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The effect of aid and state visits on trade

Alexander Urnes Johnson

Thesis Supervisor: Ragnhild Balsvik

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Abstract

This paper investigates the effect of aid on trade for twelve European countries and the effect of state visits on trade for four European countries. The theoretical foundation for the analysis is the gravity model of trade. The results show a robust statistically significant effect of aid on trade for France and in some of the robustness tests significant effects of aid on exports for Germany, Spain, United Kingdom and the twelve countries combined. No effects of state visits on trade are found. The causal relationships between aid and trade and state visits and trade are investigated with Granger causality tests. The causality between aid and trade goes in different ways dependent on whether the twelve countries are tested together or individually. No causality is found between state visits and trade.

Preface

This master thesis marks the end of my education at the Norwegian School of Economics. During my master program in Economic Analysis I have gained an interest in econometrics and econometric applications, which led me to write this empirical master thesis. The master thesis process has been challenging, stimulating and rewarding.

I wish to thank the thesis supervisor, Ragnhild Balsvik, for the suggested topic and thorough feedback and discussions throughout the entire master thesis process. I also wish to thank special advisor Tryggve Øglænd and Innovation Norway for information about Norwegian state visits. Finally I would like to thank my family for their support.

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1. Introduction

The world is becoming more interlinked. The total world export of goods and services was $15238 billion in 2010 (World Trade Organization, 2011). The importance of trade in goods and services has increased in the last decades. Trade in goods and services constituted 73 % of world GDP in 1986 and it grew to 125 % of world GDP in 2010. There are several reasons for countries to engage in trade (Neely, 1997). The exporting country can have a comparative advantage in producing a good. In this way it will be beneficial to export that good and import goods in which the country doesn't have a comparative advantage. There can also be increasing returns to scale in production. Some goods have large fixed costs in production, making it efficient to have few producers. The automobile and aircraft industries are good examples. Lastly trade increases competition, which forces the domestic industry to improve efficiency. According to microeconomic theory trade can be mutually beneficial for both the exporting and importing country (Pindyck and Rubinfeld, 2009).

There are several factors that influence trade between two countries: trade policies, globalization, government policies, exchange rate regimes, free trade agreements, migration, cultural relationships, technological opportunities and resource allocation to mention some. Since trade can be economically beneficial it is important to study the effect different factors have on trade, especially since the effect might be ambiguous. The thesis will investigate the effect of two governmental policies, aid and state visits, on trade. Aid is donated primarily to alleviate poverty and promote economic development although strategic factors such as promoting domestic industry and political policies also can be important. Over $105 billion (constant 2004 values) was donated as official development assistance in 2005. The large transfers of wealth influence the economies of the recipient countries. Do the donations also influence the donor's exports and imports? State visits are the highest form of diplomatic contact between countries. Among other objectives, state visits are used to develop business relationships with the visiting country. Is there a significant effect of state visits on trade? The problems researched in the thesis are:

What is the effect of state visits and aid on trade? Is there a measurable effect and if so how large is it?

The problem will be investigated for twelve European countries in the aid analysis and four European countries in the state visit analysis using the gravity model of trade. The aid analysis reveals robust significant effects of aid on trade for France and significant effects of aid on exports for Germany, Spain, United Kingdom and the twelve countries combined in some of the robustness tests. No significant effects of state visits on trade are found. The causal relationships between aid and trade and state visits and trade are investigated using Granger causality tests, which conclude that the causality between aid and trade goes in both directions while no believable causality is found between state visits and trade.

In chapter 2 aid and state visits will be defined and described and theoretical arguments for the causal links between trade and aid and trade and state visits will be presented. There are several arguments for bidirectional causal relationships between both trade and aid and trade and state visits. In chapter 3 the theoretical foundation of the thesis, the gravity model of trade, will be presented. In chapter 4 previous studies on the effect of aid on exports and state visits on trade will be summarized. The main result is that there is an effect of state visits and aid on trade, but the size of the effect varies between the studies. Two articles analysing the causal relationship between aid and exports will be presented. The articles, both using Granger causality tests, conclude that there is bidirectional causal relationship between aid and export. The data used in the thesis will be presented in chapter 5. The dataset consists of 33156 observations for the aid analysis and 11052 observations for the state visit analysis. In chapter 6 the model used in the analysis will be specified and estimation problems will be discussed. In chapter 7 the analysis will be performed. The preferred estimation method is fixed effect estimation taking into autocorrelation of order one in the error term. Several robustness tests are performed: a different estimation method Pseudo Poisson maximum likelihood estimation is used and the dataset is modified by removing zero trade observations, removing zero aid observations, removing trade in energy goods and altering the aid observations. Granger causality tests between aid and trade and state visits and trade will be performed in chapter 8. In chapter 9 the results will be evaluated and criticized and in chapter 10 the conclusion of the thesis will be presented.

2. The potential relationships between aid and trade and state visits and trade

Aid is a voluntary transfer of resources from one country to another. The most widely used measure of aid is official development assistance (ODA) which is defined as:

Flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25 percent (using a fixed 10 percent rate of discount). By convention, ODA flows comprise contributions of donor government agencies, at all levels, to developing countries ("bilateral ODA") and to multilateral institutions. ODA receipts comprise disbursements by bilateral donors and multilateral institutions. Lending by export credit agencies—with the pure purpose of export promotion—is excluded. (OECD, 2003)

The definition states that the promotion of economic development and welfare in the recipient country should be the main objective for aid. Aid can be donated either directly to developing countries which is called bilateral aid or it can be donated to multilateral institutions. Aid is donated for more reasons than the promotion of economic growth and development. During the cold war it was used to "fight" communism. Currently aid is used to promote human rights and democracy and in the battle against drugs and diseases. Some of the aid, most notably from the International Monetary Fund, has been donated conditional on economic reforms. Aid is used to promote universal ideas that the donor support. In some occasions these ideas have been outweighed by political considerations. After the United States started their war on terror, some allied countries received more aid regardless of their commitments to universal ideas such as democracy and human rights (Cosgrave, 2005).

Official development aid has grown constantly during the last fifty years from under $40 billion in the 1960s to $105 billion (both numbers in constant 2004 prices) in 2005 (International Development Association, 2007). 70 percentage of aid is given bilaterally and the rest is donated to multinational organizations. The numbers of donors have increased from five to six donors in the 1940s, to more than fifty-six donors in 2007. The substantial increase in donors strains the recipient countries. For example in the health sector more than 100 major organizations are involved, something that causes coordination problems. From 1997 to 2004 the number of aid projects increased from 20000 to 60000 while the average aid per project decreased from $2.5 to $1.5 million (constant 2004 dollars), something that increases the average transaction costs per project. One important step in improving aid effectiveness and reducing transaction costs is the Paris Declaration on Aid Effectiveness which was signed by 35 donor countries, 26 multilateral donors and 56 recipient countries in 2005. The Paris declaration states some principles that should govern the aid process between donors and recipient countries in order to increase the effectiveness of aid. One of the principles is to decrease the degree of tied aid.

While the primary goal of aid is to contribute to economic growth and development in the recipient countries, the primary interest in this thesis is on the link between aid and trade. There are several theoretical arguments for why aid may increase exports from the donor to the recipient. First, aid might be tied to exports from the donor in various ways (Nilsson, 1997). Direct or formal tying exists when the granting of aid requires the recipient to purchase goods from the donor or the donor specifies what the aid should be spent on. For example the United States which provides around 50 % of the global food aid, restricts most of its food aid to be purchased domestically and transported on ships registered in the United States (Provost, 2012). Informal tying exists when donation of aid means that services or goods from the donating countries are used. One example of this is technical service from the donor country, needed to maintain an aid project. The last form of tied aid is mixed credits where aid is combined with commercial trade credits to win export contracts. This means that the export from the donor country is subsidized. One example of this is the construction of power supply to a tourist destination in Botswana by Norwegian companies in the 1990s which was financed partly by Norwegian aid and partly by Botswana authorities (Hanssen-Bauer et al., 2000). All of the three types of tied aid lead to an increase in exports from the donating country. Through history a large part of aid has been tied, before 1990 the average degree of tied aid was 50 %. In the last years the degree of tied aid has decreased, and reducing it further is one of the targets in the Paris Declaration on Aid effectiveness (International Development Association, 2007).

Second, if aid is effective and increases income of the recipient country, the general income effect predicts that some of the increased income will be used for purchasing imports from the donor country. Third, as contacts between the donor and the recipient are established through aid donations, this can create an atmosphere of trust and confidence which increases trade. The degree of mutual confidence is reliant on a long-lasting aid relationship. For example if the recipient country needs maintenance and extensions of an aid project the donor country will most likely get the contract.

Fourth, as the recipient country gets accustomed with doing business with the donor country, it is likely that the recipient country's proclivity to buy goods and services from the donor country will increase through habit formation (Martínez-Zarzoso et al., 2009). Fifth, aid donations may create goodwill towards the donor country (Martínez-Zarzoso et al., 2009). When the recipient undertakes international purchases, suppliers from the donor country have a higher probability of being chosen. One example is the Libyan war in 2011. During the war a representative from the transitional council stated that companies from countries fighting against Colonel Muammar Gaddafi, would be prioritized for oil contracts when the war finished (NRK, 2011). Finally, Novak-Lehman D. et al (2009) argue that aid might increase exports through the political effect, as aid donations can strengthen bilateral and political links between the two countries.

The above mentioned six channels are focused on exports since the previous literature has primarily been interested in the effect of aid on exports. Three of the channels can also influence the imports of the donor from the recipient country. The spill-over effect might lead to increased imports, since contacts and connections have been established. The goodwill effect can lead to increased imports on account of the donor wanting to help the recipient country. For example the generalized system of preferences gives preferential access to European markets for less developed countries (European Commision, 2012). Also the political relations established through aid can lead the donor country to increase imports from the recipient country to improve its economic condition.

The causal link can also go in the opposite direction, from trade to aid. Nowak-Lehman D. et al. (2009) argues that trade groups can try to persuade the government to donate aid to countries where the trade group has commercial interest, something that can affect both exports to and imports from the developing country. They also argue that commercial links with the recipient country can influence the amount of aid the country will receive. If the donor country has some strategic interests in the country, aid donations will most likely be substantial. Large trade partners are of paramount importance and they will probably receive more aid. Finally, the donor might give aid to reward the purchase of exports from the donor. For example, the United States of America provides Foreign Military Financing to foreign governments to finance the purchase of weapons, services and training produced in the United States (Federation of American Scientists, 2012). Since 1950, the United States government has donated more than $91 billion in Foreign Military Financing. The grants are not classified as aid since development is not the primary object of military support, but the example illustrates the way purchase of exports can lead to aid.

State visits are the highest form of diplomatic contact between two countries (Nitsch, 2007). The overall goal of a state visit is to establish, strengthen and promote the contact between two countries and thereunder develop social, business and cultural relations (kongehuset.dk, 2012). A state visit is defined as:

an official formal visit by the leader of one country to another (Cambridge University Press, 2012).

The visit lasts normally for two to three days and it follows the ceremonial traditions of the hosting country (kungahuset.se, 2012). For example for incoming state visits to the United Kingdom, the royal protocol describes a state visit as follows (royal.gov.uk, 2012):

The Queen acts as host to the visiting Head of State, who stays either at Buckingham Palace, Windsor Castle or, occasionally, The Palace of Holyroodhouse in Edinburgh. Visits normally begin with a ceremonial welcome attended by the Queen and other senior members of the Royal Family. On the evening of the arrival day, the Head of State will attend a State Banquet in his or her honour. During the visit, the Head of State will meet the British Prime Minister, Government ministers and leaders of the main political parties. The visiting Head of State will also attend a Banquet hosted by the Lord Mayor and City of London Corporation, when he or she will meet leaders of commerce and industry.

The state visit requires considerable effort and preparation which leads the Queen to usually organize maximum two incoming state visits per year.

The process of choosing countries for outgoing and incoming state visits is intricate and it can be exemplified with the Norwegian procedure.[1] The process starts with the Department of Culture, Public Policy and Protocol in the Ministry of Foreign Affairs creating a recommendation for which countries to visit. The recommendation is based on internal

[1] The information about the Norwegian procedure was provided by Tryggve Øglænd, special advisor in Innovation Norway in an e-mail 11. January 2012.

evaluations and input from other ministries. Economic and commercial interests are weighted against political priorities. Input from industry and commerce is taken into account through the ministry of trade and industry. The recommendation is then brought before a coordinating committee which consists of the Lord Chamberlain, the Secretary of the Government and the Secretary General of the Ministry of Foreign Affairs.[2] The recommendations from the coordinating committee are presented for the Prime Minister and the Minister of Foreign Affairs before the final decision formally is taken by His Majesty His King. The decision is taken one to two years prior to the state visit.

State visits are carried through by the respective Head of State. In constitutional monarchies such as Norway, this will be the King or the Queen. In federal presidential constitutional republics such as the United States of America state visits will be carried through by the President. State visits are usually accompanied by a business delegation.

The causal relationship between state visits and trade could also go both ways. One the one hand, the importance of a country as a trade partner can lead to a state visit (Nitsch, 2007). When countries are selected for state visits, countries with export market potentials or strategic imports are more likely to be visited, hence trade causes state visits. On the other hand, state visits can also promote trade through the business delegation that usually accompanies the visits. The business delegation meets counterparts from the visiting country and new contacts can be created, old contacts can be maintained and business can be expanded. The Head of State can act as an important door opener for the domestic companies (Innovasjon Norge, 2011). This might increase trade and is an argument for state visits causing trade.

