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Edgar Morgenroth and Martin O'Brien

26 / 2008

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Some further results on the impact of migrants on trade

Edgar Morgenroth*, Martin O'Brien
Economic and Social Research Institute, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland

Abstract:
This paper investigates the relationship between migration and trade. Specifically it adds to the existing literature by allowing for the endogeneity of migration, as predicted by theory, while also allowing for the relationship between trade and migration to be non-linear. In contrast to previous single country studies this paper utilises a large cross section dataset for 26 countries and their trading partners.

JEL Classification: F16, F22
Key Words: International Migration, International Trade, Gravity Model

*Corresponding Author: Economic and Social Research Institute, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland. Tel. +353 (0)1 8632118, Fax. +353 (0) 1 8632100, E-mail edgar.morgenroth@esri.ie

1. Introduction

A significant trend, at least in developed countries, is the increase in the proportion of the population that is made up by migrants. For example in the period 1995 to 2004 16 out of the 21 OECD countries for which data is available recorded an increase in the share of the labour force accounted for by migrants OECD (2006).

Mundell (1957) showed that in the standard Heckscher-Ohlin (H-O) model migration and trade are substitutes. Since trade in the H-O model is driven by differences in factor endowments, migration, which would only take place due to differences in factor incomes, would reduce the differences between countries and thus reduce trade. However, this result is overturned once one relaxes the restrictive assumptions of the H-O model or considers alternative models such as the Specific Factor or New Trade Theory models (see Faini et.al., 1999).

An alternative explanation for a link between migration and trade arises out the fact that migrants tend to keep links with their origin country (Rauch, 1999). Immigrant links to their home country can exhibit a positive externality in reducing the costs of trade between home and host countries and thus lead to an increase in bilateral trade between home and host. These links include knowledge of home country markets and supporting legal and political institutions, language, preferences and business contacts.

Immigrant links affect bilateral trade flows via two mechanisms. Firstly, immigrants bring with them a preference for home produced goods. If these goods are differentiated across countries then one would expect the level of imports of the host country from the home country to increase. Secondly, the immigrant stock is embodied with information about their home market and as such costs of trade can be diminished. The prevalence of either the preferences or information effect can be ascertained by examining whether imports or exports are influenced more by immigration, however both phenomena are likely to be at work.

An important implication of the network explanation of the link between trade and migration is that it predicts a non-monotonic relationship between the two since it is likely that as migrant stock increase further international networking opportunities are exhausted. Similarly, as migrant stocks increase they are likely to substitute locally produced goods that meet their preference for imported goods.

A number of empirical papers emerged. These have focused on the impact of migrants in a particular country, and largely the USA. Gould (1994) in his study of US trade found that host exports appeared to be influenced more by the immigrants' information links to their home country than imports. However the marginal returns on these effects for the export market diminishes quite rapidly as the immigrant community from a given country increases. In contrast a relatively large immigrant community must develop before the marginal effects on the import sector are diminished. In contrast Head & Ries (1998) estimated that a 10% increase in the immigrant population in Canada from a particular country leads to a 1% increase in exports and a 3% increase in imports. The key findings of Girma and Yu (2002) were that the UK has a greater propensity to trade with Commonwealth (CW) countries as opposed to Non-Commonwealth (NCW) countries. A 10% increase in NCW immigrants increases UK exports to NCW's by 1.6% and imports from NCW's by 1%, whereas for CW the effect is statistically insignificant. There is also evidence of import substitution among NCW immigrants, either driven by a change in preferences for UK goods or the fact that large NCW immigrant communities allow for economies of scale in production of goods from their home countries. Finally Mundra (2005) presents results that indicate that the immigrant effect was positive for U.S.

finished and intermediate goods imports, finished goods exports and negative for exports of intermediate goods.

