Norwegian fish export potential to eastern and western Europe

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Abstract

The thesis attempts to estimate Norwegian trade potential in fish exports by using the augmented gravity models and panel data of five eastern and five western European countries. As an estimation technique for the period 1993-2010 fixed and random effects models have been used. The estimation results for four regressions are presented, namely: the regression on aggregated fish exports (salmon, trout, herring), and on salmon, trout and herring separately. The ratio between estimated potential trade and actual trade is then taken to predict Norwegian trade potential with the ten importing countries chosen for the analysis.

The estimation results for aggregated fish exports suggest that Norwegian fish exports are positively affected by fish production in Norway, exchange rate, price, openness variable, an index of economic freedom (EFI) and common border dummy variable. In general the variables have the expected sign. However, the distance variable is highly statistically significant, but has an unexpected positive sign. Norwegian fish exports are negatively affected by importer's GDP per capita. The importer's country becomes more self-supported when GDP per capita increases, meaning that domestic production increases, which reduces the demand for imports. Norwegian exports of salmon are positively affected by importer's GDP per capita, exchange rate and price, openness index (trade-GDP ratio), economic freedom index. The distance variable as well as the fish production variable has a negative effect on exports of salmon. However, common border dummy variable is not statistically significant and with an unexpected sign. The estimation results on exports of trout suggest that Norway's trade in trout is positively affected by higher importer's GDP per capita, exchange rate, price, openness variable, index of economic freedom. The common border dummy variable suggests that higher trade flows are attributed to the country that shares a common border with Norway. Norway's trade in herring is positively affected by price, openness index and presence of common border. However, the importer's GDP per capita has a negative effect on Norwegian exports of herring.

The estimated results show that Norway has exploited and unexploited trade potential with some countries in the sample. Suggesting that results are important for trade policy formulation to enhance Norwegian fish exports. As one of the recommendations, Norwegian authorities are advised to conduct marketing promotion program in the countries where Norway has an unexploited export potential.

Keywords: *Trade Potential, Panel data, Fixed Effect Model, Random Effect Model, Augmented Gravity Model.*

Sammendrag (Norwegian abstract)

Avhandlingen forsøker å beregne norsk handelspotensial innen fiskeeksport ved å bruke utfyllende gravitasjonsmodeller og paneldatateknikker av fem østlige og fem vesteuropeiske land. Som en estimeringsteknikk for perioden 1993-2010 har fast og tilfeldig effektsmodeller blitt brukt. Resultatene av beregningsmetoder fra fire regresjoner presenteres i denne masteroppgaven: regresjon på aggregerte fiskeeksport (laks, ørret, sild), og på laks, ørret og sild separat. Forholdet mellom estimert potensiell handel og faktisk handel er da brukt for å forutsi norsk handelspotensial med de ti importlandene valgt for analysen.

Beregningsmetodenes resultat for aggregerte fiskeeksport tilsier at norsk fiskeeksport er positivt påvirket av fiskeproduksjonen i Norge, valutakurs, pris, åpenhetsvariabel, en indeks over økonomisk frihet (EFI) og felles grense dummyvariabel. Generelt har variablene forventet fortegn, men avstandsvariabelen viser høy statistisk signifikant, men har et uventet positivt tegn. Norsk fiskeeksport er negativt påvirket av importørens BNP per innbygger. Importørens land blir mer selvforsynt når BNP per innbygger øker. Norsk eksport av laks er positivt påvirket av importørens BNP per innbygger, valutakurs og pris, åpenhetsindeks (trade-BNP ratio), samt økonomisk frihetsindeks. Avstandsvariabelen, samt fiskeproduksjonsvariabelen har en negativ effekt på eksport av laks. Imidlertid er ikke dummyvariabelen felles grense statistisk signifikant, og den viser et uventet fortegn. Beregningsmetodenes resultater på eksporten av ørret tyder på at norsk handel innen ørret er positivt påvirket dersom importørens BNP per innbygger er høy, videre er den positivt påvirket av valutakurs, pris, åpenhetsvariabelen og økonomisk frihetsindeks. Dummyvariabelen felles grense tyder på at det er en høyere handelsstrøm knyttet til de landene som har felles grense med Norge. Norsk handel med sild er positivt påvirket av pris, åpenhetsindeks og av felles grense. Imidlertid har importørens BNP per innbygger en negativ effekt på norsk eksport av sild.

De beregnede resultatene viser at Norge har både et utnyttet og et uutnyttet handelspotensial med de utvalgte landene. Resultatene er viktige for den handelspolitiske utvikling for å kunne styrke norsk fiskeeksport. Som en anbefaling, oppfordres norske myndigheter til å foreta markedsføringsprogram i de landene der Norge har et uutnyttet potensiale for eksport.

Nøkkelord: *Handelspotensiale, Panel data, Fast effectsmodell, Tilfeldig effectsmodell, Utfyllende gravitasjonsmodell.*

1. Introduction

Some nations are agriculturally-based economies, while others are more closely oriented towards exploring marine resources. Norway is an illustrative example of the latter. The fishing sector, being the second largest export sector in Norway after oil and gas, plays an important role for the Norwegian macro economy (Ludvigsen, 2004). The geographical characteristics of Norway along with the long coastline and climatic factors make this country extremely suitable for the development of the fishing industry. The fishing resources are not just important for the coastal population, but for the entire nation, creating a high turnover every year. Farmed fish and live catch account for $ 5.8 billion US or 4% of Norway's total export revenues (Criscione, 2009). Norway controls some of the world's richest fishing areas, consequently making her one of the world's largest exporters of fish and fish products. The Norwegian fishing industry is internationally oriented with more than 90% of production exported to around 150 countries. Between 1993 and 2010 Norwegian fish exports increased by 23% (Norwegian Fishermen's Association et al., 2003).

Russia and France are by far the two most important markets for Norwegian fish exports. In 2010 Norwegian fish exports accounted for 43.7% of overall fish imports of Russia, and in France, Norwegian share was equal to 16%. These markets are followed by other countries such as Denmark, Poland, Japan, Sweden, the Netherlands and others (Norwegian Ministry of Fisheries and Coastal Affairs, 2010).

This is an eastern-western European study, so the attention is concentrated on the European markets. In the West those countries are France, Sweden, Denmark, the Netherlands and Germany. The countries studied in the Eastern Europe are Russia, Ukraine, Poland, Latvia and Lithuania.

The above-mentioned countries are chosen for the analysis based on the fact that they account for the larger volume of Norwegian fish exports than the other countries do. In 1993 the share of exports of salmon, trout and herring to the ten countries chosen for the analysis accounted for 91% in total Norwegian exports of salmon, trout and herring. The countries included in the analysis are important import markets from the Norwegian perspective, meaning that the obtained results can serve as valuable recommendations for Norwegian policymakers and fish-

related businesses. Japan, China and Korea are important markets as well, but they are excluded from the study because this is the eastern-western European study.

The eastern European countries chosen for the study has been through the transition period in the early 1990s. These are events that did not take place in Western Europe making it possible to provide a comparison of trade flows between Norway and countries in the East and Norwegian trade flows with countries in Western Europe. The purpose is to see if transition economies managed to fully recover after transition period or if they are still falling back behind the western European countries. This is assessed by looking at the trade potential of Norway to the countries chosen for the study.

The thesis analyses Norwegian fish exports of salmon, trout and herring (using the HS-6, Harmonized System, digit product categories) in the form of frozen and chilled fish exports. The exports of smoked fish are not included in the study for three following reasons. First, Norway exports smoked fish such as salmon and herring, but not trout and this study employs all three species. Secondly, the share of smoked fish exports from Norway accounted for just 1% of overall fish export value both in 2009 and in 2010. Another reason for not including smoked fish in the study is that there are different preferences regarding smoked fish. People may like regular herring more than the smoked herring, for example. Simply because some may not like smoked fish, however chilled fish or frozen fish can be prepared based on the preferences that consumers may have. Consequently, in the case of inclusion of the smoked fish it would be necessary to study the preferences as well. However that is not what this thesis attempts to do.

Salmon, trout and herring together accounted for 21% of total Norway's fish export value in 1993. This share reached 38% by 1999, 50% by 2006, 57% by 2008 and in 2010 the shared slightly decreased accounted for 49%. The value of salmon exports as a share of total fish exports value increased by 16%, trout by 2% and herring by almost 3% during the period 1993-2010.

Additionally, salmon is the major farmed "animal" in Norway. In 2010 the share of salmon and trout in the imports of the countries chosen for the study on average accounted for 38% in Russia, Sweden 60.4%, France 2.7%, Denmark 24%, Poland 44%, Germany 9.3%, Latvia

29.2%, the Netherlands 4.1%, Ukraine 11.7% and Lithuania 46.4%. The Norwegian exports of salmon and trout are expected to increase due to fast development of the aquaculture production.

Norway was and is the leading world exporter of herring and Norwegian exports of herring increased from 64 million tons in 1993 to 448 million tons in 2010, an 600% increase (EAFE, 2003). Additionally, Norwegian exports of herring account for the largest share in the imports of western and eastern European markets chosen for the study. The Norwegian share of exports of herring on average is 82.4% in Russia, 43.8% in France, 36.8% in Denmark, 27.8% in Germany, 46% in Latvia, 65.9% in Lithuania, 43.9% in the Netherlands, 46.2% in Poland and 99.8% in Sweden.

The purpose of this thesis is to study Norwegian fish exports to Europe, to provide the East-West European countries comparison with regards to the Norwegian fish exports. Furthermore, to estimate Norway's fish trade potential towards Russia, Ukraine, Poland, Latvia, Lithuania, France, Germany, the Netherlands, Sweden, Denmark import markets by analyzing data from 1993 to 2010. This is done to assess whether or not Norway has managed to fully access the eastern-western European import markets chosen for the study. If the results show that the import market is not fully accessed, the ratio between the potential level of accession and the actual level of accession is estimated. It will also illustrate the potentials of eastern and western Europe which will help to provide comparison between them.

The panel data of ten importing countries for the years 1993-2010 are used. To assess Norway's trade potential a gravity model approach is implemented. The study employs a fixed and random effects model to estimate the gravity equation. The results of the regressions on the total fish of the three fish types and the regressions on salmon, trout and herring separately are presented to compare import demand across fish types.

The period chosen for the study covers the early phases of the transition from centrally planned economies to market economies in the eastern European countries, such as Russia, Ukraine, Poland, Latvia, Lithuania. One of the distinguishing characteristics of the transition economies is the restructuring of the economy. By choosing this time period one is granted the opportunity of studying the impact of the changes in microeconomic factors and macroeconomic events on the import demand of the countries. Such macroeconomic factors constitute the variables that are

used in the gravity equation as the intention to explain the reasons that stand behind the changes in the import demand. All five eastern European countries went through the process of transition in the beginning of 1990s. After the dissolution of the Soviet Union in 1991, Russia suffered from high rates of poverty and economic inequality. From being the world's largest state-controlled economy Russia was converted into a market-oriented economy, which was like a shock for the country. As a shock therapy the government decided to handle the reforms on price liberalization, liberalization of foreign trade and privatization that started in 1992 (Hardt, 1995). In the beginning of economic transition the volume of Russia's foreign trade declined. From 1992 to 1995, exports rose from US $39.7 billion to US $77.8 billion and imports rose from US $34.7 to US $57.9 billion that is when the recovery began (Curtis, 1996).

The Russian Federation was experiencing mini currency crisis in the beginning of the transition period as well. In 1995 to avoid crises Russian consulting with the International Monetary Fund implemented an exchange rate based stabilization programme. The aim of the program was to achieve single-digit inflation, financial stability and growth (Fic, 2006). The devaluation in the number of East Asian economies and sharp decline in oil prices caused capital outflows from the Russian economy during late 1997. This was followed by the second capital outflow in May 1998, which eventually resulted in the crisis of ruble in August 1998 (Fic, 2006). In 1998, Russia was left with a decrease in real output of 4.9% instead of a small growth. Due to the collapse of the ruble, Russian exports increased while imports remained low (Chiodo, 2002). The denomination took place in Russian in 1997, when 1 unit of new ruble was equal to 1000 units of the old ruble (Gladynov, 2008).

Similar story took place in Ukraine, after the independence in 1991 the country experienced a serious decline in GDP. Despite the reforms undertaken by the government the level of GDP fell to around 60% of its initial pre-independence level (Baker, 2002). The collapse of the Soviet Union left Ukraine with large manufacturing plants, however without any source of raw materials and energy. After the collapse, economic links and transportation links were destroyed as well. The main reason for that was the introduction of new national currencies in the independent states and the problem of determining the proper exchange rate. These events were one of many resistant factors that influenced international trade (Androshckuk, 2006). In 1996, due to hyperinflation Ukrainian national currency karbovanez was replaced by new currency

named hryvnia. At the time of the replacement 1 hryvnia was equal to 100000 karbovantsiv (Kaplyk, 2012).

Poland was one of the first of the eastern European countries that in 1989 started its reforms. A large amount of reforms has been implemented in very short period of time. Consequently, Poland reached the lowest level of GDP in 1991 and high level of unemployment (Androshckuk, 2006). During the denomination in Poland, the national currency zloty was replaced by new zloty in 1995. At this time 1 new zloty was equal to 10000 old zloty (Oshomkov, 1997).

Both Latvia and Lithuania went through an extremely difficult period of adjustments in the 1990s as well. Latvia has experienced harmful economic shocks in the beginning of the transition period. Being too poor to compete with the western markets, having high rates of inflation and unemployment, having additional drop in the international trade, these were the characteristics describing Latvia in the early stage of the transition period. The transition path of Lithuania has not been easy either. There were serious barriers on the way of building a market economy (United States Agency for International Development, 2010). These facts make a justification for using the chosen piece of period for the analysis.

The structure of this thesis is as follows: in Chapter 2 the trends in the Norwegian fish market are presented. This descriptive overview provides insights into Norwegian fish exports and trade patterns between 1993 and 2010. Information on the ten import markets chosen for the study is presented as well. Chapter 3 begins with the theory related to trade and that lies behind the gravity model approach that has been used for estimating trade potential of Norway. In addition, an overview of the related literature is presented together with the modeling of Norwegian fish export market and fish import markets. In Chapter 4 the gravity model is presented and the gravity model specification for Norwegian fish exports developed. The estimation results are presented and discussed in Chapter 5. The thesis ends with concluding chapter with a summary of the study, highlighting important policy or marketing implications for Norwegian fish exports, limitations of the study and recommendations.

2. Background

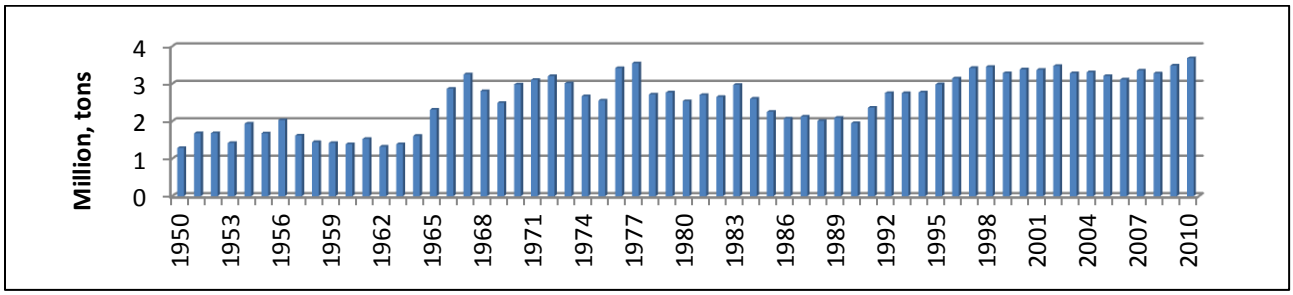
2.1. Norwegian fishing sector in a macroeconomic context

Norway is endowed with unique natural recourses such as climate, water, coastline and geography that make it perfectly suited for raising seafood. Fish products have been a major export from Norway for centuries granting fisheries an important role for Norway's national economy.

Since the 1970s oil and gas industry became a major contributor to the GDP, forcing out fisheries to the second place. Oil and gas industries are capital intensive, while the fishing sector employs people, providing livelihood to the coastal regions of the country and ensuring that various parts of the country are inhabited. Nevertheless, fisheries have always been and are of a major importance for the Norwegian economy (Le Gallic, 2006). The fishing sector of Norway is the major player in the international market.

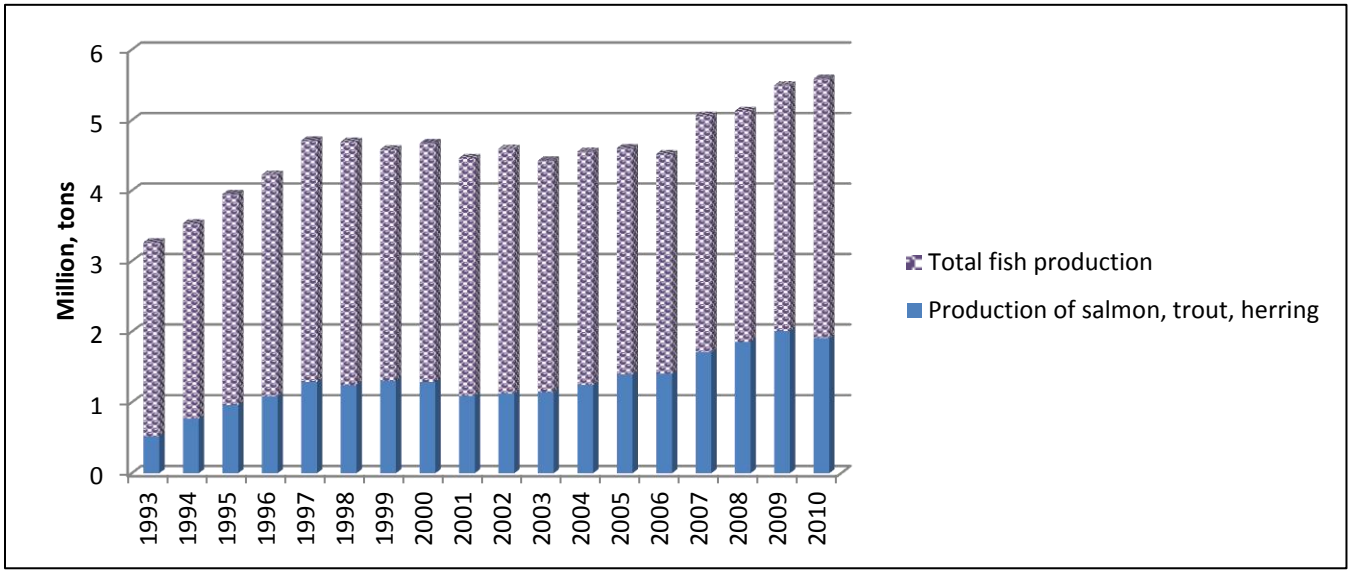
Besides oil and gas, the fishing and aquaculture industries are foremost Norway's export industries. First, it provides employment and second it creates widespread effects on trade and industry together with research and development (CEMAT, 2010).

Graph 1 illustrates fish production in Norway. The data on fish production in Norway from 1950 to 2010 reveals the importance of the fish sector for Norway as well as for the world, as Norway is the second largest fish exporter after China. Fish production increased by 35%, starting from 1950 to 2010. In the beginning of the 1990s fish production accounted for around 2 million tons and in 2010 it is doubled amounting for 4 million tons.



Graph 1: Fish production in Norway in 1950-2010 (*Source: FAO; Fisheries and Aquaculture Department****)***

Total fish production in Norway together with the share of salmon, trout and herring in the total fish production are illustrated in the graph 2. The graph suggests that the three species chosen for the analysis make up a high share in the total fish production of Norway. Additionally, it is observable that the share of these three species in the total fish production has an increasing trend over the study period. In the beginning of the study period the share of salmon, trout and herring production in total fish production in Norway accounted for 19%. By 2010 this number increases up to 52%. A percentage change in the production of salmon, trout and herring over the period 1993-2010 is equal to 268%. These 3 fish species have become among the most important fish products for Norway in recent years. This fact can be attributed to the appearance of new markets in East Europe since the transition period.



