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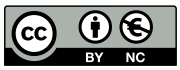

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Exports under the Flicker of the Northern Lights

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Abstract:

Picture a small open economy in the North Atlantic Ocean, highly dependent on trade with the EU and NAFTA. How important are these trading blocs to the country's exports? How important is the country's location and size, and how do these affect the export sectors? A unique version of the gravity model is applied here using an inverse hyperbolic sine function. Typically, the export volume is significantly impacted by the economic size of the exporting country, but in this case it is not. This suggests that the exports from small remote economies are driven by different factors than exports from large economies.

JEL: C23, F1, F14, F15
Keywords: *Exports; gravity model; free trade agreements; panel data*

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1 Introduction

This paper analyzes how a country's exports are dependent on the size of its economy and the cost of export transport that results from geographic distance. According to international economic theories, the export share of gross domestic product (GDP) should be greater in a small country than in that of a larger economy. However, the small economy of Iceland has been found to export only two thirds of what could be expected (Gylfason, 1999). Additionally, when corrected for its small size, Krugman (1991) observes Iceland to have smaller ratio of export to GDP than could be expected. Although he does not test this, Krugman finds geographical isolation to be one of the reasons for the unusual relationship. The objective of this paper is to seek a clearer explanation for Krugman's findings.

Given Krugman's (1991) comments, it appears as if the properties of the gravity model (Bergstrand, 1985) are particularly appropriate in the case of Iceland, since the model not only captures the effects of distance on trade volume, but also the exporting and recipient countries' market size and wealth. I examined these suppositions using the popular export gravity model in which trade is dependent on distance and economic size.

I tested the gravity model to its limits with an example that is extreme in distance and size, two factors Iceland undisputably displays, since it is remote and small, with few export sectors. A gravity model extension of the Bergstrand (1985) specification provides opportunities for decomposition by sectors (Nowak-Lehmann, 2007) or blocs (Abraham and Van Hove 2005; Kimura et al., 2006, Vollrath et al.,

2006), as well as both simultaneously. Sector decomposition is important, since the case country exports are concentrated into few sectors, with the energy intensive and fishing sectors accounting for a considerable share. Fishing has traditionally had heavy weight in overall export, and the energy intensive sector has been growing in the past few years. These sectors are both related to abundant natural resource endowments of fish stock and hydro power sources. The case country's isolation means the hydro power is not directly exportable, so it is used to produce goods with an energy-intensive manufacturing process. The goods can then be considered an indirect export of hydro power.

One challenging issue is how to best deal with the marginal export dataset of the case country. In such a small country regional and sectoral decomposition of data occasionally results in zeros, which the conventional logarithm format of the gravity model cannot handle. In order to consider the zeros in my calculations and still maintain the logarithmic features of the gravity model, I applied a transformation. I elected to use the inverse hyperbolic sine transformation[1], which has been used to analyze household data often containing zeros (Burbidge et al.,1988). It has never before been applied to export data, but I used it in this situation because the presence of zeros in the Icelandic dataset is meaningful and should be factored into my calculations rather than simply ignored.

I then extended the gravity model in several ways to achieve in-depth export analysis. With the extensions, I not only analyzed individual trade blocs and indi-

[1] I very much appreciate comments from Martin Browning suggesting the use of the hyperbolic sine function.

vidual sectors, but also both sectors and trade-blocs simultaneously.

Both current research and a forthcoming paper by Davies and Kristjansdottir do use the gravity model for the similar reason of handling zeros in the dataset. However, the reasons for the zeros are quite different, so the subsequent calculations differ. The nature of the power plant investments discussed in the Davies and Kristjansdottir (forthcoming) paper is that they are huge, irregular lump sum investments, which plot on a graph as a threshold function. Therefore, the Heckman two-step approach is suitable for that paper, which analyses the feast-and-famine nature of power plant investments. This paper is dealing with the more constant, yet less substantial flow of exports, which are subdivided in such a way that zeros occasionally appear in the dataset. In this case, the Heckman two-step is not used, since it does not fit as well with the less sporadic data.