Special advisor in Innovation Norway Tryggve Øglænd organizes business delegations for Norwegian state visits.[3] He believes that there is no causal link between state visits and trade. The reason for no causality is that "the main purpose of a state visit is to harvest and not to seed", he argues. In a state visit you celebrate existing business relationships and establishing new contacts is not prioritized.

[2] Lord Chamberlain is named "hoffsjef" in Norwegian and is the highest official of the Norwegian Royal Court.
[3] Information is from personal communication with special advisor Tryggve Øglænd in Innovation Norway 22. February 2012.

3. The gravity model

Since the workhorse model in the empirical literature relevant to this thesis is the gravity model, this section gives a short description of the model.

"*The gravity model describes one of the most stable relationships in economics: interactions between large economic clusters are stronger than between smaller ones, and nearby clusters attract each other more than far-off ones*" (Brakman and Bergeijk, 2010, p. 1) .

The gravity model is applied to explain trade flows between countries. The model provides a framework which can be used to research the effect of different policies, institutions or events on trade. [4] The name reveals that the model is inspired by Newton's law of gravity, where the force of gravity between two objects is proportional to the product of the masses of the two objects, divided by the square of the distance between them (Baldwin and Taglioni, 2006). Ideas from the law of gravity have been applied to different areas, with examples going back to 1885 (Brakman and Bergeijk, 2010). The first mathematical formulation and empirical application of the gravity model of trade was made by Jan Tinbergen in the appendix of his book Shaping the World Economy in1962 (Brakman and Bergeijk, 2010). The gravity model of trade became quickly popular among academics, but its popularity waned in the 1970s and 1980s due to lack of a theoretical foundation. Four seminal papers established a microeconomic foundation for the gravity model which restored its' popularity (Anderson, 1979) (Bergstrand, 1985) (Bergstrand, 1989) (Anderson and Wincoop, 2003). The main reference for contemporaneous work on the gravity models is the paper by Anderson and Wincoop (2003).

A simplified derivation of the gravity model, based on Anderson and Wincoop (2003), can be performed in six steps (Baldwin and Taglioni, 2006):

Step 1: The expenditure share identity

$$p_{ij}x_{ij} \equiv share_{ij}E_j \qquad (1)$$

[4] The gravity model has been used for research of several topics in international trade. Three examples of seminal studies are: the effect of borders on trade by McCallum (1995), the importance of foreign services such as embassies and consulates for promoting exports by Rose (2007) and the impact of free trade agreements on trade by Baier and Bergstrand (2007). The gravity model has also been applied to other areas than international trade such as the flow of consumers between shopping malls and the movement of patients between hospitals.

Where x_{ij} is the quantity of exports of a good from nation i to nation j, p_{ij} is the price of the good in the importing nation, E_j is the importing's nations total expenditure and $share_{ij}$ is the share of expenditure of nation j on a good produced in nation i. Equation 1 states that supply given by the left hand side must equal demand.

Step 2: The expenditure function: shares depend on relative prices

Microeconomics tells us that expenditure shares depend upon relative prices and income levels. Income levels are not considered here and the expenditure share is assumed to depend only on relative prices. Adopting the constant elasticity of substitution demand function and assuming that all goods are traded, the expenditure shares of the imported good is linked to its relative price by equation 2:

$$share_{ij} \equiv \left(\frac{p_{ij}}{P_j}\right)^{1-\sigma}, where\ P_j \equiv \left(\sum_{k=1}^{R} n_k \left(p_{kj}\right)^{1-\sigma}\right)^{\frac{1}{1-\sigma}}, \sigma > 1 \qquad (2)$$

Where p_{ij}/P_j is the real price of p_{ij}, R is the number of nations from which nation j buys goods, σ is the elasticity of substitution between goods and n_k is the number of goods exported from nation k. It is assumed that the number of goods produced by different nations is constant. Equation 2 states that the share spent by country j on country i's products is a function of the relative product price in country j.

Step 3: Adding the pass-through equation

The price in nation j of a good produced in nation i is linked to the production costs, the bilateral mark-up and the bilateral trade costs through equation 3:

$$p_{ij} = \mu p_i \tau_{ij} \qquad (3)$$

Where p_i is the producer price in nation i, μ is the bilateral mark-up (assumed to be 1), and τ_{ij} reflects all trade costs. Equation 3 states that the consumer price in country j equals the production and trade costs in country i.

Step 4: Aggregating across individual goods

Total bilateral exports from i to j is found by multiplying the expenditure share function, which is the right hand side of equation 1, by the number of goods offered by nation i (n_i). Using V to indicate total value of trade and substituting in equation 2 and 3 gives an expression for total bilateral exports in equation 4:

$$V_{ij} = n_i(p_i\tau_{ij})^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}} \qquad (4)$$

The export from country i to j will increase with the number of goods exported from country i, the expenditure of country j and the general price level in country j. The export will decrease with the producer price of the exporting good and the trade costs. The number of goods, n_i, and producer prices, p_i, are lacking from the model, something that is solved by using the general equilibrium condition of the exporting nation i.

Step 5: Using general equilibrium in the exporting nation to eliminate the nominal price.

The producer price, p_i, in the exporting nation i must adjust so all of the output can be sold either domestically or abroad. Equation 4 is an expression for total exports from country i to country j. Summing over all markets, including its home market i, produces an expression for the total sales of goods from nation i. It is assumed that markets clear, which means that the wages and prices of nation i must adjust so production equals sales.

$$Y_i = \sum_{j=1}^{R} V_{ij} \qquad (5)$$

Where Y_i is nation i's output. Equation 5 states that total output equals total export including output consumed in the domestic market. The market clearing condition for nation i can be found by substituting in from equation 4.

$$Y_i = n_i {p_i}^{1-\sigma} \sum_{j=1}^{R} \left({\tau_{ij}}^{1-\sigma} \frac{E_j}{P_j^{1-\sigma}} \right) \qquad (6)$$

The summation is over all markets, including the home market of nation i. Equation 6 can be solved for the number of goods and producer prices, $n_i p_i^{1-\sigma}$, which gives equation 7.

$$n_i {p_i}^{1-\sigma} = \frac{Y_i}{\Omega_i}, where \quad \Omega_i \equiv \sum_{j=1}^{R} \left({\tau_{ij}}^{1-\sigma} \frac{E_j}{P_j^{1-\sigma}} \right) \qquad (7)$$

Ω_i is the market potential and a measure for the openness of the exports of nation i to world markets.

Step 6: A first-pass gravity equation

Substituting equation 7 into 4 creates equation 8, the gravity equation.

$$V_{ij} = {\tau_{ij}}^{1-\sigma} \frac{Y_i E_j}{\Omega_i P_j^{1-\sigma}} \qquad (8)$$

The gravity equation expresses that exports from i to j depends positively on output in country i and expenditure in country j. Exports are negatively related to trade costs since the elasticity of substitution is greater than one. The price level in country j and the market potential of country i also influence exports. It is seen through the price level and market potential terms that exports is affected by the rest on the world and not solely by bilateral variables.

The gravity equation is normally estimated log linearly by regressing the log of exports from country i to j on the distance between the countries, variables capturing GDP of the two trade partners and different control variables influencing exports. The GDP term is specified in various ways. If the aim of the research is to investigate something different than the effect of GDP on trade, the heterogeneity of GDP specifications indicates that any of the GDP specifications can be used. Typical control variables are: colonial ties between countries, aid, membership in a free trade area or currency union, sharing the same border, sharing a common language, being a landlocked country, country being an island, exchange rates and other factors that might influence trade. Control variables are mainly included to prevent omitted variable biases (Wooldridge, 2009). The gravity equation fits the reality well with an R-squared of approximately 0.7 on cross-section data (Baldwin and Taglioni, 2006).

A problem with estimating the gravity equation log linearly is zero flows. In some studies fifty percent of the trade observations are zero, and the way they are treated influences the results (Brakman and Bergeijk, 2010). The traditional ways to deal with zero flows is either to discard the observations or add a small constant (typically one). Both approaches are correct when the zero values are randomly distributed. If the zero flows are not randomly distributed, selection biases will appear. Methods to remedy the selection biases are to use sample selection corrections or estimate the gravity equation in its multiplicative form using Poisson Pseudo Maximum Likelihood.

4. Relevant literature

There are several papers investigating the relationship between aid and exports using the gravity model. I have found no studies on the effect of aid on imports.

Nilsson (1997) studies the effect of aid on exports for the member countries in the European Union using data from 1975 to 1992. He estimates the following equation using ordinary least squares:

$$Exp_{ij,t} = \alpha + \beta_1 dist_{ij} + \beta_2 GDP_{i,t} + \beta_3 \frac{GDP_{i,t}}{POP_{i,t}} + \beta_4 GDP_{j,t} + \beta_5 \frac{GDP_{j,t}}{POP_{j,t}} + \sum_{k=6}^{n} \beta_k X_{k,ij,t} \qquad (9)$$

Where $\frac{GDP_{i,t}}{POP_{i,t}}$ is GDP per capita in country i at time t. Three aid variables are included among the control variables: bilateral aid, EU aid and a dummy variable indicating a high level of tied aid. The effect of aid is assumed to last for a number of years and for this reason three-year moving averages of each variable are used in the analysis.

Table 1 – Returns of aid on exports and average tied aid from the study by Nilsson (1997)

EU country	Belg.	Den.	Fra.	Ger.	Ita.	Netherl.	U.K.	Avg.
Dollar change in the donor's exports following a one dollar increase of bilateral aid	2.41	0.67	3.85	3.16	3.13	1.09	2.84	2.60
Average degree of tied aid (%)	67.0	39.1	51.4	33.2	58.9	18.0	70.2	48.0

Table 1 shows that an increase of one dollar in bilateral aid will increase on average exports with $2.6. Nilsson estimates equation 9 separately for each country and finds that the largest economies have a higher return of aid on exports than smaller countries. The highest return is experienced by France ($3.85) and Germany ($3.16) and the lowest by Denmark ($0.67) He finds no significant correlation between degree of tied aid and the export returns from aid, and no effect of multilateral aid from the European Union on exports. Nilsson investigates whether the economic size of the recipient country matters for the return of aid on exports and he finds that donors have higher export returns of aid for recipients that are economically larger. There are two weaknesses with the study, both mentioned by Nilsson. Firstly, there is a sign of an omitted variable bias which is not corrected. Secondly, a causality analysis between aid and exports is missing. In 1997, no standard tests for causality existed for panel data according to Nilsson.

Wagner (2003) studies the effects of aid on exports for most of the countries in the Development Assistance Committee using data from 1970-1992. The aim of the study is to research whether the Japanese aid policy, which was believed to be cynical and export focused, generated higher export returns from aid than other donors. He specifies the gravity equation in the following way (Wagner, 2003):

$$Export_{ij,t} = \alpha + \beta_1 dist_{ij} + \beta_2 \frac{GDP_{i,t} GDP_{j,t}}{GDP_{w,t}} + \beta_3 \frac{GDP_{i,t}}{POP_{i,t}} + \beta_4 \frac{GDP_{j,t}}{POP_{j,t}} + \sum_{k=5}^{n} \beta_k X_{k,ij,t} \qquad (10)$$

The gravity equation is estimated using pooled ordinary least squares on data from 1970, 1975, 1980, 1985 and 1990 and pair-wise fixed effects. In addition Wagner includes the residuals from a gravity equation with imports as the dependent variables in the original gravity equation. The residuals serve as a proxy for the special trading relationship between the donor and the recipient and are an attempt to remove the omitted variable bias. The pair-wise fixed effects will also remove omitted variable biases if the bias is time invariant (Wooldridge, 2009). In fixed effects estimation merely variation within a subgroup is considered. This is achieved by subtracting the average value of a variable from the observed value, in each subgroup. With pair-wise fixed effects, every pair of two countries is a subgroup. The pair-wise fixed effects estimation is suitable if two countries have a special relationship which influences trade and is not detected by the control variables.

The export returns from one dollar in aid are \$2.29 with ordinary least squares, \$0.73 using fixed effects estimation and \$1.85 when he includes the residuals from the import gravity equation. The export returns from one dollar in aid on a country level varies from \$5.52 for New Zealand to -\$0.03 for Norway with Japan (\$1.20) around the average. He finds no evidence for Japan having a higher degree of tied aid or earning a higher export return from aid than other countries. A way to improve the study, according to Wagner, is to include trade in services since a large part of aid are donated as services. Including trade in services in the analysis is difficult to achieve due to unavailability of data.

Two papers examines the effect of aid on exports using German data from 1962 to 2005 (Martínez-Zarzoso et al., 2009) (Nowak-Lehmann D. et al., 2009). Both papers estimate the following gravity equation.

$$Export_{ij,t} = \alpha + \beta_1 dist_{ij} + \beta_2 GDP_{i,t} GDP_{j,t} + \beta_3 POP_{i,t} POP_{j,t} + \sum_{k=4}^{n} \beta_k X_{k,ij,t} \qquad (11)$$

The two papers differ in the methods applied to analyse the question. Martinez-Zarzoso et al. (2009) estimate both a static and a dynamic version of equation 11. For the static versions, the preferred estimation method is pair-wise fixed effects controlling for heteroskedasticity and autocorrelation in the error term. In the dynamic version the lag of exports is included as an explanatory variable in the model and the preferred instrument variables estimation method is two-stage feasible generalized least square with pair wise fixed effects. The paper by Novak-Lehmann et al. (2009) utilizes time series analysis methods. Equation 11 is found to be cointegrated and the long run relationship between aid and exports is estimated using dynamic ordinary least squares with standard errors robust to heteroskedasticity and autocorrelation in the error term.

The results in both papers are in line with each other. Martinez-Zarzoso et al. (2009) trust the dynamic version of the gravity equation where one dollar in aid will increase exports by $1.40. Novak-Lehman et al. (2009), who uses data only on countries targeted by the German Ministry of Development, finds that one dollar in aid will lead to an increase in exports of between $1.09 and $1.50.