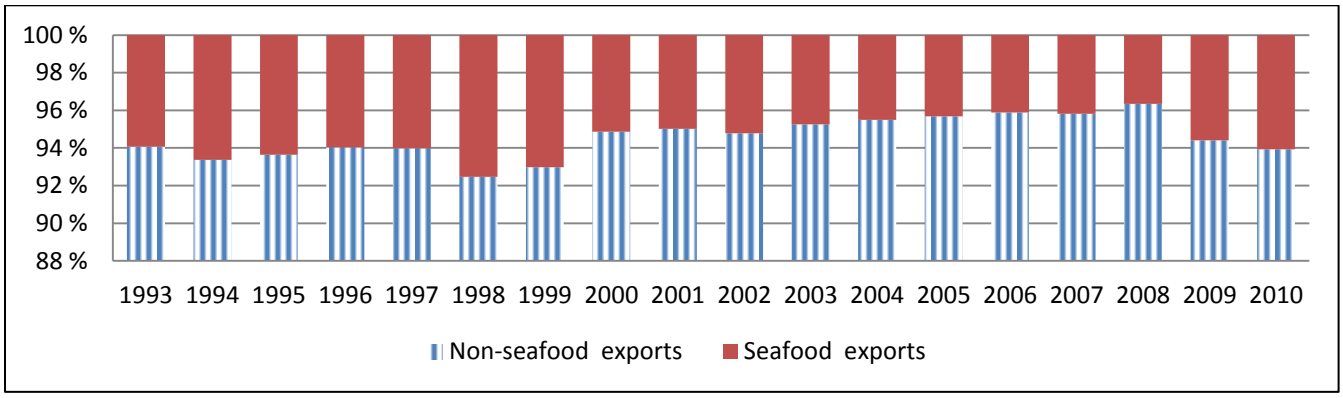
Graph 2: Volumes of salmon, trout and herring in total fish production in Norway in 1993-2010 (*Source: FAO; Fisheries and Aquaculture Department)*

Another way of assessing the importance of fishing sector for Norway is to look at the value of exports of fish as the percentage in total exports of the country which is presented in the Table 1. As it can be observed fish exports always played and still playing the important role for Norway. As mentioned before, after the 1970s the oil and gas extraction industries are calculated separately. However, at the same period of time Norway begins to farm salmon, which becomes valuables addition to the traditional fisheries (Le Gallic, 2006).

Table 1: Value of fish exports as a percentage in total exports of Norway (*Source: UN Comtrade; Le Gallic)*

Year	Percent
1938	14,7
1950	6,2
1960	12,6
1970	7,7
1981	4,5
1990	6,0
2002	5,6
2010	6,5

The importance of seafood exports can be assessed by looking at the graph 3 that shows Norwegian exports of seafood and non-seafood exports, illustrating the significance of the share of seafood exports in overall Norwegian exports over the years.

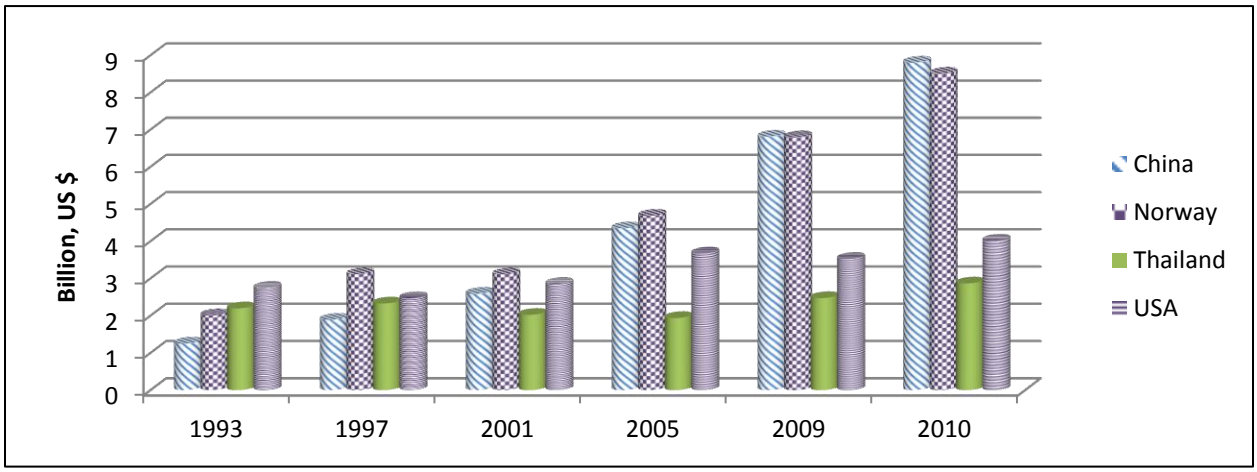


Graph 3: Norwegian exports of –seafood, -non-seafood products in 1993-2010 (Source: *UN Comtrade)*

Norway is a leading nation in the development of modern aquaculture. The main species provided by fish-farming are Atlantic salmon and rainbow trout, however, the industry is continuing to develop towards farming several new species, such as cod, wolf fish, shellfish and halibut (Fisheries and Aquaculture, 2009). This made possible to provide 47% of all seafood exports in 2005 (Norwegian Seafood Export Council, 2005). In 2010 this figure raised up to 62%, illustrating the increasing dominance of aquaculture over traditional fishing.

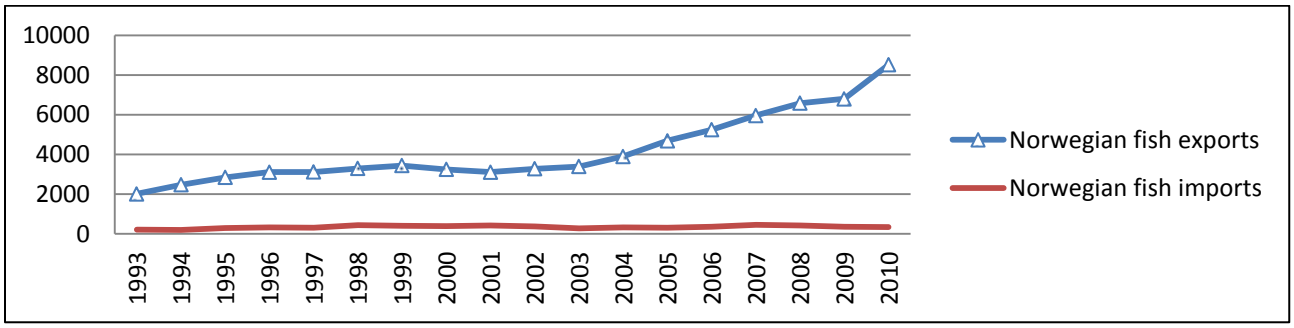
Norway exports of seafood are high, making this country the second largest world exporter of seafood. Graph 4 presents the major exporters of seafood in 1993-2010. Norway has experienced

a significant growth over the years with exports valued at $8.5 billion US in 2010. Thailand and USA are following the lead after Norway.



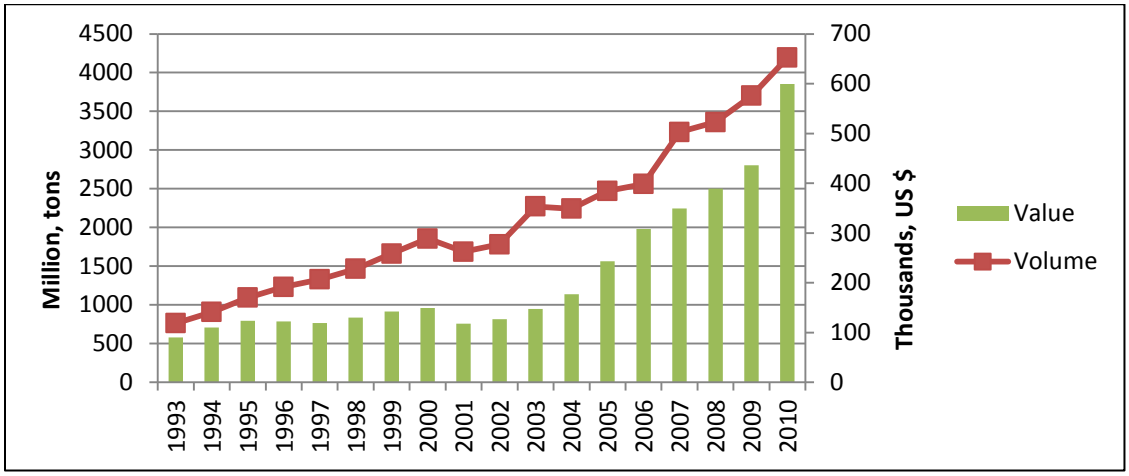
Graph 4: Major exporters of seafood in 1993-2010 (*Source: UN Comtrade)*

Graph 5 illustrates that seafood imports have never played an important role for Norway. In 2010 fish imports had a value of 340 millions US $, a small value compared with the 8.5 billion US $ value of exports in 2010, making Norway a net exporter. The majority of imports is groundfish, that is re-exported, this concerns the imports from Russia and Iceland. The imports coming from Peru are fishmeal for fish feed, primarily for aquaculture industry (Trollvik, 2002). The biggest part of the imports coming from Demark is mackerel, which is re-exported (UN Comtrade, 2012).



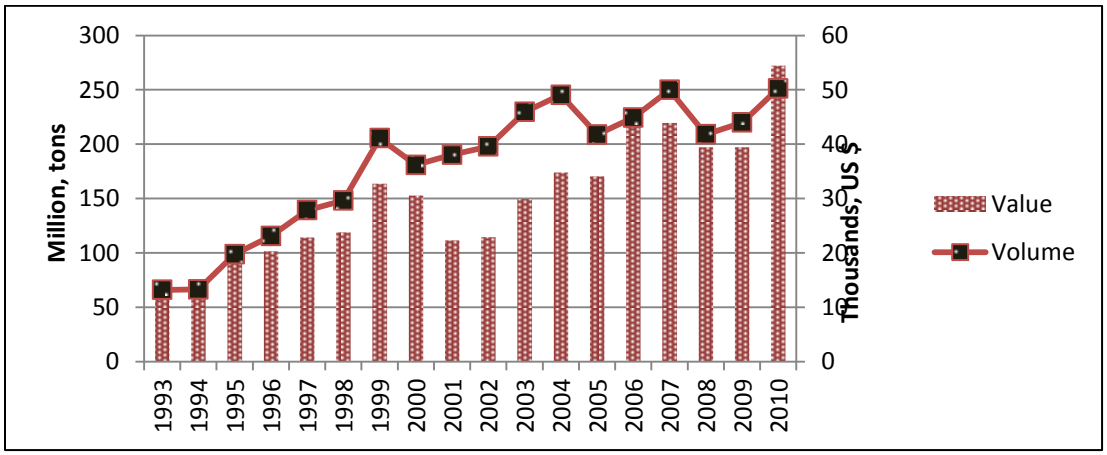
Graph 5: Norwegian seafood –exports,-imports to the World in 1993-2010 (*Source: UN Comtrade)*

The thesis focuses on three fish species, salmon, trout and herring. Graph 6 depicts Norwegian exports of fresh salmon from 1993-2010. There is an increasing trend in the exports of fresh salmon over the study period.



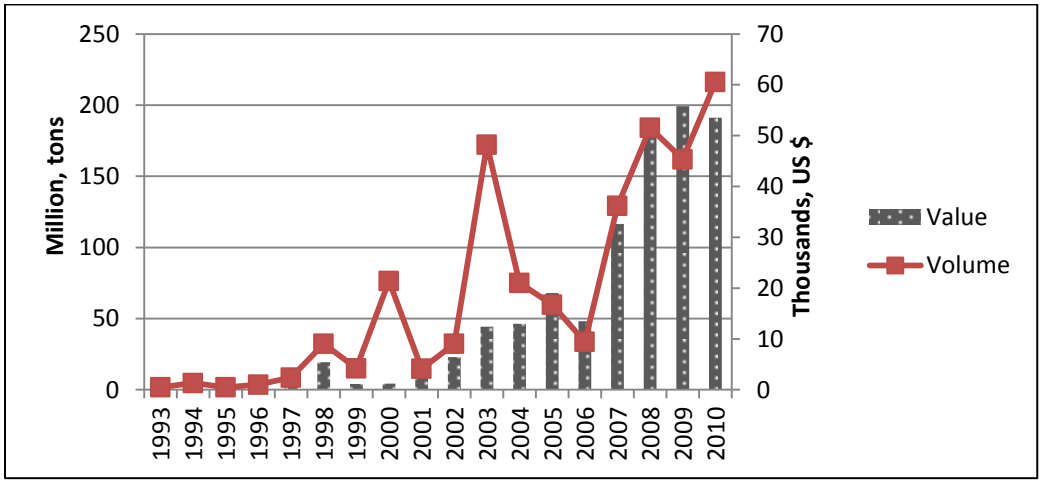
Graph 6: Norwegian exports of fresh salmon in 1993-2010 (*Source: UN Comtrade****)***

Graph 7 shows the trend in the exports of frozen salmon. As for the exports of frozen salmon, there is an increase up to 1999 when exports accounted for almost 164 million tons, followed by a fall to112 million tons in 2001. This fall can be attributed to the decrease in the production of salmon in Norway during 2001. The reason for other two declines in 2006 and 2008 are the bans on Norwegian imports in Russia, which is one of the major salmon import markets for Norway (Bondareva, 2006; Faliahov, 2012).



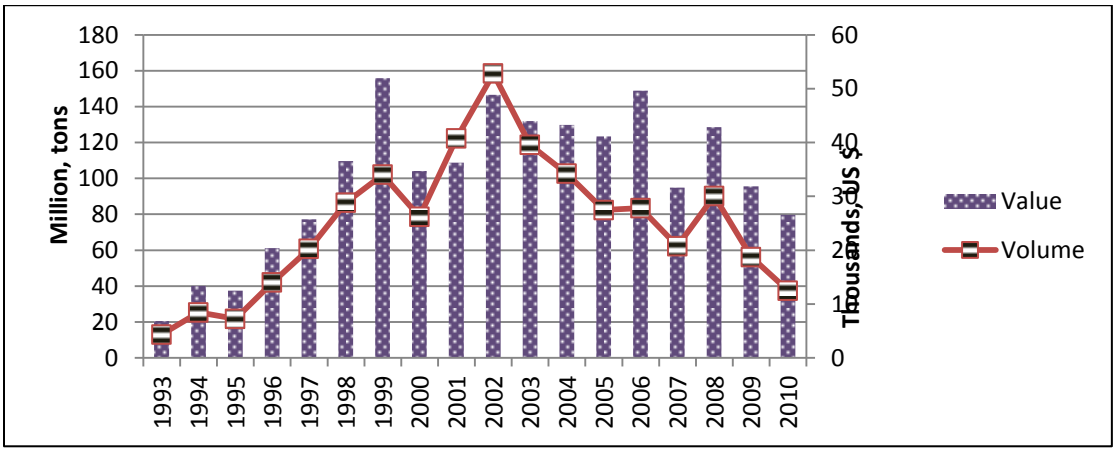
Graph 7: Norwegian exports of frozen salmon in 1993-201 (*Source: UN Comtrade)***

Graph 8 presents Norwegian exports of fresh trout. The exports of fresh trout have increased considerably from almost 22000 tons in 2000 to 60000 tons in 2010, which is a 172% increase. A fall in the exports of fresh trout in 2004-2006 can be attributed to the decreases in production of trout in Norway at that time.



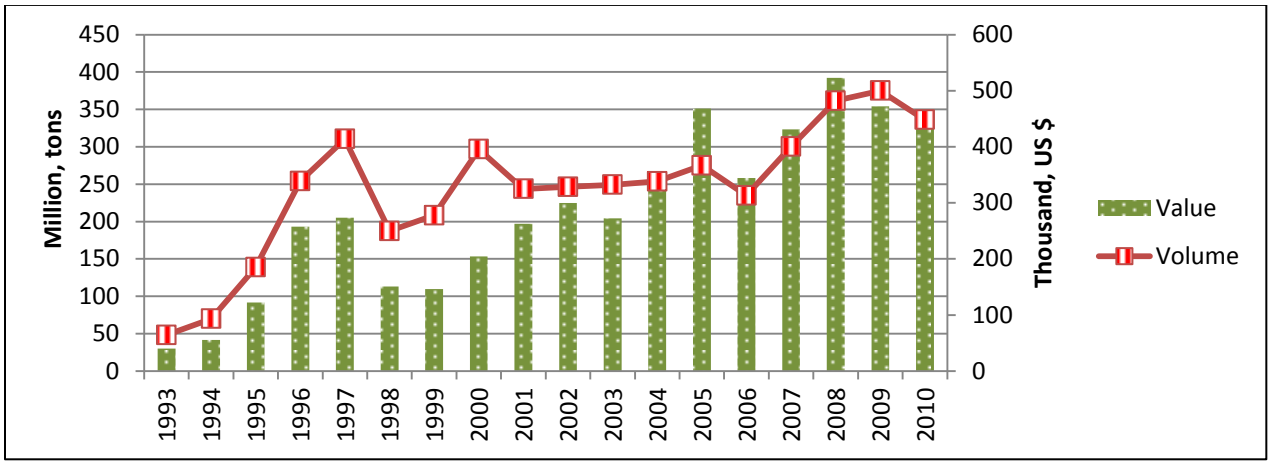
Graph 8: Norwegian exports of fresh trout in 1993-2010 (*Source: UN Comtrade)*

Graph 9 illustrates exports of fresh and frozen trout. The exports of frozen trout vary. From a peak of 52000 tons in 2002 the export volume decreased to 12000 tons in 2010, a 333% decrease. It can be seen as well that Norway exported mostly frozen fish in the beginning of the study period. However exports of fresh trout started growing in 2000 and increased by almost 43% by 2010. A peak in 2002 is due to high production of trout in Norway during this year.



Graph 9: Norwegian exports of frozen trout in 1993-2010 (*Source: UN Comtrade)*

Norway exports herring in the form of the frozen fish. The situation of exports of frozen herring is depicted in the graph 10. The graph shows that exports were at the highest point in 2008, when the export volume accounted for 382 million tons. An increase in exports of herring from 1993 to 2010 accounted for 14 %. The largest growth in exports of herring started in 1999, when exports amounted to 277 million tons. By 2005 exports rose by almost 76% compared with 1999. Norwegian exports of frozen herring had an annual average of 11% during the period 2007-2010.

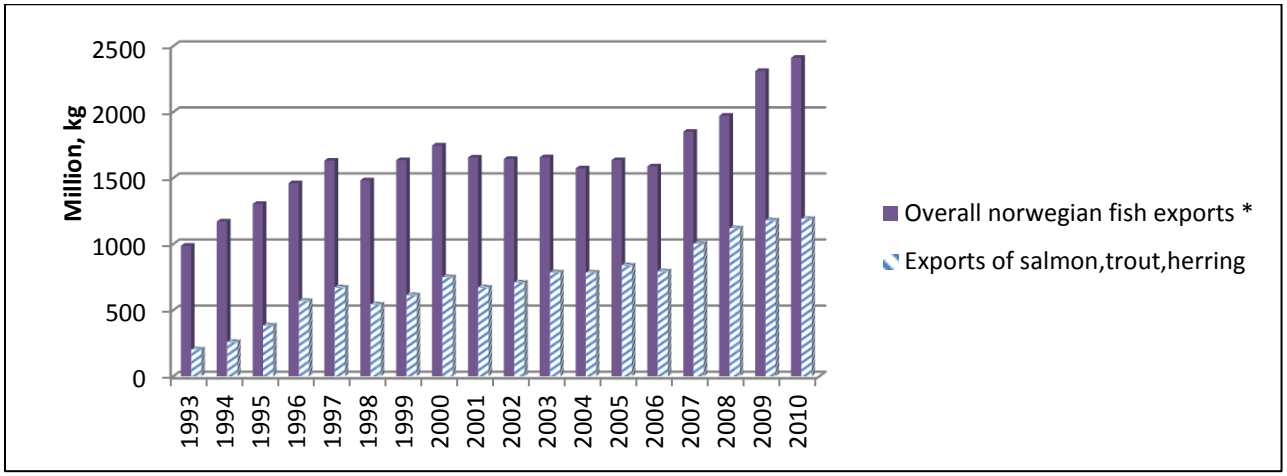


Graph 10: Norwegian exports of frozen herring in 1993-2010 (*Source: UN Comtrade****)***

Production of salmon, trout and herring, three fish species that have been taken for the thesis and the total fish production in Norway are presented in the graph 10. It is important to look at production in Norway, due to the fact that the more the country produces the larger the exportable surplus is. This means that country will export more as well.

