.cn/newsrelease/201503/t20150330_669367.html
[Accessed March 2017].

Pavlićević, D., 2014. China's Railway Diplomacy in the Balkans. *China Brief*, 14(12).

Pop, I. I., 2016. Strengths and Challenges of China's "One belt, One road" Initiative.

Prehn, S. & Brümmer, B., 2011. Estimation issues in disaggregate gravity trade models. *Diskussionspapiere*.

Qingjiang, K., 2008. *Trade Disputes between China and the EU.* s.l.:EAI Background Brief No 416.

Redding, S. & Venables, A., 2004. Economic geography and international inequality. *Journal of international Economics*, 62(1), pp. 53-82.

Renard, T., 2015. The Asian Infrastructure Investment Bank (AIIB):China´s new multilateralism and the erosion of the West. *Security Policy Brief*, Issue 63.

Reuters, 2016. *reuters.com.* [Online]
Available at: http://www.reuters.com/article/greece-privatisation-port-idUSL8N1AR252
[Accessed April 2017].

Rhodium Group, 2015. *Reaching New Heights: An update on Chinese investments into Europe.* [Online]
Available at: http://www.bakermckenzie.com/-/media/files/insight/publications/2016/03/reaching-new-heights/ar_emea_reachingnewheights_mar16.pdf?la=en
[Accessed May 2017].

Rolland, N., 2015. China´s new silk road. *The National Bureau of Asian Research*.

Santos Silva, J. & Tenreyro, S., 2006. The log of gravity. *The Review of Economics and statistics*, 88(4), pp. 641-658.

Santos Silva, J. & Tenreyro, S., 2011. Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economic Letters*, 12(2), pp. 220-222.

Scott, D., 2007. China-EU convergence 1957–2003: towards a ‘strategic partnership. *Asia Europe Journal*, 5(2), pp. 217-233.

Shepard, B., 2012. The gravity model of international trade: A user guide. *ARTNeT Books and Research Reports*.

Spulber, D., 2007. *Global competitive strategy.* s.l.:Cambridge University Press.

Stepan, M. & Ostermann, F., 2011. EU–China Relations. Strategic or pragmatic, the future or already the past.

The Guardian, 2017. *theguardian.com.* [Online]
Available at: https://www.theguardian.com/us-news/2017/jan/23/donald-trump-first-orders-trans-pacific-partnership-tpp
[Accessed April 2017].

Tinbergen, J., 1962. *Shaping the world economy; suggestions for an international economic policy.* s.l.:s.n.

Trefler, D., 1995. The case of the missing trade and other mysteries. *American Economic Review*, pp. 1029-1046.

van der Putten, F.-P. & Meijnders, M., 2015. *China, Europe and the Maritime Silk Road,* s.l.: Clingendael.

Venables, A., 2001. Geography and international inequalities: the impact of new technologies. *Journal of Industry, Competition and Trade*, 1(2), pp. 135-159.

Villafuerte, J., Corong, E. & Zhuang, J., 2016. [Online]
Available at: https://www.gtap.agecon.purdue.edu/resources/download/8280.pdf
[Accessed April 2017].

Wong, J. & Lye, F. L., 2014. Reviving the Ancient Silk Road: China's New Diplomatic Initiative. *East Asian Policy*, 6(3), pp. 5-15.

Wooldridge, J. M., 2010. *Econometric Analysis of Cross Section and Panel Data.* s.l.:MIT Press.

Xin, C., 2014. China-EU Trade and Economic Relations (2003-2013). *Global Economic Observer*, 2(1).

Yotov, Y. V., Piermartini, R., Monteiro, J.-A. & Larch, M., 2016. *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model.* s.l.:World Trade Organization.