Both papers perform additional analysis on the relationship between aid and trade. Martinez - Zarzoso et al. (2009) extend the dynamic analysis by dividing the data into eight time periods and estimating each period separately using generalized methods of moments. They find that the export returns of aid were lower in the late 1960s and in the 1970s than the 1980s. Since tied aid has decreased over the time, Martinez- Zarzoso et al (2009) argue that tied aid is not the most important factor for the effect of aid on exports. Martinez-Zarzoso et al. also find out that the returns from aid are twice as high ($2.33) for countries targeted by the German Ministry of Development than for the countries not targeted. Novak-Lehman et al. (2009) finds out that there is a crowding out effect of aid. If another country in the European Union donates aid, German exports to that country will be reduced. Both papers investigate the causality between aid and exports using a vector error correction model and Granger causality tests.[5] The result is that aid Granger causes exports, while the opposite is not true. Based on this it is concluded that causality in the long-run relationship goes from aid to exports. A weakness with the papers is the use of only German data.

[5] Granger causality tests are discussed in chapter 8.

The paper by Nitsch (2007) is the only article investigating the effect of state visits on trade. The main part of the article analyses the effect of state visits on exports for Germany, France and United States over the period 1948-2003. Over the 55 years, 1513 foreign trips are carried out by the respective Head of States of the three countries of which 629 are classified as state visits and official visits and used in the analysis. Nitsch estimates the following gravity equation with state visits as a dummy variable.

$$Trade_{ij,t} = \alpha + \beta_1 dist_{ij} + \beta_2 GDP_{i,t} GDP_{j,t} + \sum_{k=3}^{n} \beta_k X_{k,ij,t} \qquad (12)$$

The model is estimated using pooled ordinary least square, exporter and importer fixed effects and pair-wise fixed effects and pair-wise random effects. The two types of fixed effects differ by what subgroup is used. In exporter and importer fixed effects each individual country is a subgroup while in pair-wise fixed effects each country-pair is a subgroup. The pair-wise random effects estimation uses country-pairs as subgroup, but only a fraction of the average value is subtracted from the observed value for each subgroup. Random effects is preferable to fixed effects only if the omitted variable bias is not present, something that can be tested by the Hausman test. The results Nitsch highlights in his study are the results from the exporter & importer fixed effects and the pair-wise fixed and random effects. The results state that a state visits will increase exports by 8-10 %. The ordinary least squares' result is 14 % and the difference from the three other estimation methods is an indication of an omitted variable bias, according to Nitsch.

Nitsch investigates the time dependency of the effects of a state visit on exports. The result is that the effect of a state visit appears up to four years prior to the visit and the effect is largest two years after. The large two year effect can indicate that the state visit coincides with the initiation of large export contracts. Bidirectional causality between state visits and exports is controlled for through a difference-in-difference estimation. The result from the estimation reveals a strong, but short-lived effect of state visits on export growth driven by repeated state visits to a country. Nitsch estimates equation 12 with imports as the dependent variable. No statistically significant effects on imports from state visits are found which makes Nitsch conclude that state visits promote exports rather than imports.

Two papers investigate the causal relationship between aid and exports using Granger causality tests (Arvin et al., 2000) (Osei et al., 2004). The study by Arvin et al. (2000) uses German data from 1973 to 1995 and performs two different Granger causality tests: a bivariate causality test between exports and aid and a trivariate causality test between exports, aid and a third variable. As the third variable, three different variables are used: German tied and partially tied aid, German export credits and the gross national product of the recipient countries. The Granger causality tests in the study by Arvin et al. (2000) are performed on 85 developing countries which are classified into subsamples, based on regional connections. The results indicate that German untied aid has a positive causal impact on exports in general, but there is large variation among the subsamples. In some of the subsamples, such as lower middle-income countries, it is strong support for causality between aid and exports going in both ways. The idea that causal relationships differ among country-pairs is also the main idea in the study by Osei et al. (2004) where data from 1969 to1995 for four European donors and 26 African recipients are used. The 104 country pairs are classified into the following five subsamples based on Granger causality tests:

1. Trade Granger causes aid.
2. Aid Granger causes trade.
3. There is bi-directional causation between aid and trade.
4. There is contemporaneous bi-directional causation.
5. No statistical relationship exists.

The effect of aid on trade is estimated with a gravity model where dynamics is taking into account and the estimated coefficients differ significantly between the five subsamples estimated individually and jointly. Osei et al. (2004) argue therefore that if differences in the causal relationship exist, subsamples should be constructed. By estimating the gravity equation for the different subsamples separately, new information can be provided or the results from the pooled sample will be confirmed. A weakness with both papers is the low number of observations used.

5. The data

For the analysis of the effects of aid on trade, data is collected for 12 countries: Norway, Sweden, Denmark, Belgium, Germany, France, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom. In the research of the effect of state visits on trade the same data is used but I have only data on state visits for Norway, Sweden, Denmark and United Kingdom. Information collected for the analysis is:

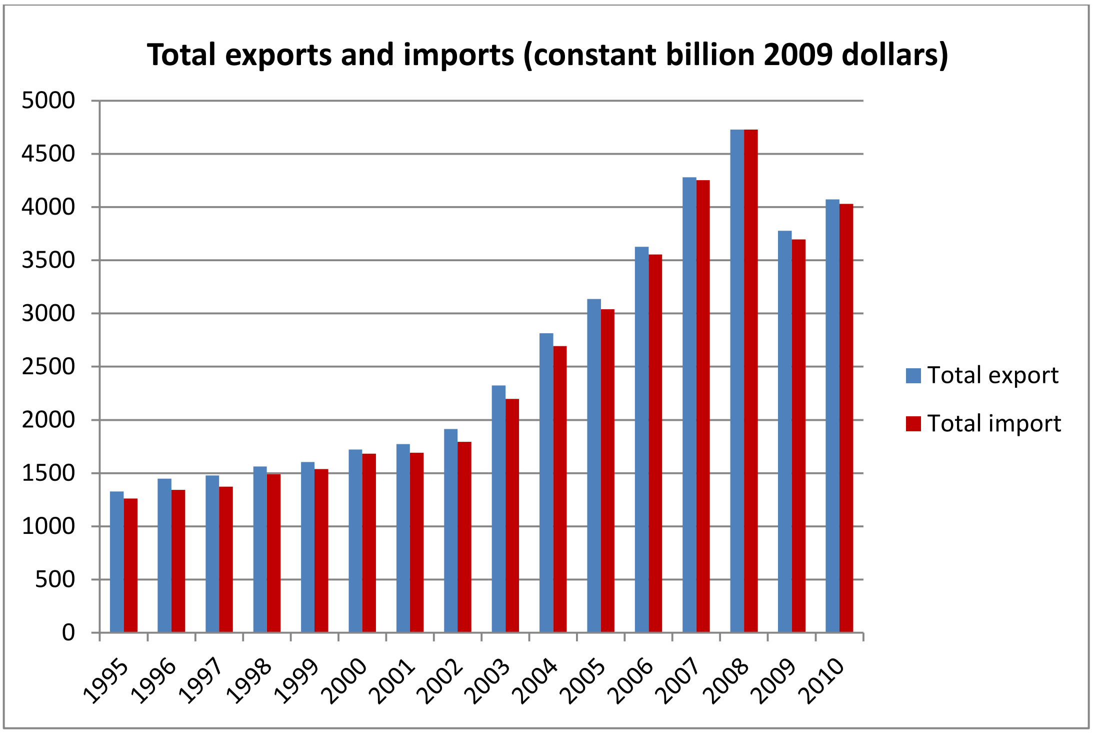
- Complete trade data, imports and exports, for the twelve countries.
- Gross domestic products (GDP) for 177 countries.[6]
- Distance between the capitals of the twelve countries and all other countries.
- Contiguity data, which provides information about countries sharing borders.
- Countries having the same official language as the twelve countries.
- Colonial relationships with the twelve countries for the 177 countries.
- Member states in the European Economic Area.
- Countries having a special access to European markets under the Generalized System of Preferences.
- Political rights, civil liberties and freedom status for the 177 countries.
- Gross bilateral aid disbursements from the twelve countries.
- Incoming and outgoing state visits for Norway, Sweden, Denmark and United Kingdom.

The source, definition and possible transformations of each variable are explained in the appendix. In addition to the variables, the dollar euro exchange rates and the United States Consumer Price Index are used to transform each monetary variable into constant 2009 dollar values. Observations are collected for the time period 1995 to 2010. If a country misses an observation of one variable, the country will be excluded from the analysis the year the observation is missing, which makes the panels unbalanced. Each of the 12 donor countries has 176 bilateral trade relationships. In total the dataset has 33156 observations for the aid analysis and 11052 observations for the state visit analysis.

The total exports and imports of goods for the twelve countries are shown in figure 1.

[6] The availability of data on key variables restricts the range of countries included.

Figure 1 - Total exports and imports for the twelve countries between 1995 and 2010



Exports and imports have grown rapidly over the 16 years, from 1328 and 1263 billion dollars in 1995 to 4072 and 4032 billion in 2010. The impact of the global financial crisis can be seen through the reduction in trade from 2008 to 2009. How the trade for the twelve countries is distributed between different regions in 2010 is shown in figure 2 and 3:

Figure 3 - Exports from the 12 countries to regions in 2010

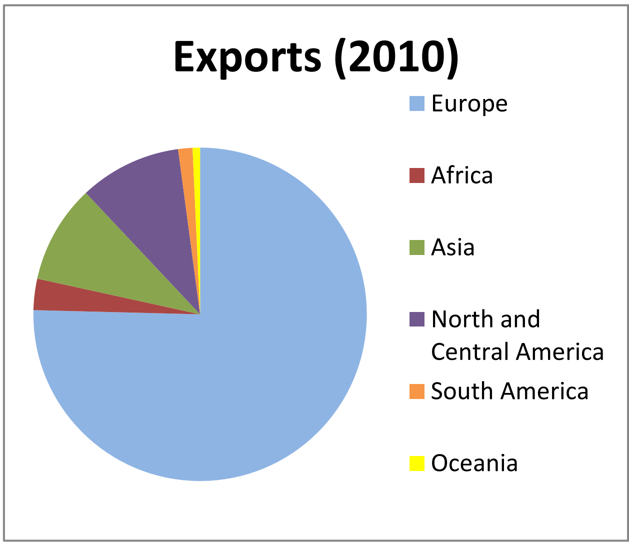
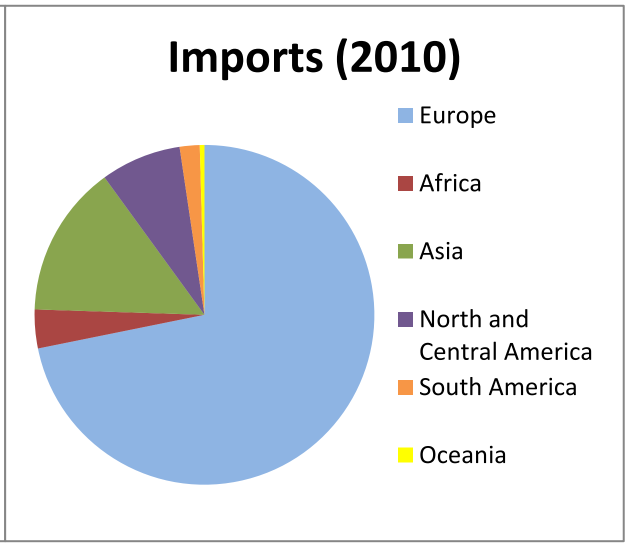


Figure 2 – Imports from the 12 countries to regions in 2010



The twelve countries trade mostly with other European countries, but Asia and North and Central America are also important. Out of the twelve countries, Germany is by far the largest exporter with $1220 billion in 2010, more than double the second largest exporter France. Germany is also the largest importers.

As discussed in section 3, zero trade observations influence the results in a gravity model estimation (Brakman and Bergeijk, 2010). 525 (1.6%) of the export and 1634 (4.9%) of the import observations are zero. Zero trade observations for the twelve countries are shown in table 2.