The three species chosen for the analysis make up a large share in Norwegian exports as well. Graph 11 illustrates the share of three species taken for the study in the total Norwegian fish exports. In 1993 the share of salmon, trout and herring accounted for 21% in total fish exports of Norway. By 1997 this number doubled and was equal 42%. The rise in the export volume of salmon, trout and herring was followed by a fall of 5% in 1998. It is observable that exports of salmon, herring and trout has been an important part of the total Norwegian fish exports in the years 1993-2010. In 2000, the share of these three species accounted for 43%, 54% by 2007 and

in 2010 this number was equal to 49% due to the decrease in total fish exports. However there was an increase in exports of salmon, trout and herring by 15% comparing to 2007. Overall percentage change in exports of salmon, trout and herring over the 18 years period is 487%.



Graph 11: Norwegian fish exports in 1993-2010 (*Source: UN Comtrade). *: Excluding molluscs.*

Table 2 presents the exports of salmon, trout and herring from Norway to five eastern European and five western European countries. This illustrative information helps to compare the volumes of trade between Norway and East Europe and Norway and West Europe over the period of the study. As it has been stated before the purpose is to compare trends in East and West paying special attention to what has happened since economic transition towards marker economy in the East. Here the export volumes will be compared. Additionally, in the next sub-section will provide a comparison of income, per capita income and per capita consumption is made to find possible explanations of the divergence or convergence.

As the table suggests there has been increase in the trade volumes both in eastern and western European countries over the years of the study. Norwegian exports of salmon, trout and herring to Eastern Europe increased by 25568% in Russia, 1591% in Poland, 1480620% in Ukraine, 541% in Latvia, 777% in Lithuania from 1993 to 2010. As for Western Europe an increase of 9763% appeared in France, 9744% in Denmark, 9744% in Germany, 9749% in the Netherlands and 162% in Sweden.

The lowest percentage change in the export volume in the west of Europe is in Sweden and Ukraine accounts for the highest one in the east. Such countries as France, Denmark and the

Netherlands had almost similar percentage change in exports over the study period. The Russia Federation had a high increase as well. The lowest percentage change in export volume in the Eastern Europe took place in Latvia.

Looking at 2010, the last year of the study Poland, Ukraine and Latvia account for the lowest volumes of trade while at the same time Russia and Lithuania follow the trend in Western Europe. France and Denmark account for almost the same volumes of trade, which is 100 million tons. The country leading the list is the Netherlands, however, Russia is close second.

It is hard to provide any conclusions by looking just at the export side. The comparison of income, per capita income and per capita consumption will help to provide some suggestions for the explanations of such trends. This is what will be presented in the next sub-section.

Table 2: Norwegian exports of salmon, trout, herring to five eastern and western European countries, in kg (*Source: UN Comtrade****)***

Year/Country	Russia	Poland	Ukraine	Latvia	Lithuania	France	Denmark	Germany	Netherlands	Sweden
1993	1401687	5361613	5542	0	0	1023221	1025214	2050428	4098863	8166237
1994	14547065	16133808	1839406	6408537	24381751	39908732	39910726	79821452	159640910	9871389
1995	44317572	24377156	11597053	20192264	56166473	41495446	41497441	82994882	165987769	13630958
1996	195377363	31170145	17920752	43675295	92766192	43162605	43164601	86329202	172656408	18372357
1997	277911537	39079284	18309943	42616501	100005728	46290126	46292123	92584246	185166495	15176592
1998	167528935	35596672	8391408	33997765	77985845	48542164	48544162	97088324	194174650	14258622
1999	169880544	47140008	49325581	19240519	115706108	50620301	50622300	101244600	202487201	14878359
1993-1999 average	124423529	28408384	15341384	23732983	66716014	38720371	38722367	77444733	154887471	13479216
2000	283548205	37622533	94982594	17259399	149864526	49461758	49463758	98927516	197853032	14883405
2001	254607083	29098561	97232682	14675694	141006937	48338697	48340698	96681396	193360791	15349913
2002	321184547	21326797	87107935	9730244	118164976	51877527	51879529	103759058	207516114	13996161
2003	367606876	23725998	84574228	9310382	117610608	56869460	56871463	113742926	227483849	14952939
2004	409310871	27335754	94763049	11663421	133762224	54433223	54435227	108870454	217738904	14798655
2005	465269509	38459097	112129715	11131113	161719925	69402249	69404254	138808508	277615011	13658772
2006	337071001	42217861	92462763	13147995	147828619	77697341	77699347	155398694	310795382	14120917
2007	502401584	49025260	102132832	14909004	166067096	90676807	90678814	181357628	362713249	2162529
2008	423259962	71252842	97117733	21284485	189655060	96559784	96561792	193123584	386245160	19948518
2009	423109192	87203119	118751161	35455144	241409424	100697149	100699158	201398316	402794623	19802499
2010	359798190	90668599	82061528	41084508	213814635	100923410	100925420	201850840	403699670	21377578
2000-2010 average	377015184	47085129	96665111	18150126	161900366	72448855	72450860	144901720	289801435	15004717

Table 3 shows that Norwegian exports of salmon, trout and herring represent large share in the total imports of these three species by the ten countries chosen for the analysis. It appears that Norway is a major supplier for these countries. It is observable from the table that Norwegian exports share of salmon, trout and herring in the chosen markets is high and in some years it even exceeds the exports of salmon, trout and herring coming from the rest of the world.

Table 3: Fish imports from Norway in the total fish imports of five eastern and western European countries in 1993-2010 (*Source: UN Comtrade****)***

Year/Country	Russia		Poland		Ukraine		Latvia		Lithuania	
	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway
1993-1999 average	153274142	101482328	38103718	32249512	82767012	15308060	15087199	31643713	17248441	27688480
2000-2010 average	259826517	201365511	54873030	47085129	120114346	96665111	9780791	10672719	16492770	18150126
	France		Denmark		Germany		Netherlands		Sweden	
	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway	Total fish imports	Fish imports from Norway
1993-1999 average	94636382	45003229	50948053	47471545	96387467	23279425	56923505	20781100	44625730	13479216
2000-2010 average	112232089	72448855	72773072	64955869	95395192	23918913	90496865	33483131	158093330	15004717

Table 4 illustrates the total fish production in Norway, together with production of salmon, trout and herring. First, the attention will be drawn to the Norwegian market of salmon. Norway started farming fish in the early 1980s and achieved a great success in farming salmon on a large scale. A rapid growth on farming of fish appeared during the last 30 years and today Atlantic salmon accounts for 90% of the total sale of farmed fish. Favorable temperature of the water and the fact that most of the coastline is protected from storm surges makes Norway an ideal location for farming salmon (World Wildlife Fund, 2012).

Table 4: Production of fish in Norway, in tons (*Source: FAO****)***

Year	All fish	Total of the three	Salmon	Trout	Herring
1993	2749236	517094	156503	8351	352240
1994	2769670	767447	203459	14367	549621
1995	2986759	963776	262367	14704	686705
1996	3143134	1084389	298350	22966	763073
1997	3422357	1289680	333219	33295	923166
1998	3451742	1241834	361559	48431	831844
1999	3282008	1303680	425981	48692	829007
1993-1999 average	3114987	1023986	291634	27258	705094
2000	3383120	1289958	441115	48784	800059
2001	3372900	1089204	436227	71775	581202
2002	3474413	1120819	463472	83570	573777
2003	3286435	1142491	510500	68942	563049
2004	3309501	1244422	564707	63494	616221
2005	3208377	1394591	587401	58970	748220
2006	3114207	1404258	630833	62834	710591
2007	3356656	1707566	745421	77552	884593
2008	3279730	1852097	738888	85336	1027873
2009	3486277	2014892	863506	74136	1077250
2010	3683302	1906856	928520	54595	923741
2000-2010 average	3359538	1469741	628235	68181	773325

According to Gain Report (2006) the most important farmed "animal" in Norway is salmon. Table 4 shows that production of salmon has shown steady growth over the last 18 years. The percentage change in production of salmon over the period of study is 493%. Norway is the largest producer of farm salmon in the world, accounting for about 45% of world production. It can be seen, that from 1993 to 2000 production of salmon increased by 35%. This increase was followed by a small decrease of 3% in 2001. However, in 2002 the production of salmon started its steady growth up to 2010.

Now we will turn to the Norwegian market for trout. Rainbow trout is the second most farmed fish species after Atlantic salmon, which is presented in the table 5. Due to its adaptability it was introduced in many parts of the world and in Norway as well (EAAP, 2011). Production of trout was growing as well. The percentage change in production of trout over the study period is 554%. The production of trout in Norway shows variation accounting for 85336 tons in 2008 and decreased by 36 % in 2010 (CEMAT, 2010). The production of trout indicates a flatter development than the salmon does, with the peak in 2008.

The situation on Norwegian market for herring shows constant increase in the production from 1993 to 1997, the increase in production of herring accounted for 38%. An increase was followed by even higher decline of 39% until 2003. The production of herring started recovering in 2004. By 2009 an increase of 57% can be observed. Despite this positive trend in production of herring during seven years of the study a decline of 14% appeared in 2010. The percentage change in production of herring over the study period is 162%.

One of the reasons for lower production of herring can be attributed to the fact that there is little raw material available. In 1998, there was a collapse of the world herring market due to the oversupply in the 1997/1998 season and the economic crisis in Russian Federation and Japan, which are the major markets for herring (Food and Agriculture Organization of the United Nations, 2000)

Comparing the two sub periods namely 1993-1999 and 2000-2010 it is observable that Norway increased its production over the study period. This increase is attributed to total fish production as well as to the production of the three species that are the focus of this thesis.

Table 5 illustrates the exports of salmon, trout and herring by Norway in 1993-2010. In 1993 share of exports of salmon in production of salmon accounted for 75%. By 2000 the share decreased to 61% and increased again to 67% by 2010. The percentage change in exports of salmon over the study period is 422%. Exports of salmon following the trend in the production had an increase in 44% up to 2000. From 2000 to 2001 a decreased of 4% appeared. In 2010 exports of salmon increased by 42% comparing to year 2000.

Table 5: Norwegian exports of salmon, trout and herring, in tons *(Source: UN Comtrade)*

Year	All fish	Total of the three	Salmon	Trout	Herring
1993		187352	118348	4706	64298
1994		243720	140971	9589	93160
1995		362155	169667	7502	184986
1996		544964	191423	14813	338728
1997		640197	205235	21163	413799
1998		505193	222698	32582	249913
1999		566471	254545	34063	277863
1993-1999 average		435722	186127	17774	231821
2000		690249	267842	26906	395501
2001		630881	261632	44392	324857
2002		665360	276047	60885	328428
2003		702252	317870	52291	332091
2004		724630	339861	46449	338320
2005		792888	383114	43017	366757
2006		748318	398148	37111	313059
2007		942595	494039	48226	400330
2008		1066832	512920	71850	482062
2009		1129333	570429	58836	500068
2010		1105132	618109	38830	448193
2000-2010 average		836225	403637	48072	384515

The elimination of a feed quota on January 1, 2005, raised concern about fast decline in prices due to over-production. However, high demand in most important export markets (Russian, France, Denmark, UK) caused the prices to go even higher. Norway produced 48 per cent of the

total production of Atlantic salmon in the world has been produced by Norway in 2006 and it has still an annual consistently strong growth (Norwegian Directorate of Fisheries, 2009).

In 1993 share of exports of trout in production of trout accounted for 56%. By 1994 the share of exports in production increased and equaled 67%. However, the increase was followed by a fall what accounted for 12 %. Starting from 1995 up to 1999 exports of trout increased its share in production by 18%. Being large share in production exports were growing over 18 years. The percentage change in exports over the period of study is 725%. The consumption of trout in Norway is increasing steadily for the last 18 years. As it can be seen an increase of almost 61% appeared from the year 2005 to 2010.

Following the pattern of production the exports of herring show an increase of almost 16% during 1993 and 1997. From 1998 to 2006 there is a variation in the exports of herring. However, an increase of 37% took place in the period of 2006-2009. Regarding the exports, the peak of it can be seen in 2009, while almost 11% decrease appears in 2010. The percentage change in exports of herring over the period of the study is 597%.

Due to the unavailability of data corresponding to the consumption of salmon, trout and herring in Norway, the assumption about stability in storage is made.

Table 6 presents the consumption of salmon, trout and herring in Norway. Consumption of salmon in Norway is considerably increasing as it can be seen from the table. More and more salmon is consumed domestically. Just for the past 10 years from 2000 to 2010 and increase of 55.8% in consumption of salmon is observed. Norwegian exports of salmon show an accelerating increase throughout 18 years that are chosen for the analysis. A dramatic increase in exports can be observed by comparing years 2000 and 2010, increase of 43.3 % in the volume of exports can be observed.

Table 6: Consumption of salmon, trout and herring in Norway, in tons *(Source: UN Comtrade)*

Year	Total of the three	Salmon	Trout	Herring
1993	474478	38269	148266	287943
1994	708295	62552	189156	456587
1995	842449	92702	247665	502082
1996	807188	107007	275464	424717
1997	938060	127989	299929	510142
1998	1034317	139002	313269	582046
1999	1100397	171513	377366	551518
1993-1999 average	843598	105576	264445	473576
2000	970546	173285	392343	404918
2001	795601	174666	364524	256411
2002	812718	187446	379923	245349
2003	865759	192770	441698	231291
2004	1005061	224866	501233	278962
2005	1114259	204321	528465	381473
2006	1199044	232804	568118	398122
2007	1404886	251454	667941	485491
2008	1425840	226033	653617	546190
2009	1659671	293098	789391	577182
2010	1659988	310462	873977	475549
2000-2010 average	1173943	224655	560112	389176

Domestic consumption of herring is showing variability also. A decrease of 13%, when comparing year 2008 and 2010 can be observed. It appears that the range in per capita consumption in the West is similar to the range in the per capita fish consumption in the East, which is around 15-30 kg, however the trade patterns in the West are stable, but do tend to change in the East.

Additionally, it can be noted that over the past several years, starting from 2003 an increase of almost 14% in per capita consumption of seafood in Norway can be observed. This can be due to the perception that seafood is a healthier alternative to meats which motivates people to start preparing seafood at home more often (Myrland et al., 2000). The consumption of seafood in Norway is high. Since many meals per day consist of open-faced sandwiches Norwegians prefer

fish in the form of cold cuts and spreads. Adult median fish consumption is approximately 65 grams per day, and the median consumption of children and teenagers varies from 6 to 19 grams per day (National scientific committee for food safety, 2006).

Summing up it is important to notice there are high increases in production and exports of salmon, trout and herring over 18 years period. It is valuable information, meaning that with higher production, exportable surplus of Norway is high. This results in the possibility of exporting more fish.

2.2. General information about countries chosen for the analysis

The thesis studies markets of five eastern European countries and five western European countries in the analysis to analyse development of market potential among the so-called economies in transition, which is the characteristic of the economy that changes from being centrally planned economy to free market.

A series of reforms were started by Mikhail Gorbachev, who was the last head of state of the Soviet Union, having served from 1988 until its dissolution in 1991. As a consequence of the reforms, the Soviet Union together with the countries over which it had a powerful influence left behind the centrally planned economies starting to the transition into market economies. This process took place in all the Soviet Republics and its neighboring eastern and central European countries at the same time. Such transformation caused the fall in the output and GDP, additionally the inflation grew as price controls were lifted on inputs (Androshchuk, 2006).

The study period as divided into two sub-periods: transition period from 1993 to 1999 and post-transition period from 2000 to 2010. The economic indicators revealing the story of countries in transmission are summarized in the table 7.

The gross domestic product in the period from 1993 to 1999 was the lowest in the Lithuania and followed by Ukraine. The highest GDP value was in Latvia and it had the same tendency in the post-transition period as well. The country with the lowest GDP per capita in the transition period was Ukraine and it leaded the list of the countries with the lowest GDP per capita value in the port-transition period as well. As it can be observed from the table 5 the country with the highest GDP per capita in transition period was Poland. Starting with the highest value in the

transition period Poland remained the country with the highest GDP per capita in 2000-2010. This result can be attributed to the fact that Poland was the first of the Eastern European countries to launch the reform process, which took place in 1989 (Androshchuk, 2006).

Russia, Ukraine and Lithuania each experienced a period of hyperinflation in the 1990s. In 1993 the annual rate of inflation in Russia was 840% and by 1994 it reached 224 %. Poland in 1994, Ukraine in 1996, Russia in 1998 all redenominated their currencies and new currencies were introduced. Average inflation rate in transition period in Latvia was the lowest in the Baltic region following the falling trend in post-transition period as well (OECD Centre for Co-operation with non-members, 1998). High inflation of 306.2% took place in Lithuania in 1993, when the new currency litas were introduced.

The Russian Federation is the only country out of five eastern European countries chosen for the study that had a budget surplus in the transition period because of oil. The same trend remained constant for Russia in post-transition period as well. Regarding the rest four countries, both Poland and Latvia had increasing budget deficit going from transition period into post-transition period. The cases of Ukraine and Lithuania showed a decline in budget deficit, especially apparent for Ukraine. High budget deficit in Ukraine was a major cause for hyperinflation. By building up government debt year after year, the government was ought to print out additional currency to pay debt.

The trade dependence index (TDI) is sometimes also referred to as the openness index. This index is calculated as the ratio between international trade to the total value of the net output (gross domestic product or GDP). A high value of the index is an indicator of a more open economy. The TDI index basically explains the importance of international trade in the overall economy (Mikic, 2007). During the transition period s Lithuania had the highest TDI, which it maintained in the post-transition period. Lithuania's TDI value exceeded 100%, because the value of trade was greater than the value of production.

Table 7: Economic indicators of countries in transition in 1993-2010 (*Source: World Bank Group; Heritage Foundation; Datapult; Eurostat; Leblond; Interstate Statistical Committee of the Commonwealth of Independent States of CIS; NMFS; Mikic and Gilber; NMFS; Mikic and Gilbert; European Parliament)*

Economic indicators	Russia		Poland		Ukraine		Latvia		Lithuania	
	1993-99	2000-10	1993-99	2000-10	1993-99	2000-10	1993-99	2000-10	1993-99	2000-10
GDP, US$ mn, current	355	850	142	321	48	91	577	1807	9	27
GDP per cap, US$ current	2481	5305	3566	7994	931	1781	2334	7903	2505	7899
Inflation, annual %	213,0	16,7	20,7	3,1	689,7	16,4	21,2	6,5	64,9	2,9
Budget deficit, % GDP	4,8	4,3	-3,8	-4,9	-5,1	-1,1	-1,15	-3,02	-3,2	-3,0
Trade dependence, %	42,8	44,5	40,4	60,9	68,4	83,4	76,0	76,0	81,7	155,0
Economic freedom, %	51,5	51,0	55,1	60,7	41,1	50,7	58,6	66,4	53,9	69,1
Fish consumed, kg per cap	12,1	21,0	12,0	12,5	9,0	14,0	40,0	37,0	18,0	13,0
	France		Germany		Denmark		Netherlands		Sweden	
GDP, US$ mn, current	1477	2087	2226	2738	164989	238145	388039	628549	245205	362173
GDP US$ per cap, current	21342	24114	27219	28603	32026	42305	17834	36486	24035	36914
Inflation, annual %	1,1	1,8	1,5	0,8	1,5	2,6	1,9	2,3	1,9	1,7
Budget deficit, % GDP	-4,1	-3,6	-3,6	-2,4	0,2	1,8	-2,8	-1,4	-4,9	1,2
Trade dependence, %	37,2	42,8	41,7	63,3	52,8	63,9	81,1	106,2	53,9	64,7
Economic freedom, %	62,0	60,9	68,0	69,7	67,5	74,3	64,3	74,6	62,5	69,7
Fish consumed, kg per cap	31,0	32,0	14,0	15,0	24,0	24,5	15,5	15,0	28,0	28,0

Ukraine and Latvia had relatively large TDI in transition period as well, but Ukraine's TDI increased in the post-transition period. The data shows that Russia's TDI had just a slight increase going from the transition period into the post-transition period.