2 Data

The export data used in this research are based on data from Statistics Iceland (2000). The data cover exports of goods from Iceland to its main trading countries. The data are annual over the eleven year period 1989-1999. Data run from the year 1989 through 1999. Data for 2000 and thereafter are not included, due to subsequent structural change to the Icelandic economy, such as the substantial privatization in the domestic market. This and other large-scale changes in the economic landscape in the more recent years result in significant data volatility that obscures the real intention of this paper.

The set of data used runs over countries and sectors. Included are the 17 main

recipient countries of exports from Iceland. These are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Japan, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States. Data for Germany refer to the years after unification, and therefore run from 1991, rather than 1989. The overall export volume used in this research accounts for 89.84% of Iceland's total merchandise exports in 1997. An export index from the Statistics Iceland (2000) is used to put all export data on 1995 level. Data on exports decomposed by sectors are from the Statistics Iceland (2000), where the sectors are split up by a domestic classification system. A definition of the variables used in this research is given in Table 1.

The gross domestic product data are obtained from the World Bank (2002), more specifically, the gross domestic product (GDP) used is "GDP at market prices" (current USD). The GDP data covers data on Iceland and the countries receiving exports from Iceland. These data are divided by the GDP deflator also obtained from the World Bank (2002). Data on distance between Iceland's capital (Reykjavik) and the capital of the importing country are used in order to capture the distance from Iceland to different countries. An exception of this data measure is the case of Canada, where the midpoint between Quebec City and Montreal is used, since it is believed to better represent the economic center of Canada than the capital city Ottawa. Also, in the case of the United States, New York is chosen rather than Washington. All distances are presented in kilometers in a logarithm format. Data on distances are collected from the Distance Calculator (2000).

Table 1. Variable Definition

Variable		Predicted signs
$\sinh^{-1}(EXP_{j,s,t})$	Exports transformed by the Inverse Hyperbolic Sine Function, running over source countries (i) and sectors (s), over time (t).	
$\ln(Y_t)$ *Export Country GDP*	Logarithm (ln) of Host country Gross Domestic Product (GDP), over time (t).	+
$\ln(Y_{j,t})$ *Recipient Country GDP*	Logarithm (ln) of Source country (i) Gross Domestic Product (GDP), over time (t).	+
$\ln(N_t)$ *Export Country Pop*	Logarithm (ln) of Host country population (Pop), over time (t).	+
$\ln(N_{j,t})$ *Recipient Country Pop*	Logarithm (ln) of Source country population (Pop), over time (t).	+
$\ln(D_j)$ *Distance*	Logarithm (ln) of distance between the source and the host country.	−
$Sector_1$ *Fishing Industry*	Dummy variable accounting for the Fishing Industries.	+ / −
$Sector_2$ *Manufacturing Ind.*	Dummy variable accounting for the Manufacturing Industries.	+ / −
$Sector_3$ *Energy Intensive Ind.*	Dummy variable accounting for the Power Intensive Industries.	+ / −
$Sector_4$ *Other Industries*	Dummy variable accounting for all remaining Industries.	+ / −
$Bloc_1$ *EFTA*	Dummy variable accounting for country membership to the EFTA trade bloc.	+ / −
$Bloc_2$ *EU*	Dummy variable accounting for country membership to the EU trade bloc.	+ / −
$Bloc_3$ *NAFTA*	Dummy variable accounting for country membership to the NAFTA trade bloc.	+ / −
$Bloc_4$ *NON Bloc Members*	Dummy variable accounting for country non-membership to any trade bloc.	+ / −

Data on population are from the World Bank (2002). Data on countries' various trade bloc memberships are from a brochure by de la Torre and Kelly (1992).