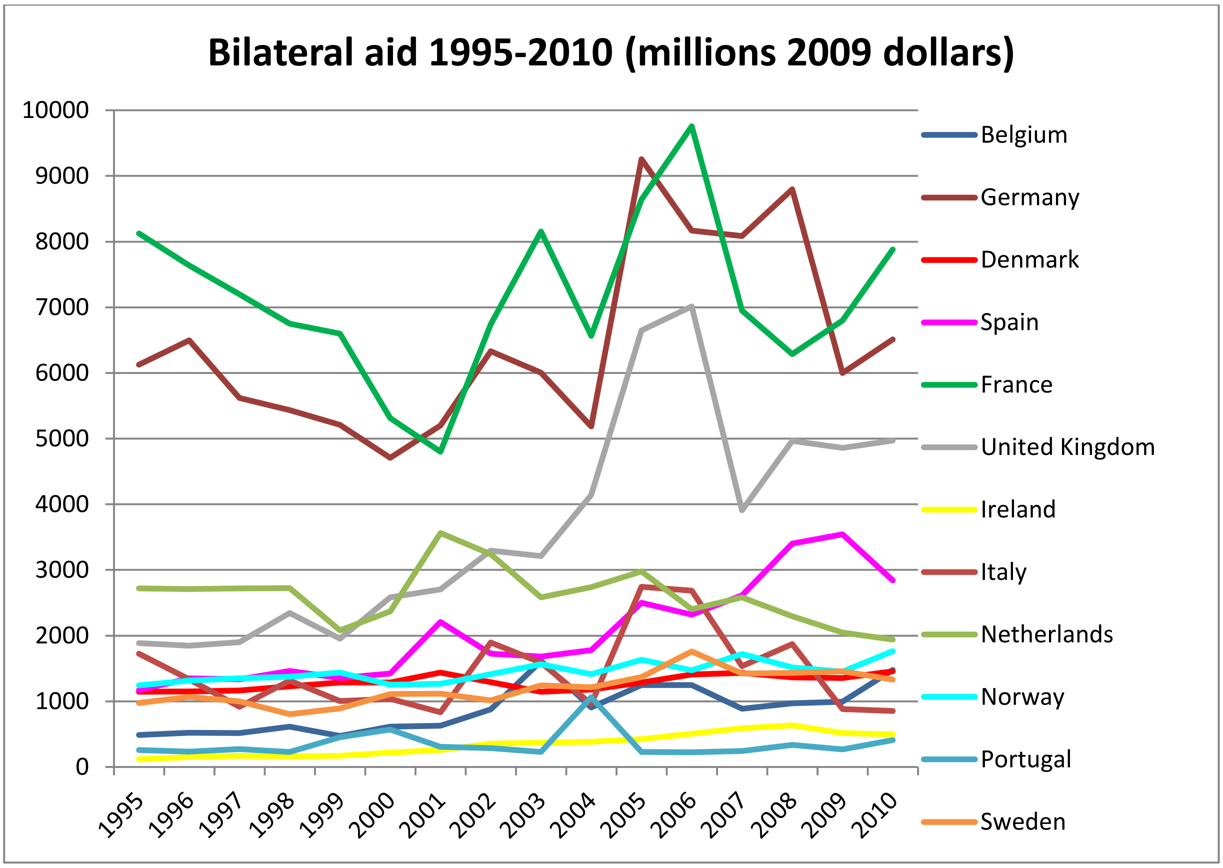
Table 2 - Zero trade observations for the twelve countries from 1995 to 2010

Country	Zero export obs.	Countries with zero export	Zero import obs.	Countries with zero import
Norway	108	23	321	48
Sweden	34	6	134	33
Denmark	22	7	162	40
Belgium	21	6	106	22
Germany	5	2	19	8
France	13	4	46	10
Ireland	99	18	296	59
Italy	18	4	73	13
Netherlands	11	4	47	13
Portugal	139	29	268	45
Spain	51	12	131	28
United Kingdom	4	1	31	6
All countries	525	42	1634	74

Naturally, the smallest economies, such as Norway, Ireland and Portugal, have most observations where trade is zero.

Annual bilateral aid disbursements from the twelve donors are shown in figure 4.

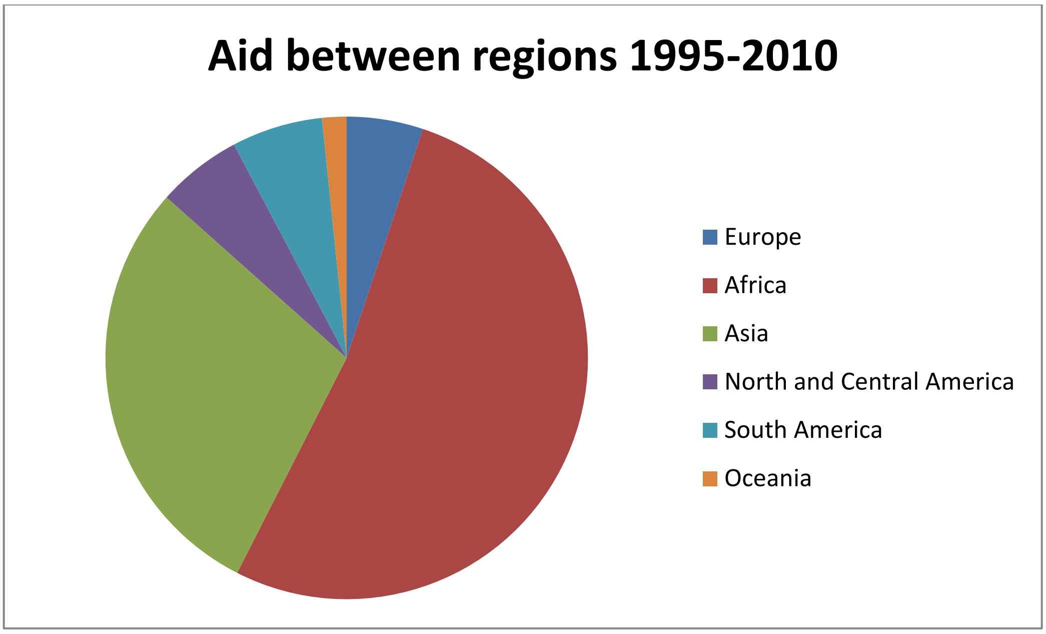
Figure 4 – Annual aid from the twelve countries.



The largest economies donate most. Over the 16 years France has donated $114.2 billion with Germany ($103.1 billion) not far behind. Ireland and Portugal are the smallest contributors of aid with $5.5 and $5.6 billion. There are variations in aid donations between years for the donors. A notable fact in figure 4 is the increase in aid from United Kingdom in 2005 and 2006 which was caused by large donations to Nigeria and Iraq. Portugal had a total aid disbursement three times larger than normal in 2004. The reason is an $888 million donation to Angola, which is over ten times the average aid disbursement to Angola in the sixteen years. The German, French, Italian and Spanish aid disbursements show significant variation. For some of the countries the annual aid donations have increased during the 16 years. The clearest examples of increased aid donations are Ireland, United Kingdom and Spain.

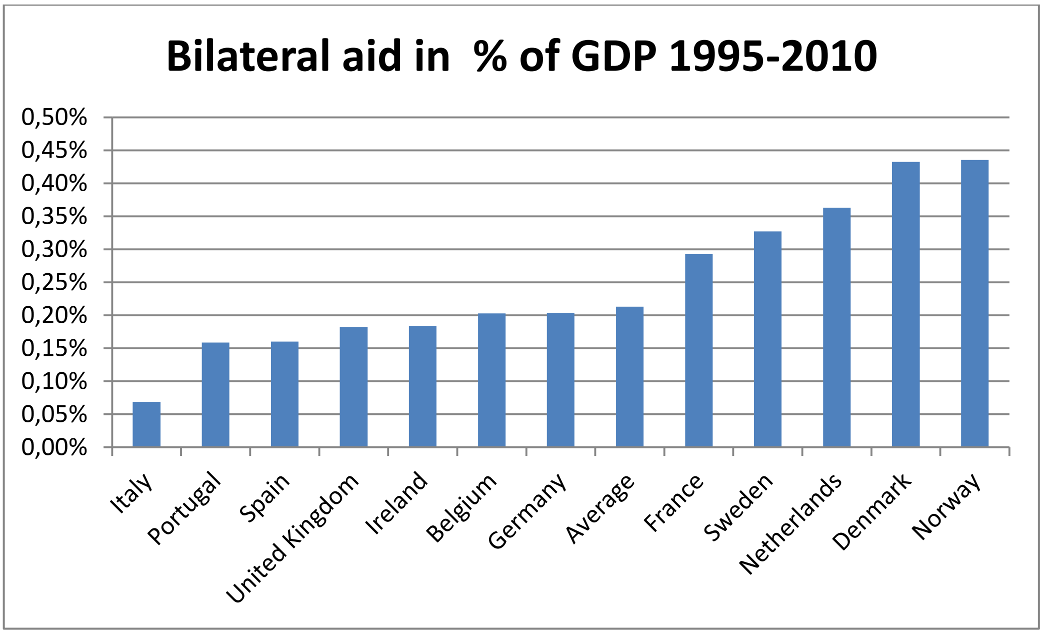
The regions that receive aid from the twelve countries are shown in figure 5.

Figure 5 – Total aid from the twelve countries to regions from 1995-2010



Most aid is directed towards Africa and 140 countries or semiautonomous countries received aid between 1995 and 2010. The economical sacrifice of aid for each donor can be measured as the fraction of GDP donated as aid, which is shown in figure 6

Figure 6 - Aid for the twelve countries as a percentage of GDP



The numbers are constructed by dividing total aid over the sixteen years by total GDP

The Nordic countries and Netherlands have the highest aid GDP ratio over the 16 years.

Aid is donated to selected countries. There are several zero aid observations for each donor as shown in table 3.

Table 3 - Zero aid observations for the twelve countries from 1995 to 2010

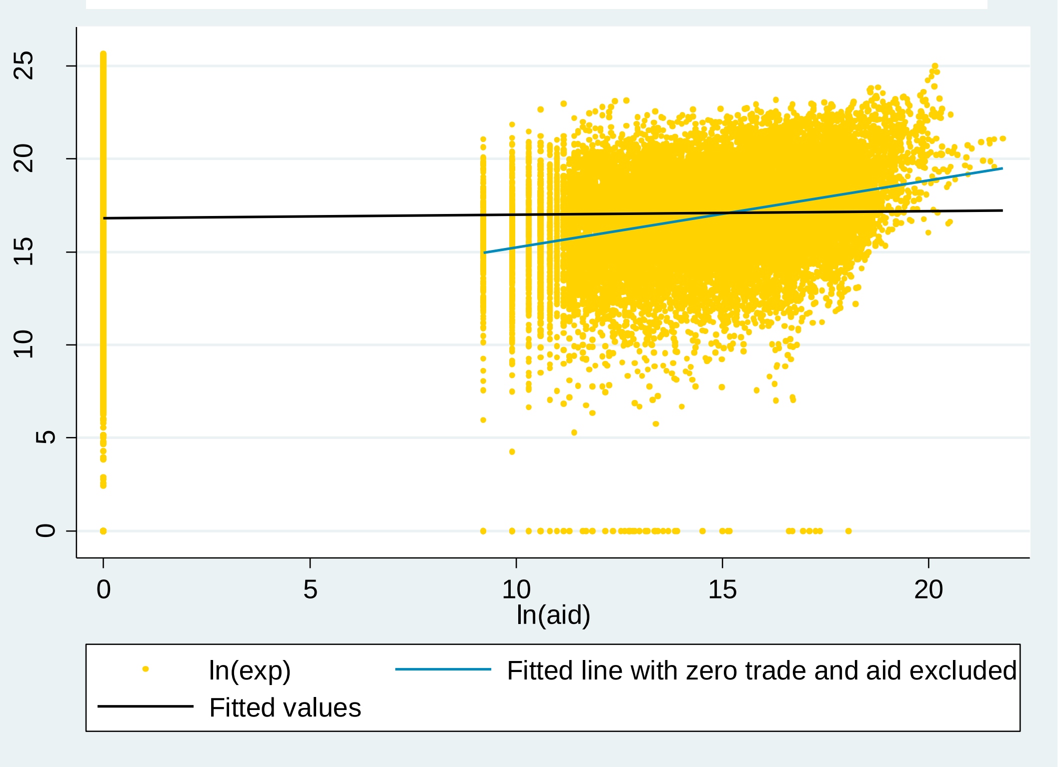
Country	Zero aid observations	Countries with zero aid	Obs. aid zero entire period	Countries w/ zero aid all the time
Norway	1142	96	786	50
Sweden	1168	96	861	55
Denmark	1477	131	990	63
Belgium	1220	108	795	51
Germany	786	66	533	34
France	783	64	549	35
Ireland	1486	132	909	58
Italy	1209	107	660	42
Netherlands	1070	105	644	41
Portugal	2223	169	1392	89
Spain	1203	108	690	44
United Kingdom	996	100	581	37
All	14763	174	9390	102

For the twelve countries combined, 14763 aid observations are zero which amounts to 44.5 % of all aid observations. France has the lowest ratio with 28.3 % and Portugal the highest with 80.5 %. The general trend is that the largest economies give aid to more countries. This is reasonable since the largest economies donate most and can afford the higher administrative costs of providing aid to more countries.

For the state visit analysis I use data on state visits for four countries. Norway, Sweden, Denmark and United Kingdom have 92 outgoing and 102 incoming state visits during the 16 years. Denmark has the fewest visits with 13 outgoing and 18 incoming followed by United Kingdom with 18 outgoing and 27 incoming visits. Norway has 30 outgoing and 30 incoming visits while Sweden has 31 outgoing and 27 incoming visits.
The state visits are often accompanied by business delegations. A complete list of the outgoing and incoming state visits for these four countries and a list of large business delegations to and from Norway can be found in tables 17-19 in the appendix.

To illustrate the correlation between trade and aid, figure 7 plots the results of a simple regression of exports versus aid. The correlation is crucially dependent on whether zero aid and export observations are included as shown in the black line or whether they are excluded as shown in the blue line. If zero aid and export observations are excluded the correlation is stronger. Both correlations are statistically significant different from zero.

Figure 7 – Correlation between ln(exports) and ln (aid)



The variance, shown by the spread of the observations, is considerable. Imports and aid have a similar correlation as exports and aid so the import aid graph is omitted.

Regressing log of exports on state visits, there are signs of correlation. For outgoing state visit exports will on average increase by 12 % and imports by 9.9 %. For incoming state visits export growth is 5.2 % and import growth is 6.1 % on average. Since there are few state visits, the standard deviations are large and none of the effects are statistically significant different from zero.