The EFI is the index that was constructed by the Heritage Foundation and the Wall Street Journal to capture the economic freedom of the countries (Heritage Foundation, 2012). The scores obtained from EFI can be classifies as "free" (i.e. combined scores of 80 or higher); "mostly free" (70-79.9); "moderately free" (60-69.9); "mostly unfree" (50-59.9); or "repressed" (under 50) (Heritage Foundation, 2012). In the transition period four countries, named Russia, Poland, Latvia and Lithuania had economies characterized as "mostly unfree", while Ukraine was classified as "repressed". The situation changed in the post-transition period. Poland, Latvia and Lithuania became "mostly free" economies. Ukraine and Russia were "mostly unfree" economies. The conclusion can be made regarding the recovery of the countries after the transition period, while three of the countries (Poland, Latvia, Lithuania) taken for the study were "mostly free" economies", the remaining two were still "mostly unfree", which points out on the poorer performance of these two countries in the contrast with the other three. This may be one of the obstacles For Norway on a way of having high trade potential towards these countries.

Per capita consumption of fish has increased from the transition period to the post-transition period in almost all five Eastern European countries, besides Lithuania, which had a decrease of 8.1 kg in per capita fish consumption. The highest increase in per capita consumption occurred in Latvia and Ukraine.

The situation in the rest five countries chosen for the study is depicted in the table 7 as well. The country with the highest GDP during 1993-2010 is the Netherlands. However, the GDP per capita in the Netherlands is lower than in Denmark, which is the country with the highest GDP per capita in this study. Inflation rates are very low comparing to the inflation rates in economies in transition.

The highest inflation rate in the period from 1993 to 1999 is 1.9% for Sweden and the Netherlands. The lowest inflation of 1.1% was in France. The lowest inflation rate in the period of 2000-2010 was in Germany.

The country with the highest budget deficit for the whole period from 1993 to 2010 was France in this case. Denmark was in budget surplus in both time periods taken for the study. This can be attributed to the fast growth and low unemployment rate (Danmarks Nationalbank, 2006).

The Netherlands, Denmark and Sweden are countries in this sample which are mostly dependent on the international trade, this is indicated by high TDI. France has the lowest TDI, pointing out on the lower dependence of the country on the international trade.

Both Denmark and the Netherlands managed to achieve a "mostly free" economy in the 2000-2010, being "moderately free" in the first part of the study period. Regarding France, Sweden and Germany, their statuses remained described as "mostly free". However, it is important to notice that the progress in these countries has been made anyhow. They remained in the same category, yet Sweden managed to almost obtain the status of "moderately free" economy, being just 0.2% apart.

Comparison of income per capita in Eastern and Western Europe shows clear divergence. It seems like East is falling back behind Western Europe. Eastern Europe did not even manage to achieve the per capita income that Western Europe had in the 1993-1999 period. There is a three-fold increase in income per capita in Latvia and Lithuania, while other Eastern European countries accounted for two-fold income per capita increase with exception of Ukraine that had just one –fold increase in income per capita. In the Western Europe all the countries had a two-fold increase in per capita income with exception of Netherlands that had a two-fold increase. Nevertheless, Eastern Europe is still falling back behind western European countries. However, it is important to take transition period in Eastern Europe into account. Despite hard times that eastern European countries suffered from they still managed to have a two in some cases even three- fold increase in per capita income which is an important fact to remember. If countries in transition will continue being on the same path they will reach the destinations at of western European countries.

Comparing the per capita consumption of east and west Europe it is easy to see that Western Europe consumes more fish than the Eastern Europe does, with the exception Lithuania. Per capita fish consumption in Lithuania is even higher than in the west Europe and its import volumes as it has been illustrated before are high as well. Consequently, that is what has been

observed in the precious sub-section that showed that Lithuania accounts for high volume of exports. Russia was following the list of importers in the Eastern Europe and in the relation to the per capita consumption it accounted for 21 kilogram per capita in 2010 which quite high per capita consumption for Eastern Europe. Countries like Poland and Ukraine accounted for similar import volumes, however with the domination of Poland and this is what is confirmed by consumption per capita. Poland has slightly higher per capita consumption than Ukraine does.

Western Europe cannot be characterized with just high per capita consumption. Countries like Germany and the Netherlands in the West have per capita consumption of 13-15 and 15.5-15 kilograms respectively. Consequently, Germany imports less than the Netherlands does. Sweden has the lowest export volumes over the study period which can be explained by constant per capita consumption in the country.

As it has been shown fish is an important export good for Norway which importance increases with each year. Due to the high global per capita consumption Norwegian fish exports as the exports of the second largest fish exporter in the world are essential for Eastern and Western European countries chosen for the analysis.

This section has provided a justification of the presence of high production and fish exports in Norway, meaning that Norway has a large exportable surplus. Next section will provide an illustration of Norwegian exportable surplus and the situation in which exportable surplus is changing due to the changes that occur in the microeconomic factors of Norwegian trading partners.

It is clear by now that there are different trends in fish exports, some countries import more while others import less. An attempt to explain these differences was presented in this section by trying to compare volume of exports, per capita consumption, per capita income and other microeconomic factors of the countries. However, this is not enough to justify the reasons for these differences. An attempt to provide reasonable explanations will be presented in Chapter 4 where an econometric model with cause-effect relationship established in Chapter 3 will be presented. This will give further insights into the possible explanations of the factors that influence Norwegian fish exports

3. Theory and related literature

3.1. Theory

This chapter provides a theoretical framework by which to analyze Norway's trade in fish products with east and west European countries chosen for the study and presents an overview of related literature. A model of the international market illustrated in the theory subsection, with the further insights into the effects of products substitutes. In the related literature subsection the popular gravity model of trade, which can be used for estimation of trade potential will be presented. Additionally, the related literature will be reported.

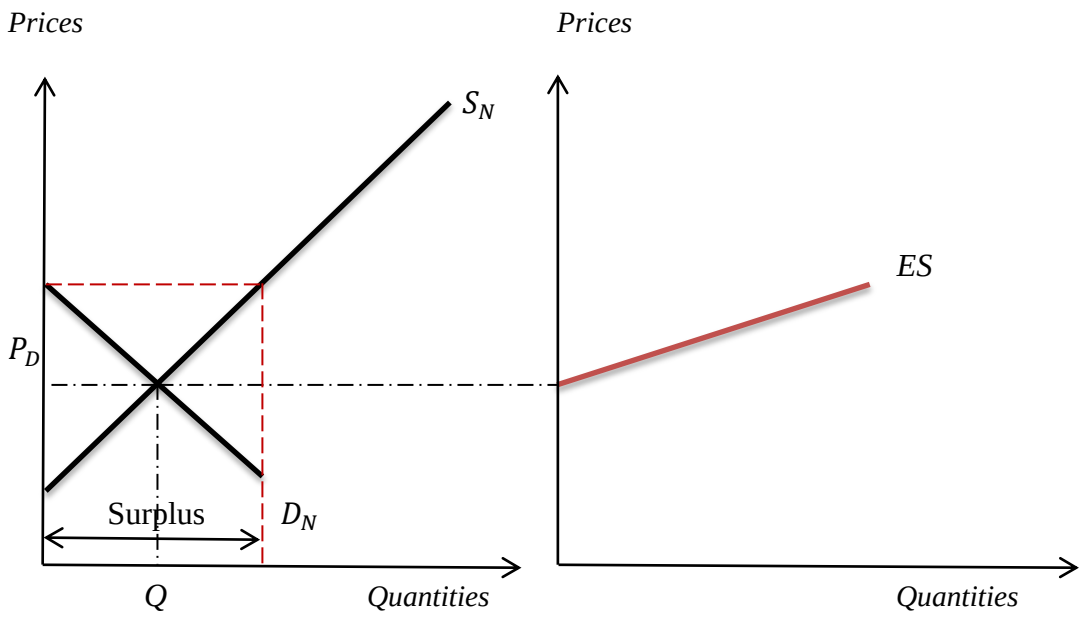
A simple trade model is used to analyze trade between two nations based on the domestic markets for a particular good in each country. This model illustrates the domestic market from one nation, with apparently high domestic price, with the domestic market from another nation, with apparently low domestic price (Applyard et al., 2008).

The nation that has a higher domestic price assigns to the import demand portion of the international market, which corresponds to the demand curve. It is referred to as the excess demand that is created as the price falls below its relatively high domestic price.

The nation that has a lower domestic price assigns to the export supply portion of the international market, which corresponds to the supply curve. It is referred to as excess supply that is created as the price rises above its relatively low domestic price.

By combining the excess demand from one country and the excess supply from another country the international market model illustrates how two nations undertake mutually beneficial trade. Let us illustrate the Norwegian export market and European import markets.

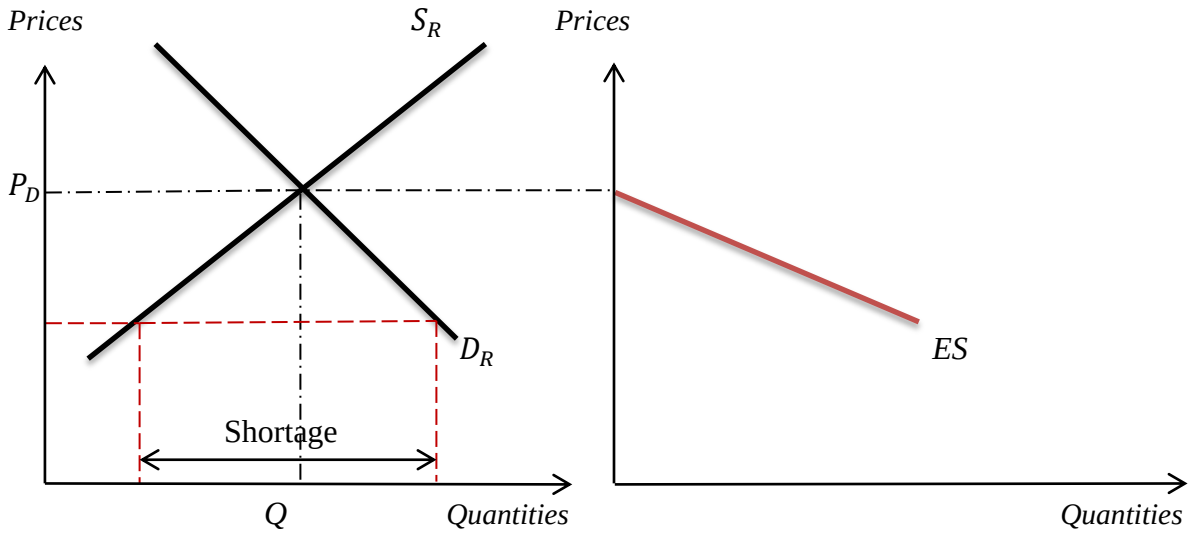
Graph 11 illustrates the Norwegian fish market. The demand curve for fish is given by D_N curve, the supply of fish is represented by the curve S_N. The market equilibrium is represented by the intersection of these two curves that generates the domestic price, P_D (Applyard et al., 2008).



Graph 11: Norwegian fish market (*Source: Applyard)*

The scenario is that in the absence of trade the prices in the foreign fish market are higher than in the Norwegian fish market. The higher price induces Norwegian buyers to reduce their quantity demanded and at the same time it encourages Norwegian sellers to increase their quantity supplied. The result of such action will generate a surplus of fish in the Norwegian market. The higher will be the price in foreign fish market, the higher will be the surplus in the Norwegian fish market. The right panel gives an illustration of these alternative surplus values at corresponding export prices. The resulting curve ES is the Norwegian excess supply of fish. It represents the amount of fish that Norway would be willing to export at different prices. Norway's excess supply is equal to the difference between Norwegian supply and demand.

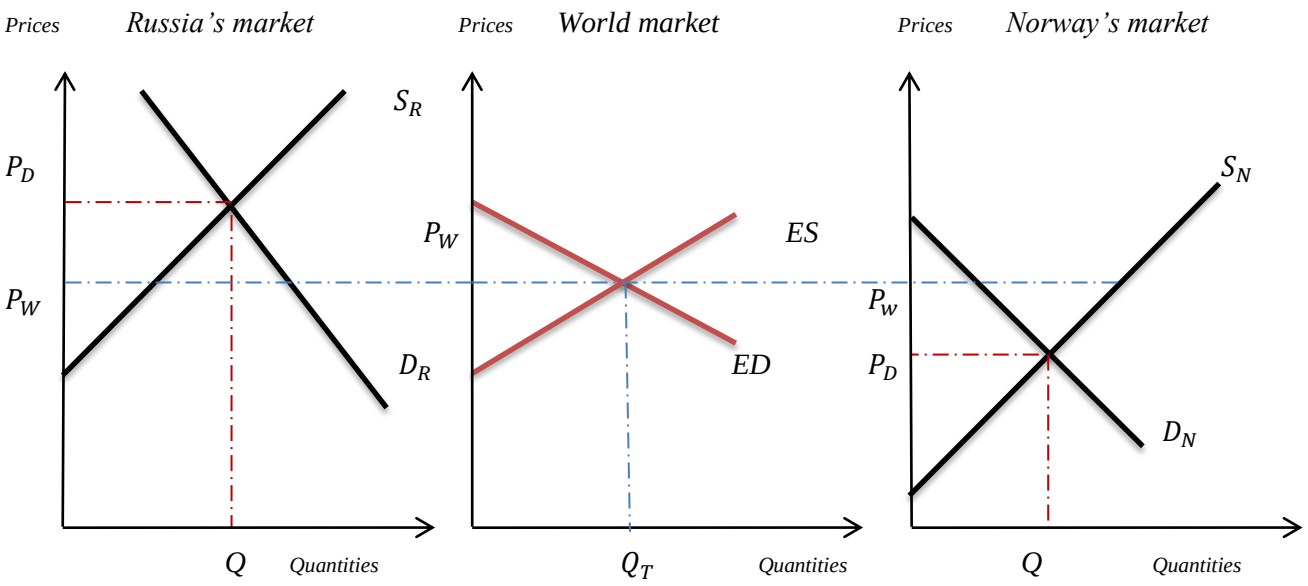
Now we can turn to the illustration of the fish markets of the Eastern and Western European countries chosen for the study. Assuming, for now that these fish markets are the same, for the sake of simplicity, the representation will employ Russian market as an example.



Graph 12: Russian fish market *(Source: Applyard)*

In graph 12 demand curve for fish is presented and it is given by D_R and the supply curve is S_R. Again, the intersection of these two curves gives a domestic market equilibrium that generates the domestic price in the Russian market, P_D (Applyard et al., 2008).

In this case we are interested in the situation where the prices in the Norwegian fish market are lower than prices in the Russian fish market. A lower price induces Russian buyers to increase the quantity demanded and at the same time it discourages Russian producers, causing a decrease in quantity supplied. The result of these actions is a shortage of fish on the Russian fish market. The right-hand side panel represents the alternative shortage values at corresponding prices. The resulting curve is the domestic excess demand for fish – ED. This curve indicates the amount of fish Russia would be willing to import at different prices. Excess demand is equal to difference between demand and supply.



Graph 13: Equilibrium on the international market *(Source: Applyard)*

In graph 13 Norwegian and import markets are combined. In the intersection of ES curve representing the supply of Norwegian market and ED curve representing the demand in import markets we get the result that helps to answer the questions about the quantity and price. The most important issue that has to be addressed here is whether countries benefit from such situation.

We can first consider Russian market. When engaging in the foreign trade, the prices in Russia fall down and consequently the quantity of fish consumed increases. This is beneficial for consumers of fish, as they can consume more now and pay a lower price than before. Unfortunately for producers in the import-competing sector, now when selling fish, they sell it for a lower price and production fish in import markets declines. Overall, import markets start to produce less and receive a lower price (Applyard et al., 2008).

In the case of Norway, prices are higher now when Norway is trading. With the higher prices production increases also. This is beneficial for Norwegian fish producers. They have an increase in production and they receive higher prices. However, this is not the end of the story. The consumers in the Norwegian fish market must pay higher prices as a consequence of the trade. Additionally, the consumers in the Norwegian market were consuming more, but as a consequence of exports to Russia, they to consume less than they did before.

The thesis attempts to capture some elements of the excess demand that is why it is important to state the determinants of the excess demand that are identified by the theory. Generally, the excess demand function looks like the following:

$$ED = f\left(Y, \frac{P_1}{P_2}, E, Pop\right), \quad (1)$$

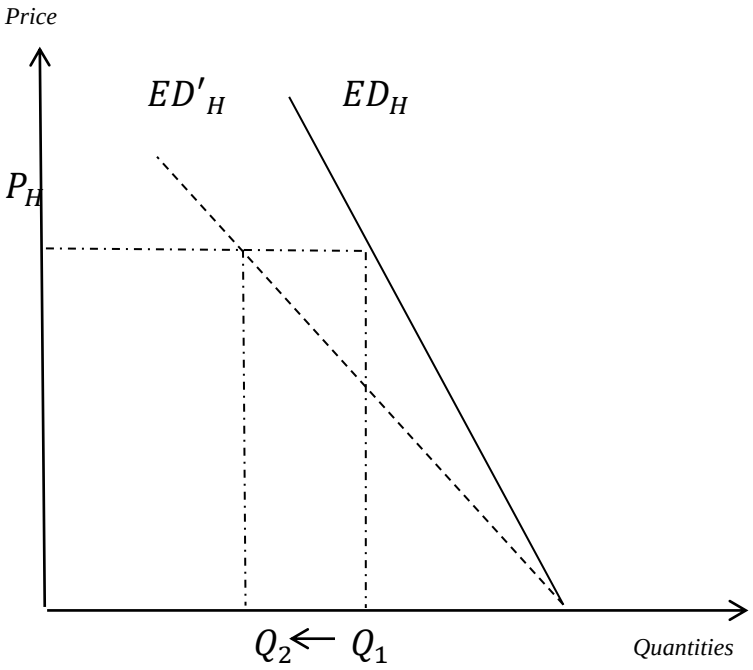
where Y is income, P_1/P_2 is the price of one good relative to the price of the other good, E is exchange rate.

As the excess demand function (1) shows one of the determinants of the excess demand is income. When changes in income occur it can lead to three outcomes. The demand can be positive, negative or neutral, depending on the type of the good we are referring to. If we are talking about normal good, then an increase in income leads to an increase in the demand for the normal goods. Consequently, a decrease in income will lead to a decrease in the demand for the normal goods. For an inferior good an increase in income leads to a decrease in the demand and vice versa. When talking about necessities, a decrease in consumer's income has little or no effect at all on the demand of the necessities (Riley, 2006). This is so called income effect. With the higher income consumer tends to choose more of the goods at a given price. One of the measurements of the income is GDP (Waggener, 1997). In this case, GDP of the importing country will be used.

Another important determinant of the excess demand is price. Here we can think of the price of the good that is offered by the exporter. A single price or the price ratio can be used, depicting the substitution in consumption.

The demand for the good can be affected by the prices of other products, which can be substitutes or complements. In case of the substitutes, a substitute product can be consumed instead of the original one. In this case, fish can be referred to as the substitute. For example, the demand for salmon, which is generally a higher priced fish species comparing to herring, can increase in case of the fall in the prices for salmon. Consumers may basically start demanding more salmon at the time when the prices will be lower for salmon. However, as soon as the prices for salmon will become high again, consumers will demand more herring (Waggener, 1997). This situation in the herring market is depicted in the graph 14, assuming that the price in

the salmon market goes down, price in the herring market denoted P_H stays the same, however the consumers decrease their consumption of herring, this is shown in the shift of ED_H and increase their consumption of salmon. In this case salmon is a product substitute for herring.