3 Model Specification

The gravity model has proven to be an effective tool in explaining bilateral trade flows as a function the of exporter's and importer's characteristics, together with factors that aid or restrict trade. Isard and Peck (1954) and Beckerman (1956) find trade flows to be higher between geographically close areas (Oguledo and Macphee, 1994). Tinbergen (1962) and Pöynöhen (1963) developed the gravity equation with exports being a function of country's gross national product and distance between economic centers (Larue and Mutunga, 1993).

The gravity model specification presented by Bergstrand (1985) is shown in Equation (1). The equation captures the volume of exports between the two trading partners as a function of their GDPs and the distance between them.

$$PX_{ij,t} = \alpha_0 (Y_{i,t})^{\beta_1} (Y_{j,t})^{\beta_2} (D_{ij})^{\beta_3} (A_{ij})^{\beta_4} \zeta_{ij} \tag{1}$$

In Equation (1), the explanatory variable $PX_{ij,t}$ represents exports from country (i) to country (j), at time (t). The variable $Y_{i,t}$ denotes the GDP of country (i) at time (t), $Y_{j,t}$ is the GDP of country (j) at time (t), and D_{ij} is the geographic distance (in kilometers) between the economical centers of country (i) and country (j). The letter A_{ij} denotes factors that affect trade between country (i) and (j), and ζ_{ij} is a log-normally distributed error term, with $\mathrm{E}(\ln\zeta_{ij})=0$.

Dummies are often also included in the model, like a dummy for "common border" determining whether countries have common borders, and a dummy for identical languages in the trading countries. However, these dummies are not applied here, since Iceland does not share a common border with other countries, nor

does it share a language with any country. The size of the exporting and the importing countries are basic determinants in explaining exports. Generally countries are expected to trade more as they increase in size. The size of the economy can either be measured by the two variables of population or the GDPs. The GDP of the domestic country is believed to reflect the capacity to supply exporting goods. Likewise, the GDP of the country importing from Iceland $Y_{j,t}$ is believed to represent its demand for exports, that is country (j)'s demand is believed to increase as $Y_{j,t}$ increases.

Recipient and export country population is commonly inserted for variable A_{ij} in Equation (1) as an additional determinant of trade. Generally the coefficient for recipient country population is expected to be positive, since a bigger market in the recipient country is expected to demand more goods. The export country population is also expected to have positive effects on exports, since the export country is expected to be able to supply more as the population grows in size.

Distance is also important in explaining trade between economies. An increase in distance between economies is expected to increase transportation costs and thus reduce trade. The value of the distance coefficient cannot be predicted in advance. If the value is estimated to be positive, it indicates that the market can be expected to be dominated by a home market effect, as explained by Helpman and Krugman (1989) and several other models such as the geographical model of Krugman (1991). The value is typically negative, however.

4 Regression Results

When choosing a gravity model specification for Iceland, Equation (1) is used as a base case. The model specification in Equation (2) is an extension of Equation (1), where population has been inserted as an additional factor in the model:

$$EXP_{ij,t} = e^{\beta_0}(Y_{i,t})^{\beta_1}(Y_{j,t})^{\beta_2}(N_{i,t})^{\beta_3}(N_{j,t})^{\beta_4}(D)_{ij}^{\beta_5}e^{u_{ij,s,t}} \tag{2}$$

Like in the Bergstrand (1985) paper, the source country of exports, export country is denoted with (i), while the recipient country is denoted with (j). However, since it is clear that this research applies to one export country only, there is no need to identify the export country specifically; the subscript (i) is therefore left out. Export therefore only varies by recipient countries (j):

$$\begin{aligned} \ln(EXP_{j,s,t}) &= \beta_0 + \beta_1 \ln(Y_t) + \beta_2 \ln(Y_{j,t}) + \beta_3 \ln(N_t) \\ &\quad + \beta_4 \ln(N_{j,t}) + \beta_5 \ln(D_j) + u_{j,s,t} \end{aligned} \tag{3}$$

In Equation (3) export from country (i) to country (j) is denoted by ($EXP_{j,s,t}$), here a regression is run on exports to different sectors (s) over time (t). The regression results for Equation (3) are shown in Table 2.