6. Econometric specification of the gravity model

I base my analysis on a gravity equation similar to the one used by Nitsch (2007)

$$Trade_{ij,t} = \alpha + \beta_1 Dist_{ij} + \beta_2 GDP_{i,t} GDP_{j,t} + \sum_{k=1}^{9} \beta_{k+2} X_{ij,t} + \delta_{ij} + \varepsilon_{ij,t} \qquad (13)$$

The subscripts $_i$ and $_j$ above refer to country i and j, $_t$ refer to a given year. δ_{ij} is the time invariant fixed effect between country i and j, $\varepsilon_{ij,t}$ is the idiosyncratic error which varies over time and country pairs and α is the constant. X is a set of control variables that affect exports. I include variables for sharing a common border, sharing the same language, being or having been in a colonial relationship, being a member of European Economic area, getting preferential access to European markets, political freedom and being a not free or partly free country. The control variables are mainly focused on country j, the country which is exported to. But for sharing the same border, sharing the same language and colonial relationship information from both countries are used. When using this base model to study the relationship between state visits and trade I add outgoing and incoming state visits as control variables and estimate one model with exports as the dependent variable and one with import. For the estimation of the effect of aid on trade the same model is used. The difference is that the state visit dummies are exchanged with an aid term which measure the flow of bilateral aid from country i to j at year t.

A potential problem with estimating the gravity equation with ordinary least squares is the time invariant fixed effects. If these unobservable effects are correlated with both the dependent variable and the independent variables, the coefficients can be biased. The correlation of the unobservable effects decides also whether random or fixed effects is the preferred estimation method to utilize the panel data structure. In the Hausman test the coefficients from a pair-wise random effects and a pair-wise fixed effects estimation of the gravity equation are compared. The Hausman test rejects the null hypothesis that the coefficients from the two estimations are equal, meaning that the time invariant fixed effects should be removed and that the ordinary least squares coefficients most likely are biased. There are two methods for removing the time invariant fixed effect: first difference or pair-wise fixed effects. Both methods remove the time invariant fixed effect and they are equally unbiased and consistent when the time period is fixed (Wooldridge, 2009). The choice between pair-wise fixed effects and first difference depends on the relative efficiency of the estimators which is determined by the autocorrelation of the errors. If the errors are serially uncorrelated pair-wise fixed effects is more efficient than first differences (Wooldridge, 2009). If the errors follow a random walk or has significant positive autocorrelation, first difference is the preferred estimation method. If the autocorrelation is of a higher order than one, first differencing will not remove all of the serial correlation in the errors. Wooldridge developed in 2002 a test to identify first order serial correlation in linear panel-data models (Drukker, 2003). In the test, the predicted first differenced errors from the first differenced estimation are regressed on the lagged first difference errors. The test is robust to conditional heteroskedasticity. The hypotheses are:

H_0: No first order autocorrelation

H_A: H_0 not true

If the null hypothesis is rejected, first order autocorrelation in the error term is present and the first differences should be used. Wooldridge tests on the gravity equation with both export and import as the dependent variable conclude that first order autocorrelation is present. This means that first differences should be preferred. A second way to take into account first order autocorrelation is the pair-wise fixed effects estimation taking into account serial correlation of order one in the error term, used by Martinez-Zarzoso et al. (2009) .[7] Both the two last mentioned methods take into account serial correlation of order one in the error term and will be performed on the gravity equation together with ordinary least squares.

A potential problem with estimating the gravity equation is incorrect averaging. Several researchers mistake the log of the average for the average of the logs (Baldwin and Taglioni, 2006). In equation form the researchers believe that:

$$\ln\left(\frac{X_1 + X_2}{2}\right) = \frac{lnX_1 + lnX_2}{2}$$

This is wrong since the two sides are different. In the gravity equation the correct way to construct averages is to take averages of the natural logarithms as done on the right side of the equality sign. If the natural logarithm is taken of the average as done on the left side, the average value will be overestimated and the estimated results biased. The method of correctly averaging numbers will be important in ordinary least squares estimation of the gravity equation using 3-years moving average of the data.

[7] In Stata 11.2 the command xtregar is used.

One problem with estimating the gravity equation is the zero trade and aid flows as mentioned in chapter 3. It is unclear whether zero observations constitute a large problem for my study since only 1.6 % of the export data and 4.9 % of the import data are zero, I hypothesize that zero trade flows don't constitute a substantial problem. The zero trade flows will be exchanged with one, which makes them zero after natural logarithm is taken. As a robustness check, the effect of aid on trade and the effect of state visits on trade will be estimated with zero trade observations removed. In the dataset, 14763 aid disbursements are zero and 54 are below zero, which makes 44.7 % of the aid observations zero or negative. The preferred method to deal with the zero aid observations is to exchange them with one. As a robustness check, the estimation will be redone removing countries which do not receive aid at all.

Another common mistake in empirical trade research is the inappropriate deflation of nominal trade flows with the consumer or producer price index of the United States (Baldwin and Taglioni, 2006). Because there are global trends in inflation rates, the price index of the United States might over or underestimate the true inflation. The inappropriate deflation can bias the results through spurious correlations. Baldwin and Taglioni's solution to the problem and a method I follow is to add year dummies to the gravity equation.

A potential problem is the log linear estimation of the gravity equation. Log linearization in the presence of heteroskedasticity will lead to inconsistent estimates (Santos Silva and Tenreyro, 2006). The reasons can be explained by a simple model from the paper of Santos Silva and Tenreyro (2006).

$$y_i = e^{\beta x_i} + \varepsilon_i$$

Where y is the dependent variable, x is the independent variable, β is the coefficient to be estimated and ε is the error term. The equation can be rewritten and log linearized:

$$y_i = e^{\beta x_i}\eta_i$$

$$\eta_i = 1 + \frac{\varepsilon_i}{e^{\beta x_i}}$$

$$\ln(y_i) = \beta x_i + \ln(\eta_i)$$

To get a consistent estimator for the coefficient it is necessary that $E[\ln(\eta_i)|x]$ is constant. The way η_i is defined, $E[\ln(\eta_i)|x]$ will be constant only if:

$$\varepsilon_i = e^{\beta x_i}\upsilon_i$$

Where υ_i is a random variable independent of x_i. Only if the error tern is specified as in the equation above, will log linearization give a consistent estimate of β. If the error term is specified differently $\ln(\eta_i)$ will be correlated with x_i and the estimate will be biased. An additional problem with log linearization is observations where the dependent variable is zero. The traditional ways to solve the problem of zero observations is to exclude the observations or exchange them with one. Both ways will generally lead to inconsistent estimators. The way to solve the problems, according to Santos Silva and Tenrevro (2006), is to estimate the gravity equation in its multiplicative form. The proposed estimation method by Santos Silva and Tenrevro (2006) for the gravity equation is the Poisson Pseudo Maximum Likelihood (PPML) estimation, which will be used and compared to the pair-wise fixed effects estimation taking into account autocorrelation of order one.

A problem with the bilateral aid data is phantom aid, which makes no difference in the recipient country. According to actionaid 61 percent of aid is phantom aid (Greenhill and Watt, 2005). Examples of phantom aid are: aid not targeted for poverty reductions, debt relief, overpriced and inefficient technical assistance, tied aid, poorly coordinated and unpredictable aid, aid spent on immigration-related costs in the donor country and aid spent on excess administration costs. Some of the phantom aid such as tied aid will influence trade, but others such as debt relief will have no effect on trade. Based on figure 4, country-specific aid donations are fluctuating something that is partly caused by debt relief. For example, aid from Belgium to the Democratic Republic of Congo increases from around $70 million in 2002 to almost $1100 million in 2003 and then returns to $330 in 2004. Portuguese aid to Angola is stable around $25 million the years before and after 2004, but in 2004 the aid donation is $888 million. Large donations caused by debt relief will not increase trade or improve the living conditions in the recipient countries in the year the debt relief is agreed. The effects from the debt relief will come over a longer time period, if they come at all.[8] Having debt reliefs in the dataset will bias the results. From the source of aid data, debt relief cannot be excluded. As a robustness test unnatural large aid donations from the donors will be modified to see if the effect of aid on trade changes.

[8] The recipient country might initially be unable to repay the debt and a restructuring can lead the donor to retrieve at least some of its' outstanding debt.

7. Analysis and results

7.1 Aid and trade

The performance of the gravity model can be evaluated by comparing the estimated coefficients with economic rationale. The model will be evaluated using the effect of aid on exports as an example. The expected signs of the coefficients are shown in table 4 and they are the same when both exports and imports are the dependent variable (Nilsson, 1997).

Table 4 - Expected signs of coefficients in the gravity equation

Variable	Sign	Reason
Distance	-	Transportation costs reduce trade
The product of the exporting and importing country's GDP	+	A larger economy fosters trade
Contiguity	+	Countries sharing a border trade more
Common language	+	Sharing the same language reduces informal barriers to trade
Dummy for countries being in a colonial relationship	+	Historical ties between countries lead to increased trade
Being a member of the European Economic Area	+	Membership in the same free trade area fosters trade.
Preferential access to EU markets for least developed countries (GSP1)	+	Reduced tariffs and improved access to markets increase trade
Preferential access to EU markets for developing countries (GSP2)	+	Reduced tariffs and improved access to markets increase trade
Political rights and civil liberties in importing country. A high number means few political rights.	-	Few political rights and civil liberties reduce trade
A dummy for being a not free country	-	Less free countries trade less
A dummy for a country being partly free	-	Partly free countries trade less than free countries
Bilateral aid	+	Aid supports donor exports in general. Donors tie aid.

Column 2 of table 5 shows the results of the gravity equation estimated with ordinary least squares (OLS). Time year dummies are included in all of the gravity equation estimations but they are excluded from the regression output. Performing a Breusch Pagan test for heteroskedasticity on the estimated residuals, the null hypothesis of homoscedasticity can be rejected, thus robust standard errors are reported in all ordinary least squares regressions. The signs of the ordinary least squares coefficients in table 5 are consistent with expectations and statistically significant different from zero for GDP, distance, common language, colonial relationship, European economic area, GSP1, GSP2, political rights and aid. The signs for contiguity and the binary variables for countries being not free and partly free are the opposite of expected. The negative contiguity coefficient is difficult to explain. One explanation can be that countries sharing borders have capitals nearby, leading to the contiguity effect disappearing in the distance coefficient. Another explanation is that most of the contiguity dummies are zero (32596 out of 33156). The coefficient of determination from the ordinary least square estimations is 0.733. The gravity model performs reasonably well in explaining variations in exports.

In columns 3 and 4 of table 5, I report the results of pair-wise fixed effects taking into account serial correlation of order one in the error term (from now on called modified fixed effects and abbreviated as FEi) and first difference (FD) estimations. For the first difference estimation every variable is first differenced except the year dummies. The modified fixed effects and first difference coefficients are reasonable similar and I choose the modified fixed effects estimation for the next estimations, since the method is used in other papers such as the study by Martinez-Zarzoso et al. (2009). First difference estimation is not used in any of the previous research on the effects of aid on exports. A drawback with the modified fixed effects is the inability to correct for heteroskedasticity.[9] Heteroskedasticity will not affect the coefficients, but the standard deviation of the coefficients will be influenced. I must be careful, when concluding about the statistical significance of coefficients with p-values close to the significance level.

[9] Other estimation methods such as generalized least squares for panel data (in Stata 11.2 xtgls) or generalized estimation equation for panel data (in Stata 11.2 xtgee) can correct for both autocorrelation of the order one in the error term and heteroskedasticity. The two methods cannot perform fixed effects transformation and therefore modified fixed effects estimation (in Stata 11.2 xtregar) is used.

Table 5 – The gravity equation with exports as the dependent variable estimated using OLS, FEi and FD

Variable	OLS	FEi	FD
Ln(GDP_iGDP_j)	0.0408*** (0.000230)	0.0460*** (0.00321)	0.0495*** (0.00724)
Ln(Distance)	-1.038*** (0.0187)		
Contiguity	-0.969*** (0.140)		
Common language	0.701*** (0.0572)		
Colonial relationship	0.791*** (0.0638)		
European Economic Area	0.0916* (0.0416)	0.184* (0.0826)	-0.0248 (0.0322)
GSP1	0.165*** (0.0391)	-0.302 (0.297)	0.163 (0.104)
GSP2	0.0778** (0.0281)	0.0498 (0.118)	0.0618 (0.0822)
Political rights	-0.0286* (0.0143)	-0.0187 (0.0193)	-0.0213 (0.0183)
Country not free	-0.195** (0.0712)	0.0190 (0.0888)	-0.0303 (0.0674)
Country partly free	-0.0479 (0.0398)	-0.0145 (0.0581)	-0.0293 (0.0439)
Ln(aid)	0.0419*** (0.00179)	0.00374 (0.00257)	0.00281 (0.00265)
Constant	-1.111*** (0.216)	-12.58*** (1.182)	-0.124*** (0.0329)
Number of observations	32880	30804	30804
Panels		2076	
R^2	0.733		0.007

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors are in parentheses and all regressions include year dummies.

According to Santos Silva and Tenreyro (2006), the gravity equation should be estimated in the multiplicative instead of the log linearized form and the proposed estimation method is the Poisson Pseudo Maximum Likelihood (PPML). The aid coefficients from the modified fixed effects estimation are compared to the aid coefficients from the fixed effect Poisson Pseudo Maximum Likelihood estimation in table 6. [10]

Table 6 - The gravity equation estimated with ordinary least square and Poisson Pseudo Maximum Likelihood

	Export dependent variable		**Import dependent variable**	
	FEi	PPML	FEi	PPML
Ln(aid)	0.00374	0.00817***	0.00558	0.00701***
	(0.00257)	(0.000000147)	(0.00404)	(0.000000140)
Number of observations	30804	32848	30804	32848

Standard errors are in parentheses. All regressions include year dummies.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimated aid coefficients differ between the Poisson and the ordinary least squares estimation both for the export and import regression which means that there can be a problem with log linearization in the presence of heteroskedasticity. What is striking is the miniscule standard deviation for the Poisson estimation which makes both aid coefficients statistically significant different from zero. The aid coefficients in table 6 are elasticities, which can be difficult to interpret. A better way to report the results is to look at the marginal effects, on the dependent (y) variable of increasing the independent variable (x) by 1, at the mean values of x and y as recommended by Nilsson (1997). The way to construct marginal effect is shown below.

$$Elasticity = \frac{\partial y}{\partial x} * \frac{\bar{x}}{\bar{y}}$$

$$Marginal\ effect = \frac{\partial y}{\partial x} = Elasticity * \frac{\bar{y}}{\bar{x}} \qquad (14)$$

The marginal effects of aid on export or import will be both called the return of aid on exports or import and the export return or import return. The formula for the export return is therefore.