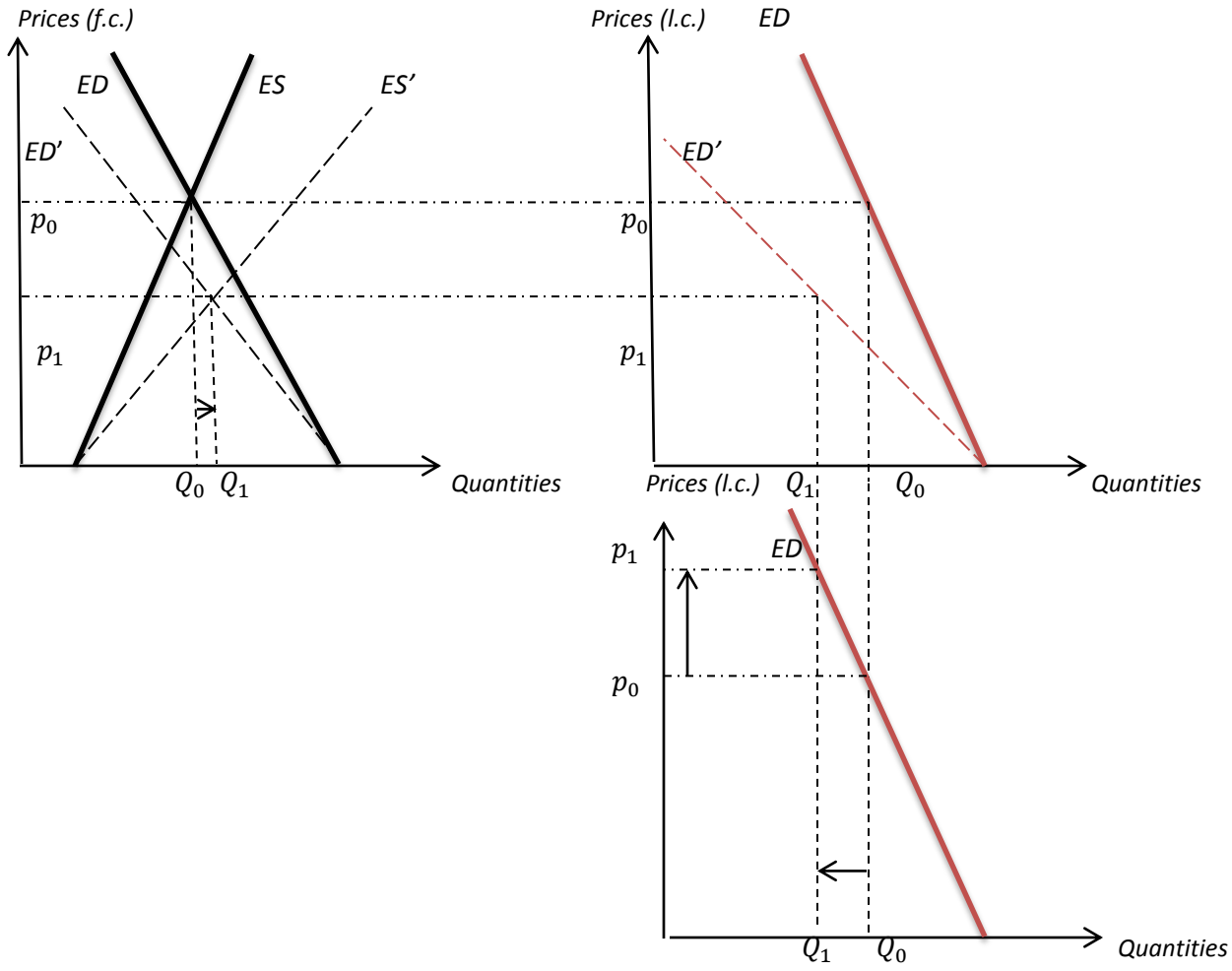


Graph 14: Herring market

The exchange rate is an important determinant of the excess demand. Exchange rate can make it cheaper for exporter to export and at same time more expensive for importer to import. It is important to look at the exchange rate in the case of determining export potential of the country in order to see if in case of unexploited potential how much of that can be attributed to the volatility in the exchange rate.

If the exchange rate of the foreign currency relative to the local currency goes down, meaning that the same amount of the foreign currency can be now bought for a lesser amount of the local currency, gives consumers the possibility of demanding more of the foreign goods than they did before. The opposite effect occurs if there is an increase in the exchange rate of the foreign currency relative to the local currency, in this situation consumers cannot buy the same amount of goods as before for the same money, now more money is needed. So, changes in the exchange rate have an effect on excess demand. The thesis uses the exchange rates of US$ to the local currency in the importing country. It is more convenient to look at the partial equilibrium model

which illustrates the situation where local currency of the importer depreciates with respect to the foreign currency. Due to the use of US $ as the currency in which exports happen, US$ is referred to foreign currency in this graph.



Graph 15: Depreciation of the local currency (*Source: Houck)*

Graph 15 depicts the situation in the case of the depreciation of the local currency with respect to foreign currency. The right-hand side of the panel represents the exporter and the left-hand side illustrates importer. Due to the appreciation of the foreign currency with respect to local currency a shift both in excess demand and excess supply occurs. Foreign consumers start to demand more domestic goods, this is reflected in the shift of the excess demand curve. A shift in the excess supply is due to a fact that it becomes more favorable for exporter to export. Due to the appreciation of the local currency of exporter it becomes cheaper to export, in this case there

is a fall in the price from p_0 to p_1. Consequently, the volume of exports increases from initial volume Q_0 to a higher volume Q_1. How large the increase in exports is depends on how large the depreciation in the currency is. The higher the depreciation of the local currency is, the higher the appreciation of the foreign currency. Consequently, the higher the shift in the excess supply and excess demand is, the higher is exportable surplus, meaning the higher the exports.

A shift in the excess demand curve appears on the importer's market. The shift can be attributed to higher prices and willingness to import less than before, this is reflected by a decrease in volume importer from initial volume Q_0 to a lower volume Q_1.

Increase in number of potential buyers, meaning the increase in population is an important factor for the excess demand as well. It is believed that when the population increases the demand for products grows as well. With the higher population more products are needed to satisfy the higher demand.

It is important to note that there is one more determinant of the excess demand such as tastes and preferences. This determinant is characterized by the difference in the knowledge of the good, cultural and individual tastes, social preferences. However, we will not be focusing on this determinant in this thesis.

3.2. Related literature

Many papers have examined the trade potentials between countries using a gravity model approach, analyzing both aggregate bilateral trade and product-level trade as well. Additionally, there are studies that used cross-sectional or panel data. This sub-section will present some of the studies that have been conducted to examine trade potentials and trade determinants.

Rahman (2003) investigated the trade flows between Bangladesh and its trading partners during 1972-1999 by estimating a gravity model of trade (sum of exports and imports), and of export and of import, separately. The results suggested that Bangladesh's trade was positively affected by the size of the economies, per capita GDP differential of the countries involved and openness of the trading countries. Among Bangladesh's main trade determinants were: the exchange rate, partner countries' total import demand and openness of the Bangladesh economy. These three

factors had a positive effect on the amount of Bangladesh's exports. This study is relevant for this thesis in many ways, both model of exports and panel data are employed in the thesis.
Paas (2000) studied trade flows of Estonia and the main trading partners estimating export and import as two separate equations. Following Pass (2000) this thesis estimates an equation for export. Additionally, five out of ten major trading partners of Norway are Russia, Ukraine, Poland, Latvia and Lithuania. These countries are as well present in Paas (2000) study. The paper uses GDP of the importing country, distance and various dummy variables that showed a significant impact on the trade of Estonia. These reasons stand out for the belief that it is important to include those variables in the gravity model of export of this thesis.

Eita and Ashipala (2008) analysed the determinant of Namibia's export to find out if there is unexploited export potential. They estimated gravity model for total exports, metal exports, fisheries exports and tourism exports. The results suggested that the rise in Namibia's total exports is positively related to the importer's GDP and Namibia's GDP. An increase in importer's GDP per capita and Namibia's GDP per capita are related to the decrease in Namibia's total exports. The explanation for this is that as there is an increase in per capita income the country becomes self-supported and also that Namibia exports less when the country grows. The variable explaining the real exchange rate was also included in the model, but it was not statistically significant. The distance variable is associated with the decrease in total exports, was as expected. The results showed that exports in the fishing sector are determined by the importer's GDP per capita, Namibia's GDP per capita, real exchange rate. If there is an increase in the importer's GDP per capita this will be followed by the increase in exports of fish. This thesis studies the fisheries sector as well, so the results might share similarities to that of Eita and Ashipala (2008). However, if the difference in the obtained results will occur, it can be attributed to the fact that disaggregated data is used in Norway's approach.

In the study of Thai (2006) the determinants of trade and trade potential of Vietnam towards 23 European countries (EC-23) has been estimated. The paper built a gravity model estimated with panel data and pooled, random, fixed effect estimation for 1993-1994. The results indicated economic size, market size and exchange rate volatility as the main determinants of trade in Vietnam with EC-23. The increase in trade between Vietnam and the EC-23 due to increase in economic size and market size was explained by the effect of economic growth of individual

economies on trade relationship. However, distance and history variables had no effect on bilateral trade between Vietnam and the EC-23. Similarly, in the case of Norway, a panel data and fixed effects model is used. Due to the similarity of Mortazavi (2006) study to the case of Norway's trade potential, an inclusion of the above mentioned variables is reasonable.

Eita and Jordaan (2010) studied the determinants of South Africa's exports of wood and tried to identify the presence of unexercised trade potential with its partners for the period 1997-2004. The results suggested that there was a positive effect of importer's GDP and South Africa's population on exports of wood products. On other hand, South Africa's GDP had a negative effect on exports of wood products, which can be explained by the high growth of the domestic construction sector in recent years. Another result concerning the importer's population suggested that there was a negative impact of importer's population on wood exports, meaning that as the population in the country grows it becomes more self-supported. This study also found a negative and statistically insignificant effect of the distance for the exports of wood. As per the method of Eita and Jordaan (2010) this thesis employs disaggregated data as well. In the previously discussed studies, the distance variable of the gravity model has not been statistically significant. The specification in this model includes distance and it could be that its influence on Norwegian fish exports is also not a relevant factor.

Leitão (2010) examined the determinants of bilateral trade between United States and NAFTA, the European Union, and ASEAN countries using panel data for 1995-2008. The results of the study suggested that the distance has a negative and significant impact on trade. Additionally, the study found the confirmation of the common border dummy variable to be statistically significant and have positive effect on the bilateral trade. Due to the similarity of the Leitão (2010) study, it is reasonable to include dummy variable accounting for common border in the case of Norway as well.

Rahman (2009) investigated the trade potential of Australia towards its main trading partners using a gravity model approach. The results suggested that bilateral trade of Australia was positively affected by economic size, per capita GDP, openness variable, common language and distance dummy variables. Distance between trading partners negatively affected Australia's bilateral trade. The largest effect on bilateral trade of Australia had openness variable which was calculated as the ratio between trade and GDP. Nearly proportional to the openness variable

effect was GDP variable and the variable with the lowest influence in GDP per capita. Following Rahman (2009) it is rational to adopt the openness variable to study Norwegian trade potential as well, because this variable may serve as a good approximation for how open to trade the country is.

Ram and Prasad (2007) estimated trade potential for Fiji using the augmented gravity model approach. They used cross-sectional data for 2005, using a gravity model estimated by using OLS method. The authors tried to cover all the data that is available on world trade flows. The results suggested that the gravity model fits well with the data and provides precise income and distance elasticity as well as the estimates for geographical, cultural and historical characteristics. The independent variables that are often used in the gravity model specification, such as the exporter GDP, the importer GDP and distance, are statistically significant providing reliable t-statistics. Meaning that the country pairs with higher GDP and geographical proximity are the most valuable recipients of Fiji's export trade flows. Historical and cultural characteristics such as common border, common language. colonial links, landlocked variable, regional trade agreements dummy all have positive affect on trade as well. In the case of Norway, a common border variable can be included as well due to existence of countries in the sample that share common border with Norway.

In its working paper of the State Bank of Pakistan, Butt (2008) investigated the trade potential of Pakistan. To make sure that the obtained results were unbiased and that the data have maximum coverage the paper included cross-sectional data for 2002-2003 and covered 132 exporting and 154 importing countries. The study applied a pseudo maximum likelihood technique, which helped to get over the estimation problems which were present in the gravity literature. Among the variables that were used in the model there are bilateral measure of market access, distance, language variable, conflict variable, the importer's GDP, the variable of southern hemisphere to test the possible lower trade in primary commodities such as agriculture and FDI (Foreign Direct Investment) that may help to investigate the bilateral trade effects. All of the variables implemented in the model provided expected signs providing reasonable explanations. Again, there is confirmation regarding the use of the importer's GDP as an important variable revealing the income characteristics of the nation. It is a valuable estimator for the Norwegian case as

well, meaning that it is possible that in case of increase in GDP importer country will demand more exports.

Batra (2004) investigated the trade potential of India with its major trading partners by using a augmented gravity model approach. The paper used cross-sectional data for 2000 and an OLS estimation technique. With the help of geographical, cultural and historical proximity of bilateral trade pairs along with their economic size the study tried to explain bilateral trade. All three traditional "gravity" effects such as the exporter GDP, the importer GDP and distance are statistically significant. The results showed as expected that the higher economic size of the country pair and geographical proximity has a positive effect of bilateral trade flows. In like fashion Norwegian fish exports may be sensible to the importer's GDP and the distance between Norway and its trading destinations as well.

It is necessary to note that a study using disaggregated fish data for Norway has not been done before. Furthermore, the papers on the aggregated fish data for Norway have not been published yet. Due to these facts, the next chapter will present a new augmented gravity model that has been constructed based on the studies of trade potentials of the countries.

3.3. Rationale for explanatory variables

Brun et al. (2005) refer to the gravity approach of trade modeling as "the workhorse". The gravity approach is widely used, no wonder why there are numerous variations in gravity model specifications. Kepaptsoglou et al. (2010) noted that when we talk about bilateral trade flows, export is the common variable to be used. However, there are number of other variables that must be taken into account. Kepaptsoglou et al. (2010) divides the variables into two groups:

- Factors testifying demand and supply of trading countries,
- Factors embodying the impedance on a trade flow between countries.

The first category may include GDP, per capita GDP, income level, population, area size, these are the variables that are commonly used in a gravity model specification. For instance, when thinking about GDP, we realize that the larger is the country in terms of GDP, the increased likelihood that the country offers a larger variety of goods. If two countries are similar to each other in terms of GDP then the bilateral trade between these two countries is higher (Paas, 2000).

GDP is used in the model as a proxy for specifying the countries' economic size, production capacity and size of the market. If the country is endowed with great production capacity, it is highly likely that the country will achieve economies of scale and will increase its exports through its comparative advantage. This also creates a situation where large domestic markets are able to sponge up more imports (Sohn, 2005). Another point of view regarding the inclusion of GDP in the gravity model was by Krugman and Obstfeld (2006) who argued that large economies have high income, consequently, they usually spend high amounts on imports.

Apart from using GDP it is also important to use GDP per capita as an independent variable that illustrates the level of development. It is quite straight forward, meaning that if the country develops more, then the consumers will demand foreign products that are referred to as superior goods. Additionally, the country with high development is progressive in innovation, that lead to larger varieties of goods and inventions of new goods that are later demanded as exports by other countries (Rahman, 2009). The theory predicts that per capita GDP has a positive effect on trade. GDP per capita is often referred to as the purchase power of exporting and importing countries (Sohn, 2005). There are studies that used GDP variable in their research (Bergstrand (1985) and (1989), Antonucci and Manzocchi (2006), Ozdeser and Ertac (2010)), others implemented their research with per capita GDP (Bergstrand, 1989; Rahman, 2003; Rose et al., 2000).

The second category which is related to impedance factors can be referred to variables that have a positive or negative effect on trade. Transportation cost is one of commonly used variables in this category. Transportation is incorporated in the gravity model as the variable of distance. Typically, distance is calculated as the distance between the countries' economic centers (Kepaptsoglou et al., 2010). It is logical to think that as the transportation costs increases, the trade between trading partners decreases. This argument is presented in Rivera-Batiz and Oliva (2003). The belief that globalization should lead to "death of distance" is misleading (Brun et al., 2005). Leamer and Levinsohn (1995) concluded that the effect of distance on trade patterns does not diminish over time, and that contrary to what is commonly stated, the world is not getting smaller. Rahman (2009) notes that trade volume is determined by the distance between the two trading countries. He differentiates three kinds of costs associated with doing business a distance: a) physical shipping costs, b) time-related costs and c) costs of (cultural) unfamiliarity.

Melitz (2007) studied North-South international trade. The study provides evidence that distance did increase trade along the North-South dimension.

Another variable that can be included in the gravity model specification is leaving a common border. Lower costs and easier access are two characteristics that are associated with common border (Papazoglou, 2007). The presence of common border between two countries gives them more chance to end up trading with each other than two countries that do not share common border (Karemera et al., 1999). Nitsch (2000) studying the effect of national borders over EU countries suggested that national borders have a crucial impact on trade patterns even within the European Union. In case of Norway it is vital to consider this variable since Norway and Russian Federation share a land border.

One more important variable is the price variable. Rahman (2003) stated that exclution of price variables in the gravity model will cause misspecifications. Other studies like Bergstrand (1985), Helpman and Krugman (1985) also share Rahman's view. Rahman (2003) writes that in general the products from one country with high prices move to another country which has lower prices. Hence, the changes in export prices are positively related to the trade flows and changes in the import prices has a negative influence on trade flows (Karemera et al., 1999). In the case of Norway the following price variables are used, price and exchange rate, inflation rate.

One more important variable is openness. Cortes (2007) suggested: "Openness in an element that makes a difference in the formulation of traditional gravity equation". An example of the country with low openness ratio was presented in Guttmann and Richards (2004), who studied Australia's trade openness. They suggested that the main reason for Australia's low openness ratio is its geographical location by which Australia is a continent that is situated far away from the rest of the world. Openness can be expressed as total exports plus total imports over GDP (Cortes, 2007). This variable can either increase or decrease the trade flow between the countries.

4. Method and data

4.1. Sources of data

The aim of the thesis is to estimate the trade potential of Norwegian fish exports during 1993-2010 to the ten eastern and western European import markets presented earlier. To capture the trading relationship between Norway and the ten countries chosen for the study a gravity model approach using disaggregated panel data will be employed. After the estimation, the obtained estimates are compared to the real trade data for Norway to estimate Norway's fish trade potential in the above mentioned markets.

The fish trade data, the quantity of exports and value of trade and production for salmon, trout and herring are taken from the United Nations (Comtrade database, 2012). The dependent variable in the model is the disaggregated annual data on fish exports trade flows which is measured in US dollars. The price variable is constructed using the trade value and volume data from the website of UN Comtrade as well.

Data on the gross domestic product of the importing countries were obtained from the World Development Indicators (WDI) and are measured in US dollars (World Bank online database, 2012). The data on the fish production in Norway were obtained from a UN website (Food and Agriculture Organization, 2012). The exchange rate, defined as the exchange between US dollar and local currency in the importing country is obtained partly from the OANDA website and from the websites of the National Banks in the ten countries chosen for the study, detailed references are provided in the bibliography list. The Economic Freedom Index (EFI) as a proxy for the country's economic freedom is obtained from the Datapult website (Datapult, 2012). Additionally, the classifications for the EFI were obtained from the Heritage Foundation website (Heritage Foundation, 2012). The openness variable is constructed using the data from UN Comtrade on overall trade volume and gross domestic product collected form the World Bank.

The dummy variable corresponding to the common border was constructed using CIA's World Factbook (CIA, 2012). The data on distance in kilometers, calculated as the distance between Oslo and capitals of the ten countries chosen for the study are obtained from the Meridian World Data website (Meridian World Data, 2012).

4.2. Data manipulation

The United Nations Comtrade database provides the data on fish exports by its volume in kilograms and its value is in US dollars. To construct the unit value of three fish species, namely salmon, trout and herring the ratio of value of exports to volume of exports were used. Such unit values are used for the regression on total fish. The rest of three regressions on salmon, trout and herring employ different approach.