Table 2. The Basic Model Specification

	LN ROBUST	IHS ROBUST	IHS ROBUST
Regressors	Only EXP>0	Only EXP>0	All EXP obs
$\ln(Y_t)$ *Export Country GDP*	-0.715 (-0.45)	-0.716 (-0.45)	-0.361 (-0.09)
$\ln(Y_{j,t})$ *Recipient Country GDP*	1.552^{***} (5.18)	1.552^{***} (5.18)	3.568^{***} (5.17)
$\ln(N_t)$ *Export Country Pop*	1.250 (0.27)	1.250 (0.27)	-7.712 (-0.62)
$\ln(N_{j,t})$ *Recipient Country Pop*	-0.559^{**} (-2.02)	-0.559^{**} (-2.02)	-1.910^{***} (-2.91)
$\ln(D_j)$ *Distance*	-2.065^{***} (-11.05)	-2.065^{***} (-11.05)	-2.993^{***} (-8.29)
Constant	22.934 (0.35)	23.626 (0.36)	166.981 (0.96)
OBSERVATIONS	652	652	740
LIKELIHOOD RATIO TEST	-1292.6301	-1292.6284	-2246.1319
DEGREES OF FREEDOM	5	5	5
R-SQUARED	0.4076	0.4076	0.1825

Note: Robust t-statistics are in parentheses below the coefficients. ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

Exports are a function of export country GDP (Y_t), recipient country GDP ($Y_{j,t}$), export country population (N_t), recipient country population ($N_{j,t}$), and the distance (D_j) between the exporting and the recipient (j) countries. Sector specific effects on exports are determined by (s) where s runs from 1 to 4, depending on the number of the sector. Later in this research, several modifications are then made to improve the basic model specification.

The first column in Table 2 represents estimates for the natural logarithm of exports. Results obtained from running the inverse hyperbolic sine (IHS) function are reported in columns two and three.

Table 2 presents results for the basic gravity model specification, for different functional forms. The advantage of using the IHS function rather than the logarithm function is that the IHS function can be applied to zeros. The gravity model specification is generally presented in a natural logarithm format, but in this research the IHS function is believed to be more appropriate. This is because when disaggregated over countries and sectors, exports from small countries become very thinly spread, resulting in many zeros in the data. Since the logarithm function can only be applied to non-negatives, it can only be applied to 652 observations out of 740, whereas the IHS function can be applied to the full data set of 740 observations.

The column in the middle of Table 2 shows the case when the IHS function is applied to positive observations only. A comparison between the first and second columns shows that when the IHS function is applied to positive observations only, it yields similar results as the logarithm function in the first column. The fact that similar coefficients are received in the first columns indicate that a considerable number of export observations is high enough for the two functions to yield similar coefficients.

The IHS results in Table 2 indicate that a 1% increase in recipient country GDP can be expected to raise exports by about 3.56%, given everything else equal. When translated to actual numbers, we can first consider the mean GDP in Iceland over the export period (as listed in Table 2) to be about USD 7 billion (1995 base), but the GDP average of the recipient countries to be about USD 1200 billion.

An increase by 1% in the population of the recipient country is estimated to negatively effect exports by about -1.91%. Let us consider an example on what this coefficient indicates about export to different countries: Two countries are about equidistant from the exporting country (Iceland), but one is about double the size of the other. These could be Norway and Sweden. In the export period examined, Sweden had an average population of 8.7 million people, whereas Norway had a population average of 4.3 million. Given everything else as equal the model predicts that, based on negative population coefficient, Sweden should only be receiving about 30% of the export volume going to Norway. More specifically, the difference between the countries is found to be 26%, indicating that Sweden should be receiving about 26% of what Norway receives. This is based on the fact that average exports to Norway over the period were valued at about USD 14 million, which would result in Sweden receiving exports of USD 14*0.26=3.64 million. The true average exports for Sweden in the period amounted to USD 5.68 million, or 5.68/14=0.4, or 40% of exports to Norway. The estimates therefore give a fair indication of the relationship of exports to certain economic factors.