Migration is likely to be endogenous since trade liberalisation impacts on factor incomes and thus the incentive to migrate. Likewise, if one favours the network explanation for the link between trade and migration one would expect migration to be endogenous since trade is likely to induce the formation of networks and thus induce migration. Furthermore, a more indirect rationale for the endogeneity arises out of the complementary relationship between FDI and migration (see Kugler and Rapaport, 2007), if FDI is trade inducing, which has for example been found in the recent study by Alguacil et.al (2002). It is therefore surprising that the existing empirical literature has ignored this simultaneity between migration and trade, which if proven would introduce a bias into the empirical results. The fact that the stock of immigrants is accumulated over many years does not imply that it is exogenous in the empirical sense since it has been shown that trade flows are also driven by past trade flows (see Eichengreen and Irvin, 1998). The analysis in this paper explicitly takes account of this endogeneity. Furthermore, given the well established relationship between GDP growth and trade, GDP which is used in the gravity model utilised below is also likely to be endogenous.

This paper adds to the existing literature on the link between migration and trade by allowing for the endogeneity of migration while also allowing for the relationship to be non-linear, using the familiar gravity model. In contrast to previous studies it utilises a large cross section dataset for 26 countries and their trading partners. Furthermore, the paper investigates the degree to which migrants from different regions have a differential impact on trade.

2. Empirical Model

A widely used empirical trade model that has been found to explain a significant proportion of bilateral trade flows is the gravity model and it is therefore not surprising that this has also been the model of choice for the analysis of migration and trade[1]. As the name suggests, the gravity model is based on the assumption that trade is generated by mass or economic size, which is proxied by GDP, and is inhibited by distance, which increases transportation and other transactions costs. In its most basic form it relates bilateral trade to distance between countries and a gravity variable, usually GDP. While a number of different versions of the gravity model have been used the most commonly adopted specification is the following:

$$\log(X_{ij}) = \alpha + \beta_1 \log(Y_i) + \beta_2 \log(Y_j) + \beta_3 (D_{ij}) \quad (1)$$

where X_{ij} are exports from country *i* to country *j*, Y_i and Y_j are the GDPs of country *i* and *j* respectively, and D_{ij} is the distance between the two countries. A number of studies assume that the coefficients on the home and foreign GDP are equal and thus use the logarithm of the product of the two GDPs. As this restriction should be tested rather than simply imposed we prefer to utilise the more general model (1). In terms of predicting the sign of the estimated parameters, a high level of income in the exporting country indicates a high level of production which increases the availability of products for export while a high level of income in the importing country suggests higher imports. We therefore expect the coefficients of both $Y_{i,t}$ and

[1] The numerous studies that have utilised the gravity model include Eichengreen and Irwin (1998) Bougheas et.al (1999), Rose (2004) and Huang (2007).

$Y_{j,t}$ to be positive. Since distance increases transport costs, which inhibit trade, its coefficient is expected to be negative.

We add the stock of migrant resident in host country *i* and originating in country *j* to the standard model, allowing this variable to enter both in levels and squared form. Furthermore we estimate equations for both exports and imports into country *i* from country *j* (I_{ij}).

$$\log(X_{ij}) = \alpha + \beta_1 \log(Y_i) + \beta_2 \log(Y_j) + \beta_3 (D_{ij}) + \beta_4 \log(IMM_{ij}) + \beta_5 \log(IMM^2_{ij}) \quad (2)$$

$$\log(I_{ij}) = \alpha + \beta_1 \log(Y_i) + \beta_2 \log(Y_j) + \beta_3 (D_{ij}) + \beta_4 \log(IMM_{ij}) + \beta_5 \log(IMM^2_{ij}) \quad (3)$$

If the predictions of Mundell (1957) are correct we would expect the elasticity of trade with respect to migrant stock to be negative while the alternative models would suggest a positive elasticity. Furthermore, as highlighted above a comparison of the elasticities for imports and exports will shed light on whether the preference for origin produced products dominates the information effect.