The regression on salmon uses the ratio between the prices for salmon relative to the weighted average of prices of trout and herring. Price for salmon is calculated as the unit value described above. Weighted average price of trout and herring is calculated in the following manner:

$$\textit{Weighted average price} = \left(\frac{Volume\ of\ exports\ of\ trout}{Volume\ of\ exports\ of\ trout * Volume\ of\ herring}\right) * P_t +$$

$$+ \left(\frac{Volume\ of\ exports\ of\ herring}{Volume\ of\ exports\ of\ herring * Volume\ of\ exports\ of\ trout}\right) * P_h, \qquad (1)$$

where P_t and P_h are price of trout and herring, respectively. The prices for herring and trout are calculated in the same ways as the price of the salmon. Consequently, the regressions on trout and herring are performed in the same manner as the one for salmon illustrated above.

Another variable that was created is, the openness index, which was calculated as the following ratio:

$$\textit{Openness index} = \frac{Total\ exports + Total\ imports}{GDP} \qquad (2)$$

4.3. Definition and expectations of variables

The GDP per capita of the importing country, measured in the US dollars, can have a positive as well as negative sign. Positive sign mean that if the GDP per capita in the importing country increases, imports increase as well. Rahman (2009) noted that a positive sign explains the tendency to trade with larger economies. A negative sign will illustrate the self-sufficiency of the country, meaning that with the higher GDP per capita country can support herself with domestic

production, so the demand for imports decreases. These results will be examined to determine whether it holds in the case of Norwegian fish exports and in an east-west country context.

The gross domestic product of the exporting country is measured in the US dollars as well. This is the variable that has been used in the numerous model specifications of the gravity model (Rahman, 2009; Rahman, 2003; Ram and Prasad, 2007; Eita and Ashipala, 2008). A positive as well as the negative sign can be obtained. Fish production in Norway is measured in tons and it is expected to have a positive sign. The explanation for the positive sign is straightforward, as the production of fish in Norway increases, Norway is expected to have larger exportable surplus, meaning that it would export more fish.

The Norwegian price of three fish types is expressed in the US dollars/kg and it is expected to have a positive sign in the estimation results. If the price of fish in Norway increases, exports increase as well. The price ratio is measured in US dollars and it is expected to appear with a positive sign as well. The higher is the price of fish in the importer's port, the larger the volume of exports by Norway.

The exchange rate variable is defined as the quantity of US dollars that can be exchanged for one unit of the local currency of the importing country. A positive sign is expected, meaning that an increase in the exchange rate leads an appreciation of the local currency making foreign currency prices goods cheaper, meaning that the quantity in import demand will increase.

The openness variable is the variable constructed as the ratio between trade (exports plus imports) and GDP of the country. The more open the countries are, the greater would be the trade between them (Rahman, 2009). Consequently, a positive sign is expected to be obtained for this variable. The Economic Freedom Index is a variable that has been included to take into account the country's economic development. The variable is expected to have a positive sign. A county being more economically opened should lead to a greater trade.

One of the important factors in trade is transportations costs (Rahman, 2009). In this thesis transportation costs are more important for the countries in the East than the countries in the West. To capture aspect a dummy variable for distance is used as a proxy for the transportation costs between the economic centers of the exporter and importer countries. Despite the globalization wave that should lead to the "death of distance", transportation costs are still important for today's trade relationships between countries (Brun et al., 2005). A negative sign for this dummy variable is expected, meaning that distance is negatively related to exports. To

capture geographical factors a dummy variable for common border is used (Ram and Prasad, 2007). Common border variable is expected to have a positive sign, meaning that if countries share a common border that may engage a larger volumes of trade between them (Ram and Prasad, 2007).

4.4. Transformation of the variables

To make the estimation of the gravity model easier the model is estimated in double log form. The transformation of the variables into natural logarithms is performed by generation command in the Stata software. All the variables except dummy variables are transformed into the natural logarithm form. In the case of Norwegian fish exports the only variable that will not be in the log form is the common border dummy variable.

4.5. Testing for stationarity

The regression that tends to accept a false relationship or to reject the true one is referred to as spurious correlation. Testing for unit roots has become a common procedure in applied econometrics to avoid spurious correlation (Chiarella et al., 2002). If the variables of the model will appear to be non-stationary, this would mean that it would be necessary to apply a co-integration test before their inclusion, then the variables are included into the final model (Villavicencio, 2010). That is why it is important to test the variables for non-stationarity (unit root) before estimating the model.

The most common tests in practice are IPS test developed by Im, Pesaran and Shin (1997) and the LLC test developed by Levin, Lin and Chu (2002). These are unit root tests conducted to provide testing of dependent and independent variables for stationarity. The IPS test provides the possibility for autoregressive parameters to vary across the countries and additionally for individual unit root processes. This test is more forceful than the single-equation augmented Dickey- Fuller test (ADF). The null hypothesis for this test is that all series contain a unit root test and the alternative is that at least one series in the panel contains a unit root (Eita et al., 2008). One of the advantages that come with the IPS test is that it can be implemented on the unbalanced data, meaning missing observations are allowed to be present in the data for some years. In the context of this study analysis, it is the absence of export flow in some years. The

disadvantage of the LLC test is that it has to be performed on strongly balanced data, meaning the presence of the data for all cross-sections for all the years of the study. The null hypothesis of the LLC test is that there a panel contains a unit root and the alternative is that all panels are non-stationary. The assumption about common autoregressive parameters across the countries is made (Eita et al., 2008).

4.6. Results of tests of stationarity

The results of the panel unit root tests for total fish exports, exports of salmon, trout and herring are presented in the table 8. In the case of the dependent variable the IPS test has been used, as the panel for this variable is unbalanced. The result for this test shows that the dependent variable, being the natural log of the fish exports from Norway, is stationary. This means that is it not necessary to imply co-integration test and that the gravity model can be estimated using ordinary least squares method.

For the panel unit root tests of total fish exports the IPS test is also performed on the variable of exports, which is log of total fish exports and price, which is the log of Norwegian price for fish. These variables are also stationary. For the rest of the variables employed in the model the LLC tests have been used as the data are strongly balanced. Some of the variables are trend stationary. These are such variables as GDP, importer's GDP per capita, exchange rate, production of fish in Norway. These variables are called trend stationary due to the fact that they become stationary when the trend term is added to the LLC test. The variable GDP, importer's GDP per capita as well as the exchange rate variable and the variable corresponding to the production of fish in Norway are trend stationary with four lags.

Table 8: Panel unit root tests for the regression analysis

Variable	IPS test statistic		LLC test statistic	
	coeff	p-value	coeff	p-value
	Estimation on total fish exports			
lnX	-2,979	0,001	-14,874	0,000
lnY_j	-2,965	0,002	-4,879	0,000
lnQ_{Nor}	-0,856	0,196	-8,585	0,000
lnP_{Nor}	-2,086	0,019	-6,428	0,000
lnE	-5,365	0,000	-5,693	0,000
lnTOI	-2,947	0,002	-1.0e+02	0,000
lnEFI	-4,716	0,000	-10,141	0,000
	Estimation of salmon exports			
lnX	-4,056	0,000	-6,414	0,000
lnY_j	-2,965	0,002	-4,879	0,000
lnQ_{Nor}	-4,056	0,000	-8,992	0,000
lnP-ratio	-1,483	0,069	-24,098	0,000
lnE	-5,365	0,000	-5,693	0,000
lnTOI	-2,947	0,002	-1.0e+02	0,000
lnEFI	-4,716	0,000	-10,141	0,000
	Estimation on trout exports			
lnX	-3,113	0,001	-24,975	0,000
lnY_j	-2,965	0,002	-4,879	0,000
lnQ_{Nor}	-3,625	0,000	-20,797	0,000
lnP-ratio	-14,09	0,000	-41,992	0,000
lnE	-5,365	0,000	-5,693	0,000
lnTOI	-2,947	0,002	-1.0e+02	0,000
lnEFI	-4,716	0,000	-10,141	0,000
	Estimation of herring exports			
lnX	-3,113	0,001	-30,118	0,000
lnY_j	-2,965	0,002	-4,879	0,000
lnQ_{Nor}	-3,113	0,001	-30,536	0,000
lnP-ratio	-4,023	0,000	-3,481	0,000
lnE	-5,365	0,000	-5,693	0,000
lnTOI	-2,947	0,002	-1.0e+02	0,000
lnEFI	-4,716	0,000	-10,141	0,000

As for the results of the panel unit root tests for exports of salmon it is not necessary to provide an interpretation of the unit root tests representing the variables such as GDP, importer's GDP

per capita, exchange rates, openness index due to the fact that all of them have been already interpreted for the regression on total fish exports.

As for the rest of the variables, IPS unit root test has been used for the exports of salmon expressed in the log form. The IPS unit root test for this variable was used due to the fact that there are some zero trade flows, meaning that the data is unbalanced. Exports of salmon are stationary with one lag. The EFI index was tested using LLC test. This variable is stationary with three lags. All the variables used for the regression on exports of salmon appeared to be stationary, meaning that no co-intergration test is necessary.

The results on the panel unit root tests for exports of trout shows that exports of trout variable in the log form has been tested for stationarity using IPS unit root test, due to the fact that the data for this variable is unbalanced. Exports of trout variable have shown stationarity with two lags. The price variable in the log form has been tested using IPS unit root test as well and shown a stationarity with four lags. As for the rest of the variables they were stationary and were tested using LLC unit root test.

For the results of the panel unit root tests for regression of herring the variable of exports of herring in the log form has been tested for stationarity by IPS unit root test. The results suggest that exports of herring are stationary with four lags. The price variable is stationary as well with one lag, tested with a help of IPS unit root tests. As for the remaining variables, those are stationary as well.

4.7. Development of the four models

There are many empirical studies on trade potential some of which has been reviewed in the previous section. All of the papers (Rahman, 2003; Rahman, 2009; Eita and Jordaan, 2010; Thai, 2006; Leitão, 2010; Eita and Ashipala, 2008) tried to create the most appropriate specification of gravity model to incorporate relevant issues that must be considered when building the model. This thesis will present another specification of gravity model by incorporating some of achievements from previous studies.

Although cross-sectional data are traditionally used in the estimation of gravity model, the approach used here is panel data as it captures the relationship between the variables over time

and for different fish products. Rahman (2003) stated that panel data can oversee the unobserved trading-partner-pairs' individual effects. In cases where there is a correlation between individual effects and regressors, OLS estimates omitting individual effects will be biased. Hence, the implementation of the panel data in this study helps to omit this problem.

The gravity approach has been an important tool for addressing issues in international trade for around 40 years, because of its explanatory power and empirical robustness (Kepaptsoglou et al., 2010). The gravity equation can be applied in four different directions, such as: estimating the cost of the border, explaining trade patterns, estimating effects with regards to regionalism and trade potentials (International Trade Centre, 2003). In this paper, the trade potential application of gravity approach, together with the effects with regards to regionalism have been investigated.

The application of a gravity model for analysis of trade flows was firstly presented in 1961 by Linder, followed up by Tinbergen (1962) and Linnemann (1966). However, the approach used in these papers was relying only on empirical results, which did not have any theoretical foundation, consequently, providing great criticism. The necessity of theoretical justification was first discussed in Anderson (1979). Bergstrand (1985) followed up by using the same assumptions that were presented by Anderson (1979). Helpman and Krugman (1985) and Deardoff (1998) continued the development of the gravity model approach. These studies realize the great usefulness of the gravity approach, estimated trade flows, but also developed gravity modeling a technique that can address other relevant issues with respect to international trade.

The standard model specification that was presented in Rahman (2003) is the most frequently used and it looks as follows:

$$PX_{ij,t}=\beta_0(Y_{i,t})^{\beta_1}(Y_{j,t})^{\beta_2}(N_{i,t})^{\beta_3}(N_{j,t})^{\beta_4}\ (D_{ij,t})^{\beta_5}(A_{ij,t})^{\beta_6}\varepsilon_{ij,t} \qquad (4.1)$$

where PX_{ij} is the value of exports from country *i* to country *j* in US $, at time *t*; $Y_{i,t}$ in the GDP of country *i* in US $ at time *t*; $Y_{j,t}$ is the GDP of country j in US $ at time t; N_i and N_j are the country's i and j population; D_{ij} is the distance in kilometers between economic centers of country *i* and country *j* which is not a time variant variable; A_{ij} are factor(s) that might help or restrict trade between country *i* and *j*; and ε_{ij} is a log-normally distributed error term, with $E(ln\varepsilon_{ij})=0$. In this case the error term combines an individual effects term and a regular error term.

Instead of using population it is possible to use per capita income, in which case the model becomes:

$PX_{ij,t}=\beta_0(Y_{i,t})^{\beta_1}(Y_{j,t})^{\beta_2}(y_{i,t})^{\beta_3}(y_{j,t})^{\beta_4}\ (D_{ij,t})^{\beta_5}(A_{ij,t})^{\beta_6}\varepsilon_{ij,t}$ *(4.2)*

where y_i and y_j are country's I and country j income per capita.

In the log form, the equation 4.2 appears:

$log(PX_{ij,t})= \beta_0+\beta_1 logY_{i,t}+\beta_2 logY_{j,t}+\beta_3 \log y_{i,t} + \beta_4 logy_{j,t} + \beta_5 logD_{ij,t}+\beta_6 logA_{ij,t}+\varepsilon_{ij,t}$

(4.3)

The pre-testing estimation of (4.3) provided reasonable results. However, it was obvious that other variables shall have to be included in the model to capture greater scope of factors influencing exports.

The studies reviewed in the literature sub-section tend to estimate gravity model adding several dummy variables. In the Norwegian case it is reasonable to include common border variable, as it is believed that sharing common border with importer results in higher trade volumes. Then the model becomes the following:

$log(PX_{ij,t})= \beta_0+\beta_1 logY_{i,t}+\beta_2 logY_{j,t}+\beta_3 \log y_{i,t} + \beta_4 logy_{j,t} + \beta_5 logD_{ij,t}+\beta_6 CB+$

$\beta_7 logA_{ij,t}+\varepsilon_{ij,t}$ *(4.4)*

where *CB* is the common border dummy variable.

In this thesis an augmented gravity models used to analyse trade potential of Norway. The model is referred to as "augmented" because additional conditioning variables are used that may influence trade. There are 4 estimations, exports of all 3 fish aggregated and for exports of each fish type separately.

Following the specification provided by Berstrand (1985) and adapting the model in the way that fits this specific case, the model for total fish exports becomes as expressed by:

$\log\left[X_{i,j}\right]_K= \beta_0 + \beta_1 \log y_j + \beta_2 \log Q_i + \beta_3 \log P_i + \beta_4 \log E + \beta_5 \log TOI_j + \beta_6 \log EFI_j + \beta_7 \log D_{ij} + \beta_8 \log Border_{ij} + \alpha_j + u_{ij}$ *(4.5)*

The model that was used for the estimation of exports of each fish species separately is expressed by the following:

This equation is used as an overall regression for estimation of three fish species, namely salmon, trout and herring. In equation (4.5) X_{ij} is the tons of fish exported by Norway to the ten European markets; k subscript refers to three fish types; y_j is GDP per capita in the importing country measured in US dollars; Q_i denotes fish production in Norway in tons; P_i is Norwegian price for fish measured in $/tons at the importer's port; E is the exchange rate between US dollars and one unit of the local currency of the importing country; TOI_j is proxy for openness in the import's market; EFI_j is the Economic Freedom Index, which has a value between 0 and 100; D_{ij} is the dummy variable for distance, which is defined as the kilometers between the economic centers of the exporter and importer; $Border_{ij}$ is a dummy variable for common border, taking a value of 1 if there is a common border and 0 otherwise; and α_j represents the individual country effects and u_{ij} is the regular error term.

To estimate separate equations for salmon, trout and herring the following equation is estimated:

$$\log \left[X_{i,j}\right]_K = \beta_0 + \beta_1 \log y_j + \beta_2 \log Q_i + \beta_3 \log \left[P_1/P_{2,3}\right]_i + \beta_4 \log E + \beta_5 \log TOI_j + \beta_6 \log EFI_j + \beta_7 \log D_{ij} + \beta_8 \log Border_{ij} + \alpha_j + u_{ij} \quad (4.6)$$

The only difference in this equation from the previous one is the price variable. Instead of using the Norwegian price for the fish, the ratio between the prices of fish species is used. The ratio changes depending on the fish species that is being estimated. In the case of salmon, P_1 denotes salmon and $P_{2,3}$ is the weighted average of the prices of trout and herring. Consequently, in the case of trout, P_1 corresponds to the price of trout and $P_{2,3}$ is the weighted average of the prices of salmon and herring. The same idea lays behind the calculation of the price ratio for herring.

4.8. Econometric tests and pre-testing

The estimation of panel data can be pursued in three different ways. The implementation of fixed effects models, random effects models and pooled regression can be used. The pooled regression is not relevant in this type of analysis as the pooled model does not allow for heterogeneity of countries, instead it assumes that all countries in the sample are homogeneous. Then, the decision concentrates on the choice between fixed effects and random effects models.

Fixed effects model helps to explore the relationship between predictor and the outcome. This model assumes that there are some individual characteristics that may or may not influence the predictor variable that is why it is important to control for this characteristics. Another assumption of the fixed effects model is that time-invariant characteristics are unique to the entity and should not be correlated with the other entity characteristics.

On the other hand, the rationale behind random effects models is that, unlike fixed effects models, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. To find out which model is the most appropriate in this analysis, the Haussmann test has been performed. The aim of the Haussmann statistic is to test the hull hypothesis that the regressors and individual effects are not correlated in order to differentiate between fixed effects model and random effects models. In the case of failure to reject the null hypothesis the estimation of the random effects model is appropriate. Consequently, if the hull hypothesis is rejected, it is more appropriate to use the fixed effects model.

Two sets of estimates are then compared, one consistent under two hypothesises H_0 and H_A and the other consistent under the H_0 hypothesis. If the resulting difference between two sets is very high, then H_0 is rejected. Hypothesises are specified as the following (Baltagi, 2005):

H_o: $E\ (u_{it} / X_{it}) = 0$, explanatory variables are uncorrelated with individual effects.

H_A: $E\ (u_{it} / X_{it}) = 0$, explanatory variables are correlated with individual effects.

The Haussmann statistic looks like the following (Hosny 2009):

$$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' \left[\hat{V}\{\hat{\beta}_{FE}\} - \hat{V}\{\hat{\beta}_{RE}\}\right]^{-1} (\hat{\beta}_{FE}\hat{\beta}_{RE}).$$

In this equation β_{FE} and β_{RE} are the estimated coefficients from the fixed and random effects estimators (Eita et al., 2008). In the case when the obtained Haussmann statistic is greater than the computed Chi-squared (χ^2) distributed with k degrees of freedom (k is equal to the number of the explanatory variables), the null hypothesis can be rejected, meaning that it is more appropriate to use fixed affects model.

Additionally, it is necessary to evaluate the results provided by the goodness of fit. In case of using the fixed affects model it is important to interpret the relevant for the fixed effects model R-square, which is a within R-square. This is due to the fact that the model concentrates on the differences "within" individuals (Verbeek, 2004). The F-test is an important statistic as well symbolizing the goodness of fit of the model to the data.

5. Results

The following chapter will present the first stage and second stage estimation results and export potentials. Furthermore, the estimation results for aggregated fish exports will be studied and the comparison between level of accession between East and West will be provided.

5.1. First stage estimation results: total fish exports, exports of salmon, exports of trout, exports of herring

Table 9 contains the results on pooled, fixed effects, and random effects models. Due to the homogeneity of the pooled model with respect to countries it is appropriate to base the choice on fixed or random effect models.

The Haussmann statistics helps to choose between these two models. Due to the high value obtained from the Haussmann test, the choice of the fixed effects model is more appropriate. Based on the results of the Haussmann test, the analysis will be concentrated on the fixed effects model results.