Appendix

Exporter countries

EU	OBOR		Rest of World	
Austria	Afghanistan	Singapore	Angola	Sierra Leone
Belgium	Albania	South Africa	Argentina	Seychelles
Bulgaria*	Armenia	Sri Lanka	Australia	Togo
Croatia*	Azerbaijan	Palestine	Burundi	Trinidad and Tobago
Cyprus	Bahrain	Macedonia	Bahamas	Tunisia
Czech Republic*	Belarus	Thailand	Belize	Tanzania
Denmark	Bosnia Herzegovina	Turkey	Bolivia	Uganda
Estonia*	Brunei Darussalam	Ukraine	Brazil	Uruguay
Finland	Cambodia	United Arab Emirates	Botswana	USA
France	China	Viet Nam	Central African Rep.	Zambia
Germany	Egypt		Canada	
Greece	Ethiopia		Switzerland	
Hungary*	Georgia		Chile	
Ireland	India		Cameroon	
Italy	Indonesia		Colombia	
Latvia*	Iraq		Costa Rica	
Lithuania*	Israel		Dominican Rep.	
Luxembourg	Jordan		Algeria	
Malta	Kazakhstan		Ecuador	
Netherlands	Kuwait		Fiji	
Poland*	Kyrgyzstan		Iceland	
Portugal	Malaysia		Japan	
Romania*	Maldives		Morocco	
Slovakia*	Mongolia		Madagascar	
Slovenia*	Montenegro		Mexico	
Spain	Nepal		Mozambique	
Sweden	New Zealand		Mauritius	
United Kingdom	Oman		Malawi	
	Pakistan		Namibia	
	Philippines		Niger	
	Qatar		Nicaragua	
	Rep. of Korea		Norway	
	Moldova		Panama	
	Russia		Peru	
	Saudi Arabia		Paraguay	
	Serbia		Senegal	

EU countries with a star* are members of OBOR

Partner countries

EU	OBOR		Rest of World	
Austria	Afghanistan	Philippines	Algeria	Mozambique
Belgium	Albania	Qatar	Angola	Myanmar
Bulgaria*	Armenia	Rep. of Korea	Argentina	Namibia
Croatia*	Azerbaijan	Russia	Australia	Nicaragua
Cyprus	Bahrain	Saudi Arabia	Bahamas	Niger
Czech Republic*	Bangladesh	Serbia	Belize	Nigeria
Denmark	Belarus	Singapore	Bolivia	Norway
Estonia*	Bhutan	South Africa	Botswana	Panama
Finland	Bosnia Herzegovina	Sri Lanka	Brazil	Paraguay
France	Brunei Darussalam	Syria	Burundi	Peru
Germany	Cambodia	Tajikistan	Cameroon	Senegal
Greece	China	Thailand	Canada	Seychelles
Hungary*	Egypt	Turkey	Central African Rep.	Sierra Leone
Ireland	Ethiopia	Turkmenistan	Chad	Swaziland
Italy	Georgia	Ukraine	Chile	Switzerland
Latvia*	India	United Arab Emirates	Colombia	Syria
Lithuania*	Indonesia	Uzbekistan	Costa Rica	Tajikistan
Luxembourg	Iran	Viet Nam	Cuba	Tanzania
Malta	Iraq	Yemen	Dominica	Togo
Netherlands	Israel		Dominican Rep.	Trinidad and Tobago
Poland*	Jordan		Ecuador	Tunisia
Portugal	Kazakhstan		Fiji	Turkmenistan
Romania*	Kuwait		Gabon	Uganda
Slovakia*	Kyrgyzstan		Gambia	Uruguay
Slovenia*	Lao People's Dem. Rep.		Ghana	USA
Spain	Lebanon		Iceland	Uzbekistan
Sweden	Macedonia		Japan	Yemen
United Kingdom	Malaysia		Kenya	Zambia
	Maldives		Liberia	Zimbabwe
	Moldova		Libya	
	Mongolia		Madagascar	
	Montenegro		Malawi	
	Nepal		Mali	
	New Zealand		Mauritania	
	Oman		Mauritius	
	Pakistan		Mexico	
	Palestine		Morocco	