The distance variable is estimated to negatively affect goods exports by a coefficient of -2.993. Distance is of particular interest in the case of Iceland because of how distant the country is from all its trading countries, as distance is a proxy for transport costs that have a high weight in overall transaction costs. The outcome obtained here is typical of trade regressions, since distance is estimated to affect export negatively. More specifically, the coefficient can be interpreted such that by

doubling distance between Iceland and the trading country, export becomes 13% of what it was before.

When the export and recipient country variable coefficients are considered specifically, what is noteworthy is that only the recipient country coefficients are estimated to be significant, whereas the export country coefficients are not. The positive significant coefficient of the recipient country GDP implies increased demand for exports as trading country economic size increases. However, recipient country population is estimated to negatively affect exports, implying negative interaction between demand and population, resulting in more exports to countries that are less populated. Another way of interpreting the coefficient estimates for the recipient country would be to say that, when combined, a positive estimate for GDP and a negative estimate for population will indicate that exports increase with per capita income of the recipient country. Overall, it therefore seems that exports are affected by both recipient country per capita wealth effects and market size effects.

The estimates obtained for the export country coefficients in Table 2 indicate that neither the export country GDP nor population are estimated to be significant. The results therefore indicate that market size (estimated by population) and economies of scale (accounted for by GDP size) in the export country do not seem to be very influential for overall exports going from Iceland to the recipient countries. This may be because goods exports from Iceland are driven largely by seafood exports, so that the supply potential is based primarily on natural resources, namely the size of the fishing stock.

4.1 Fixed Sector Effects

I order to correct for sector effects, I added fixed sector estimates to the basic regression as presented in Equation (4). The fixed effects technique is used to estimate Equation (4), where the 's are constants (s=1,2,...4) accounting for sector specific effects.

$$\begin{aligned} \sinh^{-1}(EXP_{j,s,t}) &= \beta_0 + \beta_1 \ln(Y_t) + \beta_2 \ln(Y_{j,t}) + \beta_3 \ln(N_t) \\ &\quad + \beta_4 \ln(N_{j,t}) + \beta_5 \ln(D_j) + \gamma_s Sector_s + \varepsilon_{j,s,t} \end{aligned} \tag{4}$$

Table 3 shows the results from estimating fixed sector effects, together with the basic gravity specification. Regression results obtained for the basic gravity model variables are analogous in Table 3 to those in Table 2. The sector specific effects are obtained by setting one of the sectors equal to zero, and estimating the fixed deviation of other sectors. In this research, I chose to fix sector three. The third sector accounts for energy intensive industries (ferro-silicon and aluminum), and as a base sector is not presented in Table 3, to avoid the dummy variable trap of perfect collinearity. As mentioned in the introduction, the energy intensive industries proxy for the export of hydropower.

The (t)-statistics in Table 3 clearly indicate that all other sectors vary positively from the energy intensive sector. The positive effects estimated indicate that the other sectors have significantly more weight in goods exports than the energy intensive sector. The coefficient estimates obtained range from 5.99 to 8.72.

Table 3. Fixed Sector Effects

Regressors	IHS ROBUST
$\ln(Y_t)$ *Export Country GDP*	-0.361 (-0.11)
$\ln(Y_{j,t})$ *Recipient Country GDP*	3.568^{***} (6.43)
$\ln(N_t)$ *Export Country Population*	-7.712 (-0.81)
$\ln(N_{j,t})$ *Recipient Country Population*	-1.910^{***} (-3.64)
$\ln(D_j)$ *Distance*	-2.993^{***} (-13.02)
$Sector_1$ *Fishing Industries*	8.714^{***} (16.08)
$Sector_2$ *Manufacturing Industries*	6.917^{***} (12.75)
$Sector_4$ *Other Industries*	5.987^{***} (11.13)
Constant	161.576 (1.21)
OBSERVATIONS	740
LIKELIHOOD RATIO TEST	-2043.3047
DEGREES OF FREEDOM	8
R-SQUARED	0.5275