The results on total fish exports show that independent variables explain 64% of the variability in the dependent variable. All of the variables included to the regression came up with expected signs and are additionally statistically significant as well. The F-test has a high statistically significant value, meaning that data fits the model well. The variable that corresponds to the fish production in Norway has a positive sign, meaning that exports increases when the fish production in Norway grows. This suggest that a 1% change in the production of fish in Norway results in the 1,3% increase in exports, on average. The estimation results on elasticity of GDP per capita suggest that despite the growing GDP per capita in the importer's country, exports will decrease. This fact can be attributed to the self-support characteristic of the country that gets richer and does not require as many exports as it did before (Eita et al, 2008). The elasticity of the exchange rate has a positive expected sign, which means that appreciation of the foreign currency with respect to the local currency will lead to an increase in total exports of fish. A 1% change in the exchange rate will results in increase in exports by 0,2%, on average. Price elasticity has expected sign and it is statistically significant as well. However, the coefficient is inelastic, meaning that 1% change in price of fish leads to 0,08% increase in exports, on average.

If the Norwegian price will increase, it is profitable for Norway to export. Consequently, Norway will export more. Openness index has its value for the total fish exports as well. The results state that Norway tends to have higher trade with more opened countries.

As it was mentioned before the fixed effects model does not estimate time-invariant factors at once. First, it is necessary to estimate country specific effects that are used later on to perform second stage estimation. The results of estimation of country specific effects are presented in the table in the Appendix A1. The figures in the table show that there are unique characteristics in some countries that promote trade from Norway to Russia, Poland, France, Germany, Denmark. However, there as well characteristics that repress the Norwegian fish exports to Ukraine, Latvia, Lithuania, Sweden, the Netherlands. Due to these results it is important to investigate the export potential of Norway. The results obtained from the analysis can serve as a great guidance in the policy implications.

The results on salmon exports suggest that all of the variables that are used in the regression, except the variable representing production of fish in Norway, came up with expected signs and statistically significant. The R-square is 80%, meaning that independent variables used in the regression explain 80% of the variability in the dependent variable. The F-test has a high statistically significant value, meaning that data fits the model well. The elasticity of the importer's GDP per capita variable suggests that the increase in the importer's per capita GDP will result in higher export volumes of salmon. The result of the coefficient on this variable is elastic, meaning that 1% change in the importer's GDP per capita will lead to an increase in exports by 2,6%, on average. The elasticity of the exchange rate variable suggests that depreciation of the local currency with respect to the foreign currency will lead to an increase in exports of salmon. The elasticity of the exchange rate is inelastic, suggesting that 1% change in the exchange rate will increase exports by 0,5%, on average. Price elasticity has expected sign and it is statistically significant as well. The increase in the price of salmon relative to the weighted average price of trout and herring will cause exports of salmon to increase as well. The coefficient for this variable is inelastic suggesting that in case of 1% change in price of salmon relative to the price of trout and herring, exports will increase by 0,2%, on average. The openness index for the regression on salmon came up with positive sign suggesting that Norway's exports of salmon are higher to the more open countries. The Economic Freedom

Index has a positive sign as well. This means that Norwegian exports of salmon are higher to the countries with the higher economic freedom.

The country specific effects are presented in the Appendix A2 in the table. The table shows that there are unique characteristics in some countries that promote trade from Norway to Russia, Poland, Ukraine, Latvia, Germany, Denmark and Sweden. However, there are as well characteristics that repress the Norwegian exports of salmon to France, Lithuania, the Netherlands. Due to these results it is important to investigate the export potential of Norway. The results obtained from the analysis can serve as a great guidance in the policy implications.

Table 9: First stage estimation results

Variables	Pooled model		Fixed effects model		Random effects model	
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
			Estimation of total fish exports			
Constant	-1,999	-0,38	-4,67	-0,98	-7,946	-1,45
$\ln Y_j$	0,289	2,88*	-0,454	-2,18**	-0,125	-0,77*
$\ln Q_{Nor}$	0,973	3,43*	1,255	4,04*	0,983	3,49*
$\ln P_{Nor}$	0,1	1,75***	0,086	1,74**	0,086	1,69*
lnE	0,452	5,73*	0,226	2,55**	0,284	3,28***
lnTOI	0,203	4,90*	0,238	6,62*	0,24	6,62
lnEFI	-1,452	-1,45***	1,688	1,66***	1,009	1,00**
Distance	1,099	4,63*			1,024	2,1
Border	-0,158	-0,66			0,286	0,56
R-square		0,583		0,635		0,629
Haussmann test				5,53		
			Estimation of salmon exports			
Constant	-37,546	-4,58*	-28,082	-4,17	-47,47	-5,97*
$\ln Y_j$	1,799	11,27*	2,652	8,27*	1,775	9,14*
$\ln Q_{Nor}$	1,169	2,63**	-0,702	-1,51*	0,682	1,61***
lnP-ratio	0,185	1,72***	0,237	2,63*	0,185	1,86***
lnE	0,5	4,01*	0,465	3,49*	0,475	3,62*
lnTOI	0,428	7,15*	0,508	10,23*	0,459	8,35*
lnEFI	1,098	0,71	6,298	4,13*	4,059	2,61*
Distance	1,885	5,14*			2,562	5,38*
Border	0,084	-0,22			0,269	-5,95
R-square		0,789		0,798		0,785
Haussman test				42,75		

Table 9: Continued

Variables	Pooled model		Fixed effects model		Random effects model	
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
	Estimation of trout exports					
Constant	-26,566	-2,67***	-35,099	-4,33*	-33,732	-3,17*
lnY_j	1,043	4,61*	1,988	4,94*	1,106	4,21*
lnQ_{Nor}	1,972	6,36*	1,224	3,87*	1,761	5,79*
lnP-ratio	1,402	11,69*	1,316	12,07*	1,353	11,81
lnE	0,562	3,20**	0,896	4,24*	0,666	3,51*
lnTOI	0,13	1,35***	0,218	2,48*	0,178	1,92**
lnEFI	0,566	0,24	3,094	1,2	1,856	0,76
Distance	0,449	0,86			0,924	1,42***
Border	1,178	2,30**			1,216	1,87***
R- square		0,816		0,839		0,748
Haussmann test				17,98		
	Estimation of herring exports					
Constant	8,055	0,75	22,322	2,15**	6,835	0,52
lnY_j	-0,892	-4,14*	-0,761	-1,72***	-0,799	-2,25**
lnQ_{Nor}	-0,961	-1,65***	0,074	0,12	-0,037	-0,06
lnP-ratio	0,999	3,76*	0,836	3,36*	0,852	3,46*
lnE	-0,133	-0,77	0,099	0,49	0,061	0,31
lnTOI	0,461	5,90*	0,413	5,66*	0,42	5,81*
lnEFI	2,954	1,39***	0,249	-0,1	0,222	0,1
Distance	2,454	5,13*			2,244	2,19**
Border	1,259	2,55**			0,8	0,72
R-square		0,531		0,359		0,729
Haussmann test				0,98		

*Notes: */**/*** significant at 1%/5%/10% level*

All of the variables in the regression on trout exports are with the expected signs and are significant. The R-square value is 83%, meaning that independent variables explain 83% of the variability in the dependent variable. The F-test has a high statistically significant value, meaning that data fits the model well. The elasticity of production of fish in Norway suggests that 1% change in production of fish in Norway results in increase of exports by 1,2%, on average. The elasticity of importer's GDP per capita variable appears with a positive sign, suggesting an increase in exports of trout due to an increase in GDP per capita in the importing country. A 1%

change in the importer's GDP per capita results in 2% increase in exports, on average. The elasticity of the exchange rate is also important for the exports of trout. The result states that an increase in the exchange rate will cause an increase in Norwegian exports of trout. A 1% change in the exchange rate will increase exports by 0.9%, on average. Price elasticity elastic with expected sign and it is statistically significant as well. If 1% change in the price of trout relative to the weighted average price of salmon and herring will occur this will result in the 1.3% increase in exports, on average. The coefficient on the openness index is lower than in the regression on salmon. However, it is still valuable, suggesting again that Norway tends to have higher trade with more opened countries. The Economic Freedom Index had a high coefficient, symbolizing the fact that Norway trades more with highly economically developed countries.

The country specific effects are presented in the Appendix A3 in the table. The table shows that there are unique characteristics in some countries that promote trade from Norway to Russia, Ukraine, Latvia, Germany and Denmark. However, there are as well characteristics that repress the Norwegian exports of trout to Poland, France, Lithuania, the Netherlands and Sweden. Due to these results it is important to investigate the export potential of Norway. The results obtained from the analysis can serve as a great guidance in the policy implications.

The results on herring exports show that not all the variables used for the regression received expected signs and statistical significance. The results of the Haussmann test show a high value, suggesting that the adoption of the random effects model is more appropriate than the use of fixed effects model. The R-square value is 73%, meaning that independent variables explain 73% of the variability in the dependent variable. The F-test has a high statistically significant value, meaning that data fits the model well. The negative sign is obtained in the elasticity of importer's GDP per capita, which is opposite to what have been presented in the regressions on salmon and trout. The importer's GDP per capita suggests that when the country gets richer, it becomes more self-supported so it does not require so many exports as it did before (Eita et al, 2008). The elasticity of price is significant, suggesting that 1% change in the price of herring relative to the weighted average price of salmon and trout results in 0,9% increase in exports, on average. As for the rest of the variables they did not illustrate statistical significance. One of the reasons for the exports of herring being estimated under the random effects model, suggesting

that all the countries in the sample are homogeneous, can be attributed to the fact that herring is the low-priced fish species.

5.2. Second stage estimation results: total fish exports, exports of salmon, exports of trout, exports of herring

The time-invariant variables such as distance and common border are estimated by second stage estimation. The results for the time-invariant factors are presented in the table 10.

Table 10: Second stage estimation results, individual effects

Explanatory variables	Coefficient	T-statistic
	Estimation of total fish exports	
Distance	0,682	4.20*
Border	0,482	2.49*
R-square adjusted		0,098
	Estimation of salmon exports	
Distance	-1,816	-3,38*
Border	-0,175	-0,32
R-square adjusted		0,066
	Estimation of trout exports	
Distance	2,729	10,87*
Border	1,225	4,17*
R-square adjusted		0,418
	Estimation of herring exports	
Distance	2,244	2,19**
Border	0,8	0,72

*Notes: */** significant at 1%/5% level*

The second stage estimation results on total fish exports suggest that Norway has even higher trade with the countries who are further away from it. However, it is a contradiction to the result

obtained for the common border dummy. It may seem like a strange result, however empirical evidence from Eita and Jordaan (2010) suggest that it is possible for distance variable to appear with a positive sign. The common border dummy states that Norway has higher trade flows with the countries with which it shares a common border.

As for the second stage estimation results on salmon exports the variable distance appears with the expected sign, however the variable responsible for the common border has an unexpected sign and additionally it is not statistically significant. It seems like common border has no influence on exports of salmon. This can be attributed to the fact that right now salmon is a very important type fish consumed all over the world, so exports would be high no matter how far the country is from the exporter. Another reason for the common border variable being not significant is that, there are just two countries in the sample that share a common border with Norway. Due to little variability in the data the common variable may come up as insignificant and with a wrong sign.

Both distance and common border are both significant, but distance variable appear with the unexpected signs in the results for second stage estimation on trout. Proposing that the more far apart the countries are, the higher will be the trade flows between them. The common border variable states the opposite, suggesting that a common border between exporter and importer is trade enhancing with regard to exports of trout.

The second stage results on exports of herring show that common border dummy variable is not statistically significant. Additionally, distance variable has unexpected sign, like in the regression results for total fish exports and exports of trout.

5.3. Trade potential: exports of salmon

To estimate export potential of Norway, the ratio between potential exports obtained from the estimation of fixed effects model and the actual trade data is calculated. The investigation of trade potential will show if there are still unexplored export potential of Norway to some countries taken for the study.

Table 11: Trade potential for total Norwegian exports of fish and export by species

	Total	Salmon	Trout	Herring
	Eastern European markets			
Norway-Russia	1,1067	0,0413	0,4521	0,2300
Norway-Poland	0,3917	1,3539	2,4864	0,3995
Norway-Ukraine	0,8140	0,0068	0,3427	2,1626
Norway-Latvia	8,0755	1,3370	0,1552	0,3978
Norway-Lithuania	0,2510	0,2559	1,5310	2,2840
	Western European markets			
Norway-Denmark	0,3151	2,1599	6,2207	0,1283
Norway-Netherlands	0,1132	3,3691	12,6911	1,7431
Norway-France	0,6535	2,5997	1,8964	0,4630
Norway-Germany	0,3600	5,6123	3,4770	0,0963
Norway-Sweden	0,7918	5,8964	5,3624	12,9773

The results on total fish exports suggest that Norway has unexploited potential in fish exports with Poland, Ukraine, France, Germany, Denmark, Lithuania, the Netherlands and Sweden. It appears that there are two countries in the sample with which Norway has exceeded its trade potential, these countries are Russia and Latvia. Norway has the lowest unexploited trade potential with Denmark. Such low value can be explained by the constant consumption of fish per capita in this country over the study period. This maybe well attributed to the fact that most of the Norwegian exports coming to Denmark are re-exported, not much is used for direct domestic consumption.

The next country in the list is France. Norway reached just the fourth of possible trade potential value with France. This fact can be explained by slowly increasing per capita consumption of fish in this country.

Norway has similar unexploited trade potentials with Poland, the Netherlands, Germany and Sweden. The case of Poland, Germany, Sweden and the Netherlands may be explained again by almost per capita consumption of fish over the period of 18 years. Giving Norwegian export capacities, these countries are simply not willing to import more.

The case of Lithuania is the decreasing consumption of fish per capita, which is an obstacle on the way of Norwegian fish exports. Throughout the list of the countries with which Norway was unexploited trade potentials the highest score was obtained by Ukraine. Ukrainian case is a country with increasing consumption of fish per capita, however very low GDP per capita, meaning, that there are some types of fish being exported to Ukraine that not all of the society can effort.

It can be concluded by looking at the obtained trade potential that western European countries are falling behind eastern European countries. Norway has possibilities in increasing its trade flows further with five out of five western European countries chosen for the thesis.

In order for Norway to exceed current unexploited trade potentials policy measures have to be taken, some suggestions will be presented in the Chapter 6.

The results on exports of salmon suggests that Norway has unexploited trade potential with Russia, Ukraine and Lithuania. With the countries such as Poland, Latvia, Germany, Denmark, France, the Netherlands and Sweden Norway has exploited its trade potential.

As the regression on salmon suggested GDP per capita in the importer's country plays an important role for the exports of salmon. Both Russia and Ukraine has the lowest GDP per capita in the sample of eastern European countries taken for the analysis. As for Lithuania, it has a decreasing per capita consumption of fish over the study period. The main point here is that salmon is a higher-priced type of fish, so in order to be able to import more, an importer, in this case Russia, Ukraine should have higher GDP per capita which will allow them to effort consuming more salmon versus the level of consumption they have now. This is the main reason that may stand behind the Norwegian unexploited trade potential in these countries.

The results on the export of trout show that Norway has unexploited trade potential with Russia, Ukraine and Latvia. Norway exceeded its trade potential with Poland, Lithuania, France, Germany, Denmark, the Netherlands and Sweden. Low score is obtained by Ukraine, assuming that no mistake in the data is made this means that Norway has a huge potential in exports of trout towards Ukraine. Such low value can be also explained by the fact that Ukraine is the country that started importing trout the latest out of the countries in the sample. For the first, time, Norway exported its trout to Ukraine in 1998, while at the same time other countries have

been importing this fish species for a long period of time before that. So, the explanation of the Norwegian low unexploited trade potential towards Ukraine can be due to the fact that Ukraine started importing trout on the 5th year over the 18 year study period. Similar to Ukraine, Latvia and Russia started importing trout later then the beginning of the study period. First Norwegian trout exports to Latvia took place in 1994.

It would be possible as well to look at the per capita fish consumption by fish types, for example in this case trout would be studied. Per capita fish consumption by type of fish would be one way of attempting to explain low unexploited trade potentials. However due to an unavailability of the data such an analysis cannot be conducted.

The results on exports of herring suggest that Norway has unexploited trade potential with Russia, Poland, Latvia, Denmark, Germany, France. Norway has exceeded its trade potential with Ukraine, Lithuania, the Netherlands and Sweden.

Repeating the argument with consumption of fish per capita the values obtained by Poland, Germany and Latvia can be attributed to the fact that these countries have very little increase or even in some cases constant consumption of fish per capita over the study period.

Germany obtained the highest score among the countries with which Norway has unexploited trade potential, meaning that Norway still has potential to further increase its exports of herring to Russia.

6. Conclusions

The main purpose of this thesis was to estimate Norwegian's trade potential in fish exports with its five eastern and five western European countries. Additionally, to provide an eastern-western European comparison to assess whether Norway has higher trade flows with western or with eastern European countries. This analysis was conducted using augmented gravity models.

The data on five eastern and five western European countries for the period 1993-2010 has been used. The thesis employed three types of fish, namely: salmon, herring and trout. The results presented four regressions: on total fish exports (aggregated volume of three fish species) and separate regressions on salmon, trout and herring.

The estimation results of the regression on exports of salmon suggested that Norwegian trade in salmon is positively affected by higher importer's GDP per capita, exchange rate and price, openness of the importer's country(trade-GDP ratio) , economic freedom index. Production of fish in Norway has a negative effect on exports of salmon. Distance variable has a negative effect on exports of salmon as well. However, common border dummy variable was not statistically significant with wrong sign. Economic freedom index has the highest effect on exports of salmon, meaning that the more economically opened the country is, the higher are exports flows. The importer's GDP per capita received high magnitude as well, meaning that if the country gets richer it imports more salmon. The lowest magnitude was obtained for elasticity of price. Norway has exploited its trade potential in exports of salmon with Poland, Latvia, Germany, Denmark, the Netherlands, France and Sweden. Norway had unexploited potential with Ukraine, Russia, Lithuania.

The estimation results on exports of trout suggested that Norway's trade in trout is positively affected by higher importer's GDP per capita, exchange rate, price, openness of the importer's country, economic freedom index. Common border dummy variables suggest that higher trade flows are attributed to the country that shares a common border with Norway. The highest magnitude was obtained by economic freedom index. The lowest magnitude was for openness variable. Norway has exploited its trade potential in exports of trout with Poland, France, Germany, Denmark and Sweden, the Netherlands and Lithuania. Norway had unexploited potential with Russia, Ukraine and Latvia.

Norway's trade in herring is positively affected by price, openness of the importer's country and share of common border between Norway and importer country. Norway has exploited its trade potential in exports of trout with Ukraine, Lithuania, the Netherlands and Sweden. Norway had unexploited potential with Russia, Poland, Latvia, Germany, Denmark and France.

The estimation results on aggregated fish exports suggest that Norway's trade in fish is positively affected by production of fish in Norway, exchange rate, price, openness of the importer's country, economy freedom index and share of common border. The trade in fish is negatively affected by the importer's GDP per capita. Norway has exploited its trade potential with two countries in the sample, namely Russia and Latvia. As for the rest of the countries Norway still has the potential to increase its fish exports.

By comparing the obtained trade potentials towards east and west the clear conclusion cannot be made. By comparing trade potential in fish types between east and west, it is clear that west is much further than east is. However, as stated before it is clearly observable that even though that the range in per capita fish consumption in the West is similar to the East, it is apparent that the trade patterns in the West are stable, while they do tend to change in the East.

To take advantage of unexploited trade potential, Norway could have export promotion program in the countries where it has unexploited trade potential. Export promotion will help advertise the export product as well as educate foreign customers with respect to the way of preparation of fish. This will create an increasing demand for the product, consequently helping Norway to increase its exports to these countries. Different approaches shall be implemented with regard to the different fish types. This is due to the obtained results that suggest that the same variables have different effects in some cases even negative effects on Norwegian fish exports depending on the fish type that is being studied. Pricing is another important issue. It was shown that many of the eastern European countries have low GDP per capita in comparison to the western European countries. This means that these countries can effort imports of low-priced fish such as herring in higher volumes, than imports of high-priced fish such as salmon and trout. In fact, that is what the trade potential suggests showing that the trade potential in exports of salmon, and trout in the West are much higher than the trade potential in exports of salmon and trout in the East. This is suggesting that Norwegian authorities shall consider the financial abilities of their importers as well. Meaning that it is necessary to implement different strategies towards eastern

and western European countries. In addition, the attempt to maintain the existent volumes of trade with the countries where Norway exceeded its trade potential shall be provided as well.