[10] The fixed effect Poisson estimation (in Stata 11.2 xtpoisson) could not be optimized when import was the dependent variable. The estimation produced repeated iterations with the message: (backed up). The problem was solved by restricting the number of iterations to 20. The built in trace function in Stata 11.2 showed that the results were stable during the repeated iterations, which means the results can be trusted.

$$Return_{Export} = \frac{\partial Exports}{\partial Aid} = Elasticity * \frac{\overline{Exports}}{\overline{Aid}} \qquad (15)$$

The returns from one dollar in aid using modified fixed effects are \$0.38 for exports and \$0.55 for imports.[11] The corresponding returns from the Poisson Pseudo Maximum Likelihood estimation are \$0.84 and \$0.70. From now on only the marginal effects of aid on trade will be displayed, since these results are easier to evaluate than the elasticities.

Country specific returns on trade from aid are constructed by estimating the gravity equation separately for each of the twelve donors. The results are shown in table 7 for four ordinary least squares regressions: two on annual data and two on three year moving averages of the data. The three year moving averages is the preferred method by Nilsson (1997) in his study, one of the first studies to quantify the effect of aid on exports. Nilsson results are included in column 6 in table 7 for comparisons. The estimated aid coefficients for the ordinary least squares estimation together with the mean of exports, imports and aid for the twelve countries when annual data are used are shown in table 21 in the appendix.[12]

For the return of aid on exports using the annual data which is shown in column 2 in table 7, the returns varies from \$18.29 for Belgium to \$-1.67 for Norway. The average export return is \$4.32. Most of the export returns with 3-years moving averages increase in absolute terms compared to the annual data, with only Netherlands as an exception. The larger export returns from using the 3-years moving average is as expected since the effect of aid on exports can last for several years.
Most of the export returns are statistically significant different from zero. An unexpected result is the negative significant exports returns of aid for Norway, Germany and United Kingdom, which is in conflict with the theoretical discussion in chapter 2. The estimated export returns differ remarkably from Nilsson's (1997), which is reasonable since two different data sources and periods are used. A way to compare the results is to evaluate the rankings of the countries. One of Nilsson's results is that the largest economies, Italy, France, Germany and the United Kingdom, have the highest export returns from aid. This is not the case in my estimation, where Belgium, Portugal and Spain have the highest returns. The correlation between export returns and economic size doesn't exist in my results.

[11] The formula used on the export return: $Return_{Export} = 0.00374 * \frac{1260000000}{12300000} = 0.38$
[12] Table 21 is included to give an impression of the average export, import and aid for the twelve countries.

Table 7 - Country specific returns on trade from aid using ordinary least squares.

Method	OLS		OLS with 3-years moving averages		Nilsson (1997)
Country	Export return	Import return	Export return	Import return	Export return
Norway	-1.67*	1.27*	-2.21*	1.24*	-
Sweden	1.29*	5.65*	1.36*	6.27*	-
Denmark	0.25	1.88*	0.35	2.44*	0.67
Belgium	18.29*	29.80*	25.02*	41.50*	2.41
Germany	-0.68	2.52*	-1.17*	2.52*	3.16
France	1.99*	2.42*	2.03*	2.58*	3.85
Ireland	0.28	6.43*	0.54	8.24*	-
Italy	1.95*	10.45*	2.40*	17.93*	3.13
Netherlands	0.93	4.05*	0.74	4.76*	1.09
Portugal	2.38*	2.99	4.15*	2.89	-
Spain	2.93*	7.20*	3.54*	9.67*	-
U.K.	-0.76*	2.50*	-1.02*	3.33*	2.84
All	4.32*	5.12*	5.20*	6.30*	2.60

*Statistically significant different from 0 at a 5 % significance level

The returns of aid on imports are in general larger than the export returns. All import returns are statistically significant different from zero except for Portugal. The average import return with the annual data is $5.12 with returns ranging from $1.27 for Norway to $29.80 for Belgium. None of the import returns are negative, which is consistent with theory. When the import returns are estimated with three year averages of the data most of the returns increase. The Belgium import returns increase from $29.80 to $41.5 which means that if Belgium donates $1 million in aid, imports from the recipient will increase with $41.5 million.

The conclusion from the ordinary least squares estimations of the country specific returns of aid on trade is that the returns are unusually high, especially for Belgium. This can be a sign of an omitted variable bias, which will be remedied using modified fixed effects. The modified fixed effects estimation might also solve the problem with statistically significant negative export returns.

The export returns from the modified fixed effects estimation are shown in column 3 in table 8. The export returns are much smaller than the returns from the ordinary least squares estimation showed in column 2 and therefore more in line with previous studies. The extreme Belgium export return has disappeared. France is the only country experiencing statistically significant returns from aid in the modified fixed effects estimation, with exports increasing by $4.00 for every additional dollar donated.

Table 8 - Country specific returns of aid on exports

Country	OLS	FEi	Zero export	Zero aid	Energy export	Aid altered
Norway	-1.67*	0.08	0.29	0.01	0.03	0.05
Sweden	1.29*	-0.16	0.02	-0.04	-0.15	-0.17
Denmark	0.25	0.26	0.20	0.02	0.25	0.26
Belgium	18.29*	1.41	1.78	0.18	1.49	1.51
Germany	-0.68	1.62	1.51*	0.33*	1.58	2.03*
France	1.99*	4.00*	1.14*	0.63*	3.89*	4.90*
Ireland	0.28	-1.36	-2.24	-0.10	-1.34	-1.55
Italy	1.95*	-0.24	1.21	0.08	-0.31	-0.29
Netherlands	0.93	0.67	0.50	0.08	0.73	0.68
Portugal	2.38*	-0.26	-0.21	-0.03	-0.27	-0.49
Spain	2.93*	0.41	0.85*	0.08	0.45	0.48
U.K.	-0.76*	0.27	0.51*	0.07	0.24	0.31
All	4.32*	0.38	0.32*	0.07*	0.41	0.43

*Statistically significant different from 0 at a 5 % significance level

Column 4 to 7 in table 8, show the export returns of aid using modified fixed effects with the data altered to test the robustness of the original results. In column 4, zero trade observations are excluded. It can be seen in chapter five how the 525 zero export and 1634 import observations are divided between the donors. It is expected that the estimated returns will change most for the countries with the greatest number of zero trade observations, namely Norway, Ireland and Portugal. From column 4, the export returns from aid are statistically significant different for zero for Germany, France, Spain, United Kingdom and all countries combined with exports returns of $1.51, $1.14, $0.85, $0.51 and $0.32 respectively. Italy and Spain experience a rather large increase in the export returns while the export returns of France and Ireland decrease notably.

Zero aid observations can influence the estimated returns of aid in several ways. The standard deviations of the estimated aid coefficients will increase, which can make some of the estimated returns insignificant. There might be multicollinearity between the other independent variables and the aid variable and the countries which receive no aid might have a different relationship with the other independent variables. Countries receiving no aid over the 16 years are removed in the estimation in column 5 in table 8. The number of zero aid observations per donor is shown in chapter 5 and the general trend is that the smallest economies have most zero aid observations. Among the estimated returns in column 5 Germany, France and all countries have statistically significant export returns with $0.33, $0.63 and $0.07. Besides this change in significance, the general trend is that the export returns are drastically reduced when zero aid countries are excluded. The reduction can be explained by inspecting equation 15, the formula for the marginal effects of aid on exports. The aid elasticity is multiplied by average export and divided by the mean of aid. When zero aid countries are removed, average aid will increase. The mean of export will also fall since aid is not donated to rich countries and the rich countries are the main trading partners for the twelve donors. The increased correlation between aid and export doesn't outweigh these two effects and therefore all the export returns are reduced.

As a third robustness test the export of energy goods are removed and the results are shown in column 6 in table 8. According to Nilsson (1997) the gravity model is inappropriate for trade in natural resources. Trade in raw materials is caused by resource endowments and not GDPs. The definition of energy goods and an overview of trade in energy goods for the twelve donors are found in the beginning of the appendix and in table 20 in the appendix. The export returns do not change much when energy trade is removed. The Norwegian export return, which is expected to change the most since 63.5% of total Norwegian exports are energy exports, remains practically constant. The only significant result is that one dollar in aid from France will increase exports by $3.89. The estimated export returns are robust to removing energy trade.

In column 7 in table 8, the aid observations are modified to remove unnatural aid observations such as debt relief from the aid data. Since it is impossible to remove debt relief directly from the data source, I have used an alternative approach. The ten largest aid disbursements for each donor are inspected. If one of the donations is unnaturally large compared to previous years, the donation is exchanged with an average of the aid donations the previous and subsequent year. In addition, the standard deviations of aid for all country-pairs are computed. The 50 country-pairs with the largest standard deviations are examined for unexpected surges in aid. Based on the inspections 52 aid donations are altered and how these observations are divided among the twelve countries is shown in table 9.

Table 9 - Number of unnatural aid observations for the twelve countries

	NOR	BEL	GER	FRA	ITA	NET	POR	SPA	UK
Alterations	2	4	11	16	6	3	2	6	2

In addition to the 52 alterations, all the 168 Iraq observations are removed. Aid to Iraq has skyrocketed from 2003 due to the Iraq war, and they are therefore removed. The estimated export returns when aid is modified is statistically significant for Germany and France with an increase in exports by $2.03 and $4.90 for every additional dollar donated in aid. Most countries don't experience a large change in the estimated export returns when aid observations are modified.

The gravity equation is estimated with imports as the dependent variable. The estimated import returns from aid are shown in table 10. Using modified fixed effects, the unnatural large import returns found with ordinary least squares disappear. France is the only country with a statistically significant import return with one dollar in aid increasing imports with $3.65.

The same robustness tests are performed for the import returns as for the export returns and the results are shown in column 4-7 in table 10. France has statistically significant import returns for all specifications, which means that the French import returns are robust. The general trends from the export returns' robustness tests apply to the robustness tests for the import returns. Removing zero import observations influences the results a lot. If zero aid observations are removed the import returns will decrease. The estimated import returns will not change much from removing energy trade or altering aid.

Table 10 - Country specific returns of aid on imports

Country	OLS	FEi	Zero import	Zero aid	Energy import	Aid altered
Norway	1.27*	-0.11	-0.15	-0.02	0,11	-0,07
Sweden	5.65*	0.22	0.43	0.05	0,14	0,25
Denmark	1.88*	0.15	-0.05	0.02	-0,02	0,01
Belgium	29.80*	2.77	0.40	0.36	2,76	3,24
Germany	2.52*	1.26	-0.38	0.25	0,92	1,64
France	2.42*	3.65*	1.52*	0.64*	3,29*	4,44*
Ireland	6.43*	2.07	0.23	0.12	2,41	1,69
Italy	10.45*	1.20	1.31	0.60	1,52	1,58
Netherlands	4.05*	1.66	-1.28	0.40	1,52	1,54
Portugal	2.99	1.62	-0.33	0.25	1,52	2,39
Spain	7.20*	0.06	0.68	0.12	-0,04	0,07
U.K.	2.50*	-1.33	-0.83	-0.13	-0,83	-1,64
All	5.12*	0.55	-0.13	0.12	0,58	0,60

*Statistically significant different from 0 at a 5 % significance level

7. 2 Aid and state visits

The effect of state visits on trade is estimated with modified fixed effects. The dummy variables for outgoing and incoming state visits are included in the same estimation. Only the state visits dummy variables are presented here since the other coefficients are reasonably similar to the results in subchapter 7.1. The effects of state visits on exports for the four countries are shown in table 11. Norway+ is Norwegian state visits accompanied by a business delegation. Standard deviations are shown in the parentheses.

Table 11 – Percentage change in exports from outgoing and incoming state visits using modified fixed effects

	All	Norway	Norway+	Sweden	Denmark	UK
Outgoing state visits	-0.0394 (0.115)	-0.232 (0.309)	-0.0615 (0.267)	-0.0224 (0.176)	-0.0222 (0.267)	0.160 (0.105)
Incoming state visits	-0.0135 (0.112)	0.00946 (0.311)	0.0841 (0.500)	-0.0393 (0.198)	0.0254 (0.240)	-0.0085 (0.0860)

*Statistically significant different from 0 at a 5 % significance level. Standard

No effects are statistically significant from zero. The outgoing state visit coefficient for United Kingdom is closets to being significant with 1.52 standard deviations away from zero. The average effects of an outgoing and incoming state visit are a reduction in exports by 3.9 % and 1.35 % respectively. The negative effect is contrary to the theoretical discussion in chapter 2. The effects of state visits on imports are shown in table 19.

Table 12 – Percentage change in imports from outgoing and incoming state visits using modified fixed effects

	All	Norway	Norway+	Sweden	Denmark	UK
Outgoing state visits	-0.0914 (0.199)	-0.227 (0.418)	-0.190 (0.361)	-0.0399 (0.345)	0.0481 (0.585)	0.00658 (0.236)
Incoming state visits	0.0171 (0.195)	-0.0118 (0.420)	0.0473 (0.670)	-0.00800 (0.391)	0.103 (0.527)	-0.0466 (0.195)

*Statistically significant different from 0 at a 5 % significance level

No effects are statistically significantly different from zero. The average effect of an outgoing state visits is a reduction of imports by 9.1 %, which is contrary to the theoretical discussion in chapter 2. The average effect on imports from an incoming state visits is a growth in exports by 1.71 %.