Note: Robust t-statistics are in parentheses below the coefficients. ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

Moreover, the coefficient estimates indicate that sector 4, "other industries", deviates least from the energy intensive sector. The manufacturing sector comes second, and the fishing sector third, with the biggest deviation. Another way of interpreting the sector specific results would be to say that, when corrected for market size and economic wealth as well as distance (trade cost), the fishing sector has the highest share of exports, whereas the manufacturing sector comes second, other industries third, and the energy intensive sector fourth. However, the esti-

mated coefficients are only expected to give an indication of sector weights. There are two reasons why the estimates can only be considered to give an indication of export volume. First, the average presented here is a geometric average which is not comparable to the "common average" generally used, and second, the data source does not include all the countries receiving exports from Iceland.

All the coefficient estimates indicate that the share of all sectors is low when compared to the fishing industry. Although the fishing industry strongly dominates exports of goods, its relevance in overall merchandise exports (goods and services) is much lower than other sectors. In 2000, the fishing industry accounted for 41% of overall merchandise exports, compared to a 64% share of goods exports.

In order to get an indication of whether the regression results presented in Table 3 are more reliable than those in Table 2, the likelihood ratio test was used for comparing regressions. If its value was less than the critical value, the null hypothesis would be rejected. The likelihood ratio test produced a value of -2043.30 for the sector regression, which indicates that the sector specification model predicts better than the basic regression (third column in Table 2) and should therefore be the preferred model.

4.2 Fixed Trade Bloc Effects

The next step in this research was to determine whether there is a fixed difference between the trade blocs receiving exports from Iceland. The bloc specific effects are presented in Equation (5) as $Bloc_n$, where (n) runs from 1 to 4. The model specification can then be expressed as the following:

$$\sinh^{-1}(EXP_{j,s,t}) = \beta_0 + \beta_1 \ln(Y_t) + \beta_2 \ln(Y_{j,t}) + \beta_3 \ln(N_t) \quad (5)$$
$$+\beta_4 \ln(N_{j,t}) + \beta_5 \ln(D_j) + \pi_n Bloc_n + \varepsilon_{j,s,t}$$

When the omitted category is set equal to zero, it holds that π_2=0 where π_2 is the constant for the EU trade bloc. Other trade blocs (categories) can be represented in comparison to the EU bloc.

The results obtained for the trade bloc specification indicate that the main variation in the basic specification variable estimates is that recipient country population now loses its significance, although continuing to have a negative value. This indicates that, when corrected for trade bloc membership, neither market size of the export nor recipient country matters. These results make sense, in that they imply that countries identify themselves with bigger markets as they become trade bloc members. Another change from the basic regression results is that in Table 4 export country GDP becomes positive (it was previously negative), indicating positive wealth effects of the export country on exports, although the coefficient is far from being significant. Other estimates are analogous to those of the basic regression. After correcting for GDP and population size as well as distance, the EFTA and non-bloc countries are estimated to have positive effects on exports, when compared to the EU. What might support these results is the fact that Iceland is a member country of EFTA. The trade bloc dummy effects indicate a significantly higher share of exports going to EFTA countries, and countries outside of trade blocs, than EU countries. However, NAFTA countries are not estimated to receive a higher share

of exports than EU countries.

Table 4. Fixed Trade Bloc Effects

Regressors	IHS ROBUST
$\ln(Y_t)$ *Export Country GDP*	0.188 (0.04)
$\ln(Y_{j,t})$ *Recipient Country GDP*	2.466*** (3.40)
$\ln(N_t)$ *Export Country Population*	−5.085 (−0.41)
$\ln(N_{j,t})$ *Recipient Country Population*	−0.827 (−1.17)
$\ln(D_j)$ *Distance*	−5.567*** (−5.55)
$Bloc_1$ *EFTA*	0.982* (1.82)
$Bloc_3$ *NAFTA*	0.813 (0.83)
$Bloc_4$ *NON Bloc Members*	5.122*** (2.87)
Constant	137.699 (0.80)
OBSERVATIONS	740
LIKELIHOOD RATIO TEST	-2240.507
DEGREES OF FREEDOM	8
R-SQUARED	0.1948