6.1. Limitations of the study

Despite the contributions of the thesis it is important not to divert the attention away to the limitations that are present in this thesis as well. There are some missing data in the trade flows that make the estimation complex and the results weaker. The regression on herring did not explain the herring market well enough. There must be some other variables that have great effect on the exports of herring. Additionally, the thesis employs salmon, trout and herring in a way of frozen and chilled fish, but does not study the exports of smoked fish. The countries of eastern and western Europe were chosen for the thesis. However the Asian countries were excluded from the estimation. Additionally, due to unavailability of the price data, weighted average prices have been used, instead of the fish prices on the local importer's markets.

6.2. Suggestions for further research

The further research can be built on the larger time period and inclusion of smoked type of fish as well. It would be interesting to include other countries in the estimation as well. An idea of making the study by comparing the Norwegian trade with Eastern and separately with Western European countries is possible. Another suggestion in case of studying the same time period would be to regress transition years versus non-transition years. Furthermore, one could include Asian countries in the estimation. Further research can as well investigate the difference in trade flows between Norway and the countries that are the EU members and non-EU members, to see if EU-membership has any influence on trade. The World Trade Organization is aimed to reduce the trade barriers between the countries. Hence, the variable representing the accession to WTO by the importer country can be an indicator of trade promoter or trade repressor.

Referances

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

Androshchuk, A. (2006*). Transition economies: A look at Russia, Ukraine and Poland*. Honnors College Theses. Paper 32. New York, Pace University. 38 p.

Antonucci, D., Manzocchi, S. (2006). Does Turkey have a special trade relation with the EU? A gravity model approach. *Economic Systems*, 30(2): 157-169.

Appleyard, D., Field, A., Cobb, S. (2008). *International economics*. 6th ed. New York, McGraw Hill. 804 p.

Baker, O. (2002). Ukraine in the 1990's: Achievements, Disappointments and Lessons Learned. *UCLA Undergraduate History Journal*, Los Angeles, University of California. 18 p.

Baltagi, B.H. (2005). *Econometric Analysis of Panel Data*. 3rd ed. West Sussex, John Wiley & Sons Ltd. 302 p.

Batra, A. (2004). *India's global trade potential: the gravity model approach*. Working paper No.151. New Delhi, Indian Council for Research on International Economic Relations. 38 p.

Bergstrand, J.H. (1985). The gravity equation in international trade: some microeconomic foundations and empirical evidence. *The Review of Economics and Statistics*, 67 (3): 474-481.

Bergstrand, J.H. (1989). The generalized gravity equation, monopolistic competition, and the factor-proportions theory in international trade. *The Review of Economics and Statistics*, 71 (1): 143-153.

Bondareva, O. (1997*). What the frozen salmon is silent about.* Localised on 15th April 2012 on the World Wide Web: http://pressa.irk.ru/sm/2006/06/012001.html#2

Brun, J., Carrere, C., Guillaumont, P., De Melo, J. (2005). *Has distance died? Evidence from a panel gravity model*. Oxford, Oxford University Press. 22 p.

Butt, W.A. (2008). *Pakistan's Export Potential: a gravity model analysis*. Working Paper No. 23. Karachi, State Bank of Pakistan. 26 p.

CEMAT National Report. (2010). *Future challenges: Sustainable spatial development of the European continent in a changing world*. Moscow, CEMAT. 18 p.

Central Intelligence Agency. (2012). *The World Factbook*. Washington, CIA. Localised on 15th April 2012 on the World Wide Web: https://www.cia.gov/library/publications/the-world-factbook/

Chiarella, C., Gao, S. (2002). *Type I Spurious Regression in Econometrics.* Working paper 114. School of Finance and Economics. Sydney, University of technology. 17 p.

Chiodo, A.J., Owyang, M.T. (2002). *A case study of currency crisis: the Russian default in 1998*. St. Louis, Federal Reserve Bank. 18 p.

Cortes, M. (2007). *Composition of trade between Australia and Latin America: Gravity Model*. Working paper 07-19. Department of Economics, University of Wollongong. 32 p.

Criscione, V. (2009). *Norway's vibrant seafood economy. Official Norwegian Trade Portal.* Localised on 5th January 2012 on the World Wide Web: http://www.nortrade.com/index?cmd=show_article&id=437

Curtis, G.E. (1996). *Russia: A Country Study. Washington: GPO for the Library of Congress*. Localised on 5th January 2012 on the World Wide Web: http://countrystudies.us/russia/

Danmarks Nationalbank. (2006). *Danish Government Borrowing and Debt*. Copenhagen, Danmarks Nationalbank. 186 p.

Datapult. (2012). Localised on 2nd April 2012 on the World Wide Web: http://www.datapult.info/en/content/index-economic-freedom-2011

Deardorff, A.V. (1998). *The regionalization of the world economy*. University Chicago Press. 286 p.

EAAP (2011). *Agriculture and livestock production in Norway*. Annual meeting. Stavanger, EAAP. Localised on 2nd February 2012 on the World Wide Web: http://www.eaap2011.com/index.php?name=General_information/Livestock_production_in_Norway.html

Eita, J.H., Ashipala, J.M. (2008). *Estimating Namibia's export potential: a gravity model approach*. Namibia, United Nations Development Programme. 37 p.

European Association of Fisheries Economics. (2003). *EAFE 2003 proceedings*. Fifteenth Annual Conference. Brest, EAFE. Localised on 5th January 2012 on the World Wide Web: http://books.google.no/books?id=rrBvc0XFaPsC&pg=PT126&lpg=PT126&dq=Norway+was+and+is+the+leading+world+exporter+of+herring&source=bl&ots=N0sh0GICx1&sig=08bSMMXv2vAnGKx6yMzK2bONMBg&hl=no&sa=X&ei=hY-

XT4yzD4Wn4gSThYnFBg&ved=0CCIQ6AEwAA#v=onepage&q=Norway%20was%20and%20is%20the%20leading%20world%20exporter%20of%20herring&f=false

European Parliament. (1998). *EMU and Denmark*. 2nd revision. Brussels, European Parliament. 13 p.

Faliahov, R. (2012). *Salmon sailed with salmonella*. Localised on 15th February 2012 on the World Wide Web: http://www.gazeta.ru/business/2012/04/11/kz_4343045.shtml

Fic, T., Saqib, O.F. (2006). *Political Instability and the August 1998 Ruble Crisis*. Discussion papers 626. Berlin, German Institute for Economic Research. 17 p.

Food and Agriculture Organization of the United Nations (2000). *The state of world fisheries and aquaculture*. Rome, FAO Fisheries Department. 142 p.

Food and Agriculture Organization of the United Nations. (2012). Localised on 26th February 2012 on the World Wide Web: http://www.fao.org/fishery/countrysector/FI-CP_NO/3/en

Gladynov, O., Kykol, E. (2008). Money for high stakes. Will "extra" zeroes be removed from the Russian bank notes. *Russian newspaper*. No. 4563. Localized on 26nd February 2012 on the World Wide Web: http://www.rg.ru/2008/01/16/rubl.html

Guttmann, S., Richards, A. (2004). *Trade Openness: An Australia perspective*. Research Discussion paper 11. Economic Group, Reserve Bank of Australia.11 p.

Hardt, G.P. & Kaufman, R.F. (1995). *East-Central European economies in transition.* Joint Economic Committee. New York, Congress of the United States. Localised on 5th January 2012 on the World Wide Web: http://books.google.no/books?id=Yv-ehBPBdgYC&printsec=frontcover&hl=no#v=onepage&q&f=false

Helpman, E. & P. Krugman (1985). *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy*. Cambridge, MIT Press.

Heritage Foundation. (2012). Localised on 2nd April 2012 on the World Wide Web: http://www.heritage.org/;http://www.heritage.org/index/about

Heritage Foundation. (2012). Localised on 2nd April 2012 on the World Wide Web: http://www.heritage.org/index/press-release-europe

Hosny, A. (2009). *Assessing Trade Potential between Countries of the Greater Arab Free Trade Area.* Friday Seminar Series. Milwaukee, University of Wisconsin.

Houck, J.P. (1986). *Elements of agricultural trade policies*. New York, Macmillan. 191 p.

Im, K.S., Pesaran, M.H., Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels, *Journal of Econometrics*, 115: 53-74.

International Trade Centre UNCTAD/WTO. (2003). *TradeSim (second version), a gravity model for the calculation of trade potentials for developing countries and economies in transition*. Geneva, International Trade Centre UNCTAD/WTO. 26 p.

Interstate Statistical Committee of the Commonwealth of Independent States of CIS. (2011). *Monitoring of the main targets of macroeconomic indicators of economic development of the CIS.* Moscow, Interstate Statistical Committee of the Commonwealth of Independent States of CIS. 47 p.

Jordaan, A.C., Eita, J.H. (2010). Identifying South Africa's wood exports potential using a gravity model. Hong Kong, International Conference on E-Business. Management and Economics. *International Proceedings of Economics Development and Research*, 3:159-164.

Kaplyk, G., Blohtyr, A. (2011). Ups and downs of hryvnia. Localised on 26th February 2012 on the World Wide Web: http://glavcom.ua/articles/4618.html

Karemera, D., Smith, W.I., Ojah, K., Cole, J.A. (1999). A gravity model analysis of the benefits of economic integration in the Pacific Rim. *Journal of Economic Integration*, 14(3): 347-367.

Kepaptsoglou, K., Karlaftis, M.G., Tsamboulas, D. (2010). The gravity model specification for modeling international trade flows and free trade agreement effects: A 10-year review of empirical studies. *The Open Economics Journal*, 3: 1-13.

Krugman, P.R., Obstfeld, M. (2006), International Economics:Theory and Policy. 7th ed. Boston, Addison-Wesley. 680 p.

Latvijas Banka. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.bank.lv/en/monetary-policy/exchange-rate-policy/overview-of-exchange-rates

Le Gallic, B. (2006). *Using market mechanisms to manage fisheries: Smoothing the path.* France, OECD Publishing. 325 p.

Leamer, E., Levinsohn, J. (1994). *International Trade Theory: The Evidence*. NBER Working paper No. 4940. Cambridge, National Bureau of Economic Research. 66 p.

Leblond, P. (2003). *Fiscal Convergence and Stability in the EMU: Alchemy, Missed Opportunities, and Commitment Institutions.* Nashville, European Studies Association 8th International Conference. 45 p.

Leitão, N. C. (2010). The gravity model and United States' trade. European Journal of Economics. *Finance and Administrative Sciences*, 21: 92-100.

Levin, A, Lin, C F and Chu, C (2002). Unit Roots Tests in Panel Data: Asymptotic and Finite Sample Properties. *Journal of Econometrics*, 108:1-24.

Linder, S.B. (1961). An Essay on Trade and Transformation. *Economica*, 31(121): 86-90.

Linnemann, H. (1966). An econometric study of international trade flows. *The American Economic Review*, 57 (1): 283-285.

Ludvigsen, S. (2004). *Norwegian Fisheries policy – with main focus on the promotion of sustainability.* Seattle, University of Washington. Localised on 5th January 2012 on the World Wide Web: http://www.regjeringen.no/en/dokumentarkiv/Regjeringen-Bondevik-II/fkd/Taler-og-artikler-arkivert-individuelt/2004/norwegian_fisheries_policy_with.html?id=268117.

Melitz, J. (2006). North, South and distance in the gravity model. *European Economic Review*, 51: 971-991.

Meridian World Data. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.meridianworlddata.com/Distance-Calculation-Demo.asp

Mikic, M., Gilbert, J. (2007). *Trade Statistics and Policymaking. A handbook of commonly used trade indices and indicators.* New York, Economic and Social Commission for Asia and the Pacific. 128 p. Localised on 15th April 2012 on the World Wide Web: http://www.scribd.com/doc/57309387/2/III-Trade-and-Economy

Myrland, Ø., Trandsen, T., Johnston, R., Lund, E.(1999). Determinants of seafood consumption in Norway: Lifestyle, revealed preferences, and barriers to consumption. Tromsø, *Food Quality and Preferences*, 11(3): 169-188 p.

National Bank of Poland. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.nbp.pl/homen.aspx?f=/kursy/kursyen.htm

National Bank of Russian Federation. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.cbr.ru/currency_base/dynamics.aspx

National Bank of Ukraine. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.bank.gov.ua/control/uk/index

National Marine Fisheries Service. (1997). *World consumption-by region and country. Fisheries* Statistics Division. Localised on 15th April 2012 on the World Wide Web: http://www.st.nmfs.noaa.gov/st1/fus/fus95/index.html

National Marine Fisheries Service. (2002). *World consumption-by region and country. Fisheries* Statistics Division. Localised on 15th April 2012 on the World Wide Web: http://www.st.nmfs.noaa.gov/st1/fus/current/index.html

National Marine Fisheries Service. (2010). *World consumption-by region and country. Fisheries* Statistics Division. Localised on 15th April 2012 on the World Wide Web: http://www.st.nmfs.noaa.gov/st1/fus/fus10/index.html

Norwegian Fishermen's Association, Norwegian Seafood Federation, Norwegian Ministry of Fisheries. (2003). *Facts about the Norwegian fisheries industry*. Oslo/Trondheim, Norwegian Fishermen's Association, Norwegian Seafood Federation, Norwegian Ministry of Fisheries. 27 p.

Norwegian Ministry of Fisheries and Coastal Affairs. (2009). *Facts about Fisheries and Aquaculture.* Oslo, Norwegian Ministry of Fisheries and Coastal Affairs. 32 p.

Norwegian Ministry of Fisheries and Coastal Affairs (2010). *Facts about Fisheries and Aquaculture.* Oslo, Norwegian Ministry of Fisheries and Coastal Affairs. 36 p.

Norwegian scientific committee for food safety (2006). *Fish and seafood consumption in Norway-Benefits and risks.* Oslo, Norwegian scientific committee for food safety. 7 p.

Norwegian Seafood Export Council. (2005). *Norwegian Seafood exports: Facts and figures.* Tromsø, Norwegian Seafood Export Council. 20 p.

OANDA. (2012). *Historical Exchange Rates*. Localised on 15th April 2012 on the World Wide Web: http://www.oanda.com/currency/historical-rates/

OECD Centre for Co-operation with non-members. (1998). *Agricultural policies in Emerging and Transition Economies.* Paris, OECD Centre for Co-operation with non-members. Localised on 2nd February 2012 on the World Wide Web: http://books.google.no/books?id=0ytdLjZg0VMC&pg=PA59&lpg=PA59&dq=inflation+in+latvia+1993-1997&source=bl&ots=SmQNVCpeou&sig=34rfudodPnq41St9mKW3nYAckus&hl=no&sa=X&ei=OFx4T-SxA6yB4AT2-

8ntDg&ved=0CCIQ6AEwAA#v=onepage&q=inflation%20in%20latvia%201993-1997&f=false

Oshomkov, M. (1997). Denomination. Businessman Dengi, 29 (137). Localised on 26th February 2012 on the World Wide Web: http://kommersant.ru/doc/20588?stamp=634720915301286045

Ozdeser, H., Ertac, D. (2010). Turkey's Trade Potential with Euro Zone Countries: A Gravity Study. *European Journal of Scientific Research*, 43(1): 15-23.

Paas, T. (2000). *Gravity approach for modeling trade flows between Estonia and the main trading partners*. Tartu, University Press. 49 p.

Papazoglou, C. (2007). Greece's potential trade flows: a gravity model approach. *International Advances in Economic Research*, 13(4): 403-414.

Rahman, M.M. (2003). *A panel data analysis of Bangladesh's trade: the gravity model approach*. Madrid, 5th European trade study group conference. 54 p.

Rahman, M.M. (2009). *Australia's Global Trade Potential: Evidence from the Gravity Analysis.* Oxford, Business and Economics Conference. 41 p.

Ram, Y., Prasad, B.C. (2007). *Assessing Fiji's Global Trade Potential Using. The Gravity Model Approach*. Fiji, University of South Pacific. 48 p.

Riley, G. (2006). *Income elasticity of demand*. Localised on 2nd February 2012 on the World Wide Web: http://tutor2u.net/economics/revision-notes/as-markets-income-elasticity-of-demand.html

Rivera-Baliz, L.A., Oliva, M. (2003). *International trade: theory, strategies, and evidence*. New York, Oxford University Press, 712 p.

Rose, A.K., Lockwood, B., Quah, D. (2000). Currency unions-one money, one market: the effect of common currencies on trade. *Economic Policy*, 15(30): 7-45.

Sohn, C. (2005). Does the gravity model explain South Korea's trade flows? *Japanese Economic Review*, 56 (4): 417-430.

Statistical Office of the European Communities. (2012). Localised on 2nd April 2012 on the World Wide Web: http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do;jsessionid=9ea7d07e30ee82f6b725b33f42d88b47dc1240b2a3f7.e34MbxeSahmMa40LbNiMbxaMbhaPe0?tab=table&plugin=1&pcode=teina200&language=en

Statistics Norway. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.ssb.no/english/yearbook/2011/tab/tab-288.html

Statistics Norway. (2012). Localised on 15th April 2012 on the World Wide Web:http://www.ssb.no/english/subjects/09/01/knr_en/kopiTab/tab-08-en.html

Thai, T.D. (2006). *A gravity model for trade between Vietnam and twenty-three European countries.* M.Sc. thesis. Bolänge, Högskolan Dalarna, Department of Economics and Society. 34 p.

Tinbergen, J. (1962). Shaping the World Economy: Suggestions for an International Economic Policy. *Journal of Farm Economics*, 46 (1): 271-273.

Triacom. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.triacom.com/frame.html?http://www.triacom.com/archive/exchange.en.html&en

Trollvik, T. (2002). *The impact of World Trade Organization agreements on fish trade*. Rome, Food and Agriculture Organization of the United Nations. 977: 69 p.

United Nations Commodity Trade Statistics Database. (2012). Localised on 24 April 2012 on the World Wide Web: http://comtrade.un.org/

United States Agency for International Development. (2000). *Celebrating Lithuanian-American partnership.* Vilnius, US Agency for International Development. 40 p.

USDA Foreign Agricultural Service. (2006). *Norway. Fishery Products*. Washington, USDA Foreign Agricultural Service. 10 p.

Verbeek, M. (2004). *A guide to modern econometrics.* 2nd ed. West Sussex, John Wiley & Sons Ltd. 429 p.

Villavicencio, X.A. (2010). Essays on the effect of climate change on agriculture and forestry. Ph.D. dissertation. Texas, A&M University, *Agricultural Economics.* 112 p.

Waggener, T.W., Lane, C. (1997). *Pacific Rim demand and supply situation, trends and prospects: implications for forest products trade in the Asia-Pacific region*. Seattle, Food and Agriculture Organization of the United Nations. Localised on 15th April 2012 on the World Wide Web: http://www.fao.org/docrep/W4388E/w4388e0t.htm

World Bank Group. (2012). Localised on 2nd April 2012 on the World Wide Web: http://www.worldbank.org/

World Favourite Currency. (2012). Localised on 15th April 2012 on the World Wide Web: http://www.xe.com/currencytables/?basecur=DEM&historical=true&month=1&day=1&year=2010&sort_by=name&image.x=27&image.y=2

World Wildlife Fund. (2012). *Aquaculture. Salmon.* Washington, World Wildlife Fund. Localised on 26nd February 2012 on the World Wide Web: http://www.worldwildlife.org/what/globalmarkets/aquaculture/dialogues-salmon.html

Appendix A1

Country	Fixed effects
Russia	0.4296797
Poland	0.079516
Ukraine	-0.0300082
Latvia	-0.4999796
France	0.4602556
Germany	0.2472565
Denmark	1.017351
Lithuania	-1,189642
Netherlands	-0.084749
Sweden	-0.4296797

Appendix A2

Country	Fixed effects
Russia	0.429085
Poland	0.421646
Ukraine	1.338779
Latvia	0.556443
France	-0.563992
Germany	0.030588
Denmark	0.651609
Lithuania	-1.442180
Netherlands	-1.544357
Sweden	0.122380

Appendix A3

Country	Fixed effects
Russia	0.267413
Poland	-0.177268
Ukraine	0.635070
Latvia	0.953938
France	-0.241440
Germany	0.115107
Denmark	0.542141
Lithuania	-0.797227