3. Data Sources and Definitions

The aim to widen the analysis from single country studies to a larger set of countries is constrained by data availability. Specifically once one attempts to widen the number of countries to be included in the analysis it becomes difficult to find consistent data over time. Consequently we are constrained to use a cross section of data covering 26 reporting countries, most of which report migrant stocks for 179 partner countries the exception being Austria, which has only 77. While the estimation is done on a cross-section basis, the data is reported for different countries for different years spanning 1999-2003. As such each individual country variables have been chosen for the appropriate year before pooling takes place.

Data on stock of immigrants, bi-lateral trade flows and other standard gravity model variables have been collected from various sources for this study. For the purposes of this paper an immigrant is defined as a person resident in a country other than their country of birth. This broad definition is necessary to be consistent with the data for all the reporting host countries. The data was taken from the *OECD Database on Immigrants and Expatriates* (2005). The immigrant stock is reported by country of birth, which is the partner (home) country, the number of which for each reporting (host) country. The partner (home) countries in our dataset are restricted to those for which both trade and gravity variables were available and as such are fewer than those in the original OECD database.

Given the endogeneity of the immigrant stock variable, two-stage least squares estimation is carried out. Immigrant stock is instrumented by the relative age dependency ratio between the host and origin countries as per the *World Development Indicators* (2006).

Aggregate bi-lateral trade data is taken from the UN COMTRADE database for the respective trading partners. The data is reported in current US Dollars, which we deflate by the respective host countries GDP deflator derived from the Penn World Tables, so as to obtain trade flows in constant 2000 US Dollars.

The gravity model is primarily concerned with the economic size of and the distance between trading partners. For size we use the log of real GDP for both countries as per the Penn World Tables (PWT 6.2), which are given in constant 2000

US Dollars. For distance we use a database provided by the CEPII[2], which presents geodesic distances in kilometres between the major population centres of the respective trading partners, calculated by the great circle distance formula. The logs of real GDP of both countries are instrumented by their respective logs of per-capita capital stocks.

4. Estimation Results

Table 1 presents the OLS and 2SLS regression results for both imports and exports, to and from the host country (*i*) respectively. As all variables are in logs, the coefficients can be interpreted as elasticities. The OLS results broadly support the proposed functional form, with the majority of variables entering with their expected signs and magnitudes and being highly significant. An exception is the IMM_{ij}^2 coefficient for imports, which is not found to be statistically significant.

If, as hypothesised, the immigrant stock and real GDPs are endogenous, then these OLS estimates are biased and inconsistent. The conventional approach would be to find appropriate instruments and apply a standard instrumental variables approach (IV). However, as we include a squared endogenous variable we utilise the approach of Kelejian (1971), of using powers and cross products of the exogenous and predetermined variables in the two stage least squares (2SLS) estimation. For both imports and exports, all the 2SLS coefficients are statistically significant at the 1% significance level. The standard gravity model variables, host and home real GDP's and distance enter with the expected signs. The negative effect of distance is less pronounced for imports than exports. The coefficients of particular interest in this paper, IMM_{ij} and IMM_{ij}^2, are highly significant and have the expected positive and negative signs, respectively, showing diminishing marginal returns to immigration for bi-lateral trade. This supports the complementarity of immigration and trade flows, however the degree of that complementarity is diminishing as the immigrant group grows.

The application of the 2SLS approach is validated using three tests. The Anderson canonical correlations test is a likelihood-ratio test of whether the equation is identified, i.e. that the instruments are relevant. The test statistic is distributed as chi-squared under the null hypothesis of underidentification. With a test statistic of 86.63 the test rejects the null hypothesis at the 1% significance level for imports. The second test is the Cragg-Donald test for weak instruments as proposed by Stock and Yogo (2005), which has a joint null hypothesis of weak instruments and underidentification. The test rejects the null at the 5% significance level with a test statistic of 6.48 for imports. The final test is the Durbin-Wu-Hausman (DWH) test, where the test statistic reported for the endogenous variables all reject the null hypothesis of exogeneity at the 1% level for the imports equation. For exports we cannot reject the null of exogeneity for host country RGDP with the DWH test. Thus the regression is run again treating $RGDP_i$ as exogenous and results are presented under 2SLS^. Qualitatively the results do not differ from the original exports 2SLS regression. The 2SLS^ regression, however, rejects the null hypotheses of weak and irrelevant instruments of the Anderson and Cragg-Donald tests more explicitly than the original exports regression, with test statistics of 642.24 and 57.91 versus 86.67 and 6.72 respectively. The DWH test for the IV^ regression confirms that $RGDP_j$ and IMM_{ij} are endogenous, rejecting the null hypothesis of exogeneity at the 1% level.