The two estimations are supplemented by investigating whether lagged state visits influence exports or imports using the general to specific approach. I start with a general model where the gravity equation includes four lags of outgoing and incoming state visits. The most insignificant lag is removed until either all lags are removed or significant coefficients are found. The approach is performed on the four countries combined and separately using modified fixed effects. The result from the regressions is that no significant coefficients for lagged incoming and outgoing state visits are found. The lagged state visits coefficients are also not jointly significant, something that is tested through F-tests.

Two robustness tests are performed on the effects of state visits on trade. Firstly, zero export observations are removed from the export regression and zero import observations are removed from the import regression. This changes the estimated state visits coefficients, but none of them become statistically significant different from zero.[13] The outgoing state visit coefficient for United Kingdom in the export regression is close to being significant with 0.166, 1.91 standard deviations away from zero. Secondly, energy trade is removed. The removal of energy trade doesn't change the estimated state visit coefficients much and none of them become statistically significant.

[13] Since no significant coefficients are found, the results will not be presented.

8. Granger causality tests

A Granger causality test is a test of causality between two variables, where a variable is regressed on lags of the same variable and lags of the other variable (Enders, 2004). If coefficients for the lagged independent variable are statistically significant, the independent variable Granger causes the dependent variable. The regressions must be performed with both variables as the dependent variable.

There are some limitations with the Granger causality test (Abdel-Aziz and Fares, 2010). Firstly, Granger causality identifies time dependent causality and not theoretical causality. There is a pitfall illustrated by the rooster and the sunrise problem.[14] Secondly, the Granger causality test investigates the causality between two variables, x and y, but it might be the case that a third variable, z, is causing both x and y. Lastly, in Granger causality tests the lagged independent variable is used to predict the dependent variable. Many economic variables have simultaneous influence on each other, something that is not picked up by the Granger causality test. Based on the three limitations, Granger causality tests should be used with care.

A prerequisite for performing the Granger causality test is that both variables are stationary. The aid, export and import series in natural logarithms are first differenced, and stationarity is tested for with the Fisher-test.[15] The null hypothesis of the Fisher test, that all panels have a unit root, is rejected. This result together with econometric knowledge that most data series are difference stationary leads me to use the first differenced series in the Granger causality tests. Zero aid observations are removed to avoid noise. The panel structure of the dataset is utilized through pair-wise fixed effects estimation. The appropriate regression model is found using the general to specific approach, where the general model includes three lags of the dependent variable and four lags of the independent variable. A model with more lags is avoided since observations are lost for every lag added. The results from the regressions with exports and aid are shown in table 13 and the results from the regression with import and aid are shown in table 14.

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[14] The rooster crows before the sunrise and information is provided about the coming sunrise. However, it is flawed to assume that the rooster's crow causes the sunrise.

[15] This can be performed in Stata 11.2 using the command xtunitroot.

Table 13 – Granger causality tests of exports and aid

	Export dependent variable	Aid dependent variable
Export lagged	-0.483*** (0.0421)	
Export lagged twice	-0.265*** (0.0348)	-0.0520** (0.0198)
Export lagged three times	0.00711* (0.00319)	
Aid lagged		-0.622*** (0.00968)
Aid lagged twice	0.00678** (0.00245)	-0.422*** (0.00877)
Aid lagged three times		-0.264*** (0.00790)
Constant	0.184*** (0.00849)	0.894*** (0.00392)
N	13666	13666
Panels	1424	1424
R^2	0.214	0.489

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14 – Granger causality tests of imports and aid

	Import dependent variable	Aid dependent variable
Import lagged	-0.589*** (0.0229)	0.0197 (0.0118)
Import lagged twice	-0.293*** (0.0220)	
Import lagged three times	-0.157*** (0.0182)	
Aid lagged	0.0237*** (0.00648)	-0.622*** (0.00971)
Aid lagged twice	0.0188** (0.00673)	-0.422*** (0.00879)
Aid lagged three times		-0.264*** (0.00789)
Constant	0.195*** (0.00511)	0.887*** (0.00345)
N	13666	13666
Panels	1424	1424
R^2	0.269	0.489

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13 shows two things. Firstly, aid Granger causes export which is shown by the significant positive coefficient for aid lagged twice. If aid increases, exports will increase. This is consistent with the theoretical discussion in chapter 2. Secondly, export Granger causes aid, which is shown by the significant twice lagged export coefficient in the aid regression.

The main result from table 14 is that aid Granger causes import, which can be seen from the significant coefficients for aid lagged and aid lagged twice in the import regression. In the aid regression, the different lags of import are not significant. Imports do not Granger cause aid. The results in table 14 together with the discussion in chapter 2 indicate that causality might go from aid to imports.

The research by Arvin et al. (2000) and Osei et al. (2004) highlight that the causal relationship between aid and trade might differ for different donors and recipients. The dataset consists of 2112 unique donor recipient pairs, with maximum 15 observations each after first differencing. According to Enders (2004), a time series model with fewer than 50 observations cannot be trusted. I should therefore not perform Granger causality tests one the 2112 pairs individually. The claim that the causal relationship differs for different country pairs will be investigated through Granger causality tests for the twelve donors. The individual tests will use data only from the respective country. The same methodology as in the previous tests is used. The magnitudes of the coefficients and which lags are significant are of minor importance and therefore only crosses are used to illustrate significant Granger causalities in table 15.

From table 15 it can be seen that aid Granger causes exports for France while exports Granger causes aid for Sweden, Germany, Italy, Netherlands and United Kingdom. Aid Granger causes imports for Norway and Sweden, imports Granger causes aid for France, Portugal and the United Kingdom while Italy has Granger causality going in both ways. The results from the table 15 confirm the conclusions from Arvin et al. (2000) and Osei et al (2004) that different country pairs can have different causational relationships.

Table 15 - Granger causality tests of trade and aid for the twelve countries

	Granger causality export and aid		Granger causality import and aid	
Country	Export dep. var.	Aid dep. var.	Import dep. var.	Aid dep. var.
Norway			X	
Sweden		X	X	
Denmark				
Belgium				
Germany		X		
France	X			X
Ireland				
Italy		X	X	X
Netherlands		X		
Portugal				X
Spain				
U. K.		X		X
All	X	X	X	

The causality between state visits and trade is examined with the same methodology as in the trade aid causality tests. The only difference is that the state visit variables are not first differenced, since they are dummy variables.[16] The general to specific approach is used in the Granger causality tests and the results of the Granger causality test between exports and state visits are shown in table 16.

There is one significant result for the independent variable in table 16. Incoming state visits lagged four times is significant in the export regression. Incoming state visits Granger cause exports. For the Granger causality tests between imports and state visits no significant coefficients are found for the independent variable.[17] This is an indication of no causal relationship between imports and state visits.

[16] First differencing a dummy variable would create an unintended negative spike in the subsequent year of a state visits.
[17] Since no significant coefficients are found, the results of the tests are omitted.

Table 16 - Granger causality tests between exports and outgoing and incoming state visits

	Granger causality test export and outgoing state visits		Granger causality test export and incoming state visits	
Dependent variable	Export	Outgoing state visit	Export	Incoming state visit
L.export	-0.526*** (0.0426)		-0.526*** (0.0426)	
L2.export	-0.309*** (0.0438)	0.000140 (0.000140)	-0.309*** (0.0438)	-0.000350 (0.000218)
L3.export	-0.164*** (0.0284)		-0.164*** (0.0283)	
L.statout/L.statin	-0.0154 (0.0382)	-0.0965*** (0.00373)		-0.0987*** (0.00657)
L2.statout/L2.statin		-0.0740*** (0.0111)		-0.0988*** (0.00827)
L3.statout/L3.statin		-0.0683*** (0.0139)		-0.0919*** (0.00791)
L4.statout/L.statin			-0.112* (0.0531)	
Constant	0.183*** (0.00913)	0.0104*** (0.000164)	0.184*** (0.00906)	0.0114*** (0.000210)
N	8236	8940	8236	8940
Panels	696	704	696	704

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

9. Evaluation and critique of the results

The main results for the effects of aid on trade come from the modified fixed effects estimation of the gravity equation. One dollar donated as aid will increase export by $0.38 and imports by $0.55. The returns are not statistically significant different from zero. The only significant effects are found for France with export returns of $4.00 and import returns of $3.65. The robustness tests reveal that the results are highly dependent on the data used. Removing zero trade observations makes the German, Spanish, United Kingdom's and the average export returns significant with $1.51, $0.85, $0.51 and $0.32 increase in export for every additional dollar spent on aid. The removal of zero trade observations reduces French export return from $4.00 to $1.14 and the import returns from $3.65 to $1.52. The removal of zero aid observations will reduce the estimated returns from aid mainly due to reduced average export and import and increased average aid. The German and the average export return become significant when zero aid observations are removed. The robustness test where energy trade was removed showed that the original returns are robust to this test. In the last robustness test, some aid observations were altered. The modification made the German export return significant. Most of the countries experienced small changes in the estimated returns after the aid modifications, something that might be caused by that only a limited number of aid observations were altered. If all debt relief was removed the results might change even more.

The main result from the robustness tests is that the magnitudes of the returns are highly influenced by how zero trade and aid observations are dealt with and which data are used. The French export and import returns are significant in all specification which means the result is trustworthy. The German export return is significant in two robustness test and the average, the Spanish and the United Kingdom export returns are significant in one. The fact that a number of export returns are significant in some of the robustness tests indicates that more significant results can be found if the research is improved. For most of the countries no significant relationship between aid and trade exist, which is good news from an aid point of view. The primary goal of aid is to contribute to economic growth and development in recipient countries (Nilsson, 1997). Export interests of the donor should not be the main driver for bilateral aid. The Paris Declaration on Aid effectiveness was signed in 2005 and provides principles to follow in the aid process (International Development Association, 2007). It might be that most of the twelve countries have implemented these principles, which will reduce the effect of aid on exports. From a developmental point of view it would be beneficial that imports from the recipient country increased with aid. The lack of significant import returns might indicate that the donations are not targeted at stimulating the productive sector of the recipient's economy. Aid might be focused on improving human capital through education, health services etc. The effect on trade from such investments can take decades to mature. Something peculiar is the fact that France has significant and larger returns from aid than the other 11 countries. This is a question which might justify further research. The study can be improved by increasing the number of yearly observations. My study includes 16 yearly observations for each country, which are fewer than Nilsson (19), Wagner (23) and Martinez Zarzoso et al (44). Having more observations will reduce the standard error of the estimated coefficients and might make some of the insignificant returns significant.

There are no significant effects of state visits on trade. Over half of the estimated state visit coefficients are negative. The conclusion is that there is no correlation between state visits and trade for the four selected countries. The study can be improved by including more state visit observations. My study had 92 outgoing and 102 incoming state visits which are well below the study by Nitsch (2005) which had 629 outgoing state visits.

The estimation of the gravity equation in its multiplicative form using the poisson regression changed the estimated returns. The change is an indication for log linearization leading to biased results, and the gravity equation should therefore be estimated using Poisson Pseudo Maximum Likelihood. Recent research has shown that the Poisson Pseudo Maximum Likelihood estimation has problems with zero trade observations (Martin and Pham, 2008). Martin and Pham's (2008) recommended method for estimating the gravity equation is two stage Heckman maximum likelihood, which solves the zero trade problem and minimizes the bias. The recommendation by Martin and Pham (2008) and the change in the estimated returns from the removal of zero trade observations are arguments for using the two stage Heckman selection procedure (Helpman et al., 2008). In the procedure two equations will be estimated. The first is a Probit model, where the probability that the country will export is estimated. In the Probit model, it is important to have an exclusion restriction (Wooldridge, 2009). In the article by Helpman et al. (2008), where the gravity equation is estimated using the two stage procedure, two variables are used as exclusion restrictions. The first is a common religion index that measures the shares in the trading countries that have the same religion. The second variable is an entry cost variable which measures the costs of establishing a new firm. Both variables influence the probability of trading, but do not affect the volume of trade and can therefore be used as the exclusion restrictions. From the results of the probit model the inverse Mills ratio is constructed which is the probability density function divided by the cumulative distribution function of the distribution (Wooldridge, 2009). The inverse Mills ratio is included as an explanatory variable in the gravity equation estimation, which is the second stage in the two stage Heckman selection procedure. The procedure will correct the bias coming from zero trade observations and the bias coming from potential asymmetries in the trade flows between country-pairs (Helpman et al., 2008). From the robustness tests it is clear that my study will benefit from using a two stage Heckman selection procedure. The only problem with the procedure is to obtain a suitable exclusion restriction.

The Granger causality tests between aid and trade indicate that there is bidirectional causation between export and aid, and aid causes import. When the tests are performed for each donor separately, the results are mixed with causation going in both ways. The mixed results are in accordance with previous research. In the Granger causality tests between state visit and trade, only incoming state visits four years ago can significantly influence the current export. There are only 70 incoming state visits in the dataset and the low number of observations might be the reason for the correlation. The significant four year lag is most likely a spurious correlation and I will therefore claim there are no causal relationship between state visits and aid. There are some limitations to the Granger causality as explained in chapter 8. Beside these limitations the quality of the data is important and especially for the aid variable. If debt relief and other noise are removed from the aid variable, the results from the Granger causality tests might change. Another weakness with the Granger causality tests is the low number of observations for each panel. It would be beneficial to have more than 16 yearly observations.