Note: Robust t-statistics are in parentheses below the coefficients. ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

What sheds light on these results is the fact that EFTA bloc membership not only accounts for current member countries of EFTA, but also those of the 17 recipient countries that had EFTA membership sometime in the period estimated (1989-1999). The fact that the NAFTA coefficient is not significantly different from the EU coefficient indicates that the export volume to the NAFTA countries is not so different from that going to the EU countries, when corrected for sizes and distances. Finally, a comparison of the Table 4 likelihood ratio test to those

obtained previously indicates that the trade bloc regression is roughly the same as the basic one in Table 2. These are less advantageous as the sector-specific results in Table 3.

4.3 Fixed Sector and Trade Bloc Effects

Table 5. Fixed Sector and Trade Bloc Effects

Regressors	IHS ROBUST
$\ln(Y_t)$ *Export Country GDP*	0.188 (0.06)
$\ln(Y_{j,t})$ *Recipient Country GDP*	2.466*** (4.05)
$\ln(N_t)$ *Export Country Population*	−5.085 (−0.54)
$\ln(N_{j,t})$ *Recipient Country Population*	−0.827 (−1.46)
$\ln(D_j)$ *Distance*	−5.567*** (−6.21)
$Sector_1$ *Fishing Industries*	8.714*** (16.29)
$Sector_2$ *Manufacturing Industries*	6.917*** (12.84)
$Sector_4$ *Other Industries*	5.987*** (11.25)
$Bloc_1$ *EFTA*	0.982** (2.33)
$Bloc_3$ *NAFTA*	0.812 (1.14)
$Bloc_4$ *NON Bloc Members*	5.122*** (3.07)
Constant	132.295 (1.00)
OBSERVATIONS	740
LIKELIHOOD RATIO TEST	-2033.5182
DEGREES OF FREEDOM	11
R-SQUARED	0.5398

Note: Robust t-statistics are in parentheses below the coefficients. ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

The final step in estimating the gravity model specification for overall volume

of goods exports is to run a regression including both sector and bloc specific effects simultaneously. Estimates for a specification including sector and bloc specific effects are presented in Table 5:

In Table 5, sector 3 (energy intensive industries) and bloc 2 (EU) are kept fixed simultaneously. The estimates in Table 5 imply that the coefficient estimates obtained for the first five variables and the last three variables are analogous to estimates obtained in Table 4. Moreover, the estimates obtained for fixed sector differences are very similar to those obtained in the sector specific regression presented in Table 3.

Taken together, the fixed effects estimates obtained can be interpreted such that the coefficients indicate how greatly exports of the third sector (energy intensive) to the second bloc (EU) vary from other sectors and blocs. For example, the coefficient obtained for fishing industries exports to EFTA would be $8.714 + 0.982 = 9.696$.

Thus, after controlling for unobserved sector-specific effects and trade blocs, the coeffcient signs indicate that Icelandic exports exhibit patterns similar to those of other countries with regards to recipient market size and distance.

5 Conclusion

Results from applying the gravity model to a small and distant country imply that transport costs proxied by distance significantly reduce the volume of exports. These results support Krugman's earlier findings.

Regression estimates indicate that when corrected for country distance, country size and population, the EFTA trade bloc and countries outside EU, EFTA and

NAFTA attract more exports than the EU countries. However, NAFTA countries are not estimated to be different from EU countries in terms of export attractiveness. Moreover, estimates indicate that over the period analyzed, the fishing sector strongly dominates all other export sectors.

The exporting country market size is not estimated to have a significant impact on export volume. Instead, recipient market size and wealth seem to be more important.

However, after controlling for sectors and trade blocs, results indicate that exports for small remote developed economies follow the same patterns as exports from large economies.

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