10. Conclusion

In the thesis an empirical analysis is performed to evaluate the effects of aid and state visits on trade. The theoretical foundation for the analysis is the gravity model of trade, a successful tool for analysing trade flows. In the gravity model, trade between two countries is influenced by the size of the economies and different trade enhancing and trade diminishing factors.

Previous studies have found positive and significant effects between exports and aid and between exports and state visits. The previous studies have not given a univocal answer regarding the causal relationship between trade and aid and between trade and state visits.

The thesis has attempted to answer the following question:
What is the effect of state visits and aid on trade? Is there a measurable effect and if so how large is it?
The results show that there is no significant effect from state visits on trade. The Granger causality tests find no significant causality. It cannot therefore be claimed that state visits significantly influence trade. For the aid question, the Granger causality tests show that causality goes in different direction for different donors. There is one robust significant country-level result on the effect of aid on trade. One dollar in aid from France will increase exports by $4.00 and imports by $3.65. The German, Spanish, United Kingdom's and all twelve countries' export returns are significant in some of the estimations, which indicates that there can be more robust significant results if data quality is improved or the estimation technique is changed. On average one dollar in aid will increase exports by $0.38 and imports by $0.55. These results are small and not significant. Based on the results I will claim that it cannot be stated univocally for all of the countries that aid influences export and imports.

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12. Appendix

Trade data are collected from Eurostat (Eurostat, 2012b). The data comes from the Intrastat system which was constructed after the adoption of the single market 1. January 1993. Products are classified into groups. For the main analysis, aggregate numbers from the Standard International Trade Classification (SITC) are used. In two robustness tests SITC category 3 data are subtracted from the aggregate numbers. The SITC category 3 consists of four subcategories (United Nations, 2012) :

32 – Coal, coke and briquettes
33 – Petroleum, petroleum products and related materials
34 – Gas, natural and manufactured
35 – Electric current

The trade data from Eurostat come in current prices of Euros. The trade data are transformed into constant 2009 dollars using the average reference exchange rate and the consumer price index for the United States (Eurostat, 2012a) (Department of Labor, 2012).

GDP data are collected from the World Bank database (World Bank, 2012b). The GDP series used are GDP in constant 2000 dollars. The GDPs are transformed into constant year 2009 GDPs by dividing with the constant 2009 value and multiplying by the current 2009 value for each country (World Bank, 2012a). The GDP dataset consists of 2923 observations divided between 185 countries. The data set is not balanced, with fewer observations the first years and the last year. The twelve countries in my study have over 25 % of the world GDP in 2009.

Aid disbursements are collected from a database provided by the Organization for Economic Co-Operation and Development (OECD, 2012). Official Development Aid by recipient in constant year 2009 dollars is chosen. The type of aid selected is total gross disbursement, which is the sum of grants, capital subscriptions and gross loans paid out during a year. Bilateral aid is chosen which means that aid to international organizations, such as UNICEF, is excluded.

State visit data is collected from the webpages of the royal families for Norway, Sweden, Denmark and the United Kingdom (kongehuset.no, 2011) (kongehuset.dk, 2012) (kungahuset.se, 2012) (royal.gov.uk, 2012). The state visits are often accompanied by business delegations. An overview over large business delegations from Norway is provided by Innovation Norway.[18]

Distance between capitals are found in the database Geodist, which is constructed by the French institute "Centre d'Etudes Prospectives et d'Informations Internationales" (CEPII, 2005). The dataset provides different measures of distance between countries. The measure chosen is the simple distance measure, which is the distance between the most important cities in a country and in the other countries. The distance is calculated using the great circle formula (Mayer and Zignano, 2011).

Information about contiguity, sharing the same language and colonial relationships are collected from GeoDist (CEPII, 2005). There are 223 countries/semi-autonomous countries in the dataset excluding the reporting country. The three variables are dummy variables having either the value one or zero. The colonial relationship variable includes a country being either colonized or the colonizer. For example Ireland was a part of the United Kingdom before and has therefore been in a colonial relationship with United Kingdom.

The European Economic Area variable is a dummy variable that indicates if the country is a member. The information is collected from a dataset produced by Statistics Norway which gives some basic information about different countries.[19] The information in the dataset is static, so it is modified to take into account recent entrants to the European Economic Area.

The generalized system of preferences data is constructed based on a static dataset from Statistics Norway and information from the Norwegian Customs and Excise (Norwegian Customs and Excise). The generalized system of preferences is defined as "*non-reciprocal concessions under which developed countries allow duty-free or low-duty entry to imports from selected developing countries up to a certain limit or quota*" (BusinessDictionary.com). Two dummy variables are created based on the generalized system of preferences. The first (GSP1) indicates whether a country is a least developed country and gets the most preferential access to European markets. The second (GSP2) indicates whether a developing country gets preferential access to European markets. The dataset is modified to take into account movements from and between the two groups. From 1995 to 2010 between 27 and 28

[18] The list is obtained from special advisor Tryggve Øglænd in Innovation Norway.
[19] I got this dataset from Professor Ragnhild Balsvik at Norwegian School of Economics.

countries were classified annually as GSP1 and between 48 and 66 countries were classified as GSP2.

The variables giving information about political rights, civil liberties and freedom status is provided by Freedom House in their report Freedom in the World (Freedom House, 2012). In the yearly report every country is classified. For civil liberties and political rights each country get an integer score from 1 to 7 where 1 represent the best and 7 the worst. The scores for political rights and civil liberties are highly correlated, with a correlation of 0.9284, so I choose to include only political rights and freedom status in the analysis. For the freedom status a country is classified as free, partly free or not free. Freedom house provides their analysis for 193 countries per year.

Table 17 - List of outgoing state visits for Norway, Sweden, Denmark and United Kingdom from 1995 to 2010

Year	Norway	Sweden	Denmark	United Kingdom
1995	Spain and USA	The Czech Republic		
1996	Poland, Netherlands, Luxembourg and Austria	Malaysia, Finland and Chile	South Africa	Poland, The Czech Republic and Thailand
1997	The Czech Republic and China	South Africa		
1998	South Africa, Russia, Estonia, Latvia and Lithuania	Mozambique		
1999	Romania	Greece	Brazil	South Korea
2000	France	Bulgaria	Great Britain, Romania and Bulgaria	Italy
2001	Japan, Italy and the Holy See	Belgium and Russia	Thailand and Slovenia	Norway
2002	Canada and Hungary	Slovakia and Mexico	Belgium	
2003	Belgium and Brazil	Thailand, Romania and Finland		
2004	Greece, Singapore and Vietnam	Vietnam, Brunei, Slovenia and Iceland	Japan	France
2005		Thailand and Australia		
2006	Switzerland and Ireland	Turkey, China and Canada	Greece	Lithuania, Latvia and Estonia
2007	Finland and Germany	Japan, Denmark and Austria	South Korea	The Netherlands, USA and Belgium
2008	Portugal	Portugal and Ukraine	Tanzania and Mexico	Turkey, Slovenia and Slovakia
2009	South Africa	Italy and Netherlands	Vietnam	
2010	Slovakia	Brazil		USA, United Arab Emirates and Oman

Sources: (kongehuset.no, 2011) (kongehuset.dk, 2012) (kungahuset.se, 2012) (royal.gov.uk, 2012)

Table 18 - List of incoming state visits for Norway, Sweden, Denmark and United Kingdom from 1995 to 2010

Year	Norway	Sweden	Denmark	United Kingdom
1995	Poland and Austria	Poland, Estonia, Latvia and Lithuania	Poland and Belgium	Kuwait and Finland
1996	Russia and China	Hungary	Lithuania and Iceland	France and South Africa
1997	Iceland and Belgium	Ireland, Austria and Russia	Latvia and USA	Israel and Brazil
1998	Germany	Italy, Argentina and Iceland	Jordan and Japan	Japan and Germany
1999	South Africa, Hungary and USA	South Africa, Ukraine and Slovenia	South Africa	Hungary and China
2000	Jordan, Latvia and Finland	France, Finland and Japan		Denmark
2001	Great Britain		Finland	South Africa and Jordan
2002	Estonia and Russia		Germany	
2003	Poland	Germany and Jordan	Luxembourg	Russia and USA
2004	Portugal and Italy		Romania	Poland, France and South Korea
2005	Japan	Latvia and Malaysia	Norway	Italy, Norway and China
2006	Spain and Bulgaria	Botswana	Bulgaria	Brazil
2007	Austria and Brazil	China, Brazil and Bulgaria	Brazil and Sweden	Ghana and Saudi Arabia
2008	Vietnam and Ireland	Romania, Luxembourg and Greece		France
2009	Canada		Greece	Mexico and India
2010	Russia, Netherlands and Switzerland		Russia	South Africa and Qatar

Sources: (kongehuset.no, 2011) (kongehuset.dk, 2012) (kungahuset.se, 2012) (royal.gov.uk, 2012)

Table 19 - Large business delegations from and to Norway from 1995 to 2010

Year	Country	Type of visit
1996	Austria	State visit out
	Austria	Prime Minister Brundtland out
	Poland	State visit out
1997	Estonia	Prime Minister Jagland out
	Chile/Argentina/Brazil	Minister of Trade and Industry Knudsen out
	Czech Republic	State visit out
1998	South Africa	State visit out
	Russia	State visit out
	Germany	State visit in (President Herzog)
1999	South Africa	State visit in (President Mandela)
2000	Mozambique/South Africa/Nigeria	Prime Minister Bondevik out
	Italy	Secretary of State Berg out
	Poland	Prime Minister Stoltenberg out
2001	Japan	State visit out
	Italy	State visit out
2002	China	Prime Minister Bondevik out
	South Korea	Prime Minister Bondevik out
	Estonia	State visit in (President Rüttler)
	Canada	State visit out
	Hungary	State visit out
	Russia	Official visit in (President Putin)
2003	Singapore	Minister of Defence Devold out
	Belgium	State visit out
	Japan	Prime Minister Bondevik out
	Poland	State visit in (President Kwasniewski)
	Brazil	State visit out
2004	Portugal	State visit in (President Sampaio)
	Greece	State visit out
	Italy	State visit in (President Ciampi)
	Singapore	State visit out
	Vietnam	State visit out
	Thailand	The Crown Prince and Princess official visit out
2005	Germany	The Crown Prince out
	Poland	The Crown Prince and Princess official visit out
	Sweden	The King, Crown Prince and Princess off. visit out
	United Kingdom	The Crown Prince and Princess special visit out
	Denmark	The Crown Prince out
	Denmark	The King, Crown Prince and Princess off. visit out

2006	Switzerland	State visit out
	Ireland	State visit out
	India	The Crown Prince and Princess official visit out
2007	Austria	State visit in (President Fischer)
	South Korea	The Crown Prince and Princess official visit out
	Finland	State visit out
	Brazil	State visit in (Lula)
	Germany	State visit out
2008	Chile	The Crown Prince and Princess official visit out
	Portugal	State visit out
2009	Mexico	The Crown Prince and Princess official visit out
	South Africa	State visit out
2010	Malaysia	The Crown Prince and Princess official visit out
	Netherlands	State visit in (Queen Beatrix)
	Switzerland	State visit in (President Ms. Leuthard)
	Slovakia	State visit out

Source: E-mail from special advisor Tryggve Øglænd in Innovation Norway.

Table 20 - Summary statistics of trade in energy goods for the twelve countries

Country	Av. export (mill $)	% of tot. exp.	Av. import (mill $)	% of tot. imp.	Obs. zero exp.	Obs. zero imp.	Av. exp. (mill. $) given exp.>0	Av imp. (mill. $) given imp.>0
Norway	47200	63.5	1980	4.5	71.8 %	80.7 %	716.0	43.7
Sweden	4590	4.7	9190	10.9	54.3 %	74.6 %	42.9	155.0
Denmark	5090	8.3	3130	5.6	67.0 %	78.8 %	66.0	63.2
Belgium	14100	5.8	25800	11.1	30.8 %	68.3 %	87.1	348.0
Germany	11000	1.5	46700	8.0	26.6 %	66.8 %	64.2	601.0
France	11400	3.3	43700	11.6	31.3 %	60.1 %	70.8	468.0
Ireland	469	0.6	3310	7.1	78.6 %	86.7 %	9.4	106.0
Italy	8700	3.1	34800	12.3	39.4 %	64.7 %	61.4	421.0
Netherlands	31200	11.0	37200	13.8	32.2 %	59.2 %	196.0	390.0
Portugal	882	3.0	5790	12.2	74.8 %	74.9 %	14.9	98.6
Spain	4070	2.9	28400	14.2	46.4 %	65.7 %	32.5	354.0
U. K.	27000	9.7	28300	8.0	31.9 %	66.8 %	170.0	365.0
All	13800	6.3	22400	10.4	48.8 %	70.6 %	115.0	325.0

Table 21 - Aid coefficients from the estimation of aid on trade using ordinary least squares and average trade and aid

Country	γ_{export}	γ_{import}	Av. exp. (mill $)	Av. imp. (mill $)	Av. aid (mill $)
Norway	-.026527*	.0343993*	430	253	6.84
Sweden	.013635*	.068754*	562	487	5.93
Denmark	.005025	.068755*	356	325	7.15
Belgium	.047141*	.080251*	1400	1340	3.61
Germany	-.005608	.025794*	4190	3390	34.70
France	.035259*	.039201*	1990	2180	35.30
Ireland	.001139	.043819*	447	271	1.85
Italy	.008963*	.047533*	1620	1640	7.46
Netherl.	.007496	.034034*	1640	1570	13.20
Portugal	.021879*	.017190	172	275	1.58
Spain	.039467*	.067637*	808	1160	10.90
U. K.	-.008856*	.022938*	1610	2050	18.80
All	.041887*	.050417*	1270	1250	12.30

*Statistically significant different from 0 at a 5 % significance level