[2] Centre d'Etudes Prospectives et d'Informations Internationales.
http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Table 1 - Immigrant Effects on Bilateral Trade Flows: OLS and Two-Stage Least Squares (2SLS) regressions

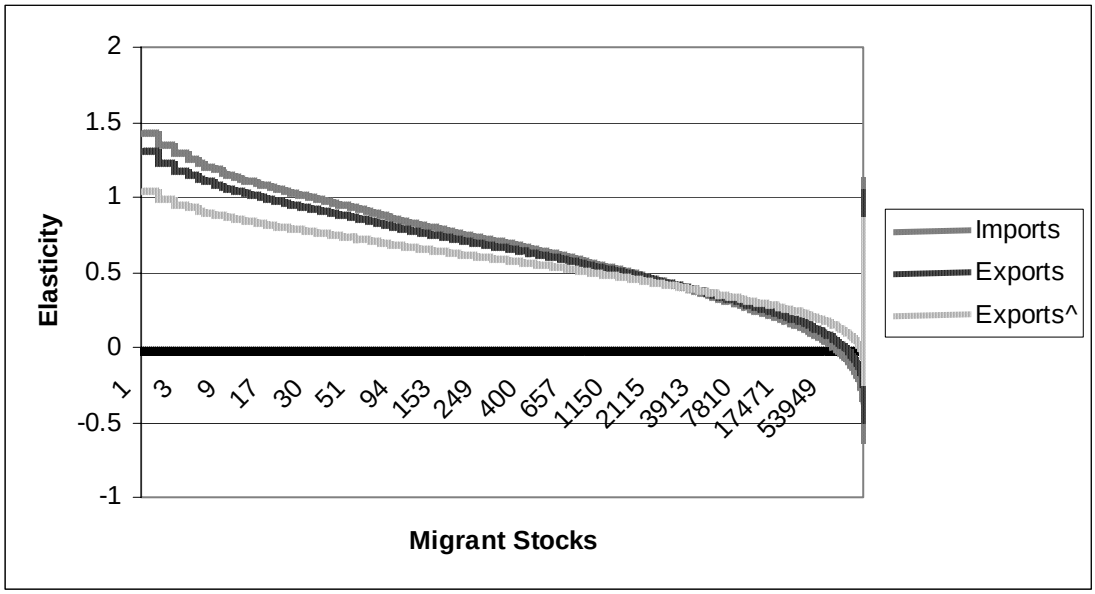
	Imports		Exports		
Variable	OLS	2SLS	OLS	2SLS	2SLS^
Intercept	-32.446***	-20.472***	-16.329***	-4.341*	-5.655*
	(32.70)	*(6.31)*	*(21.55)*	*(1.70)*	*(4.16)*
$RGDP_i$	1.061***	0.795***	0.806***	0.500***	0.539***
	(35.20)	*(8.84)*	*(34.79)*	*(7.05)*	*(13.73)*
$RGDP_j$	1.127***	0.645***	0.777***	0.397***	0.463***
	(58.03)	*(6.52)*	*(52.16)*	*(5.14)*	*(15.76)*
DISTANCE	-0.994***	-0.702***	-1.092***	-0.851***	-0.905***
	(24.79)	*(7.16)*	*(34.92)*	*(11.25)*	*(22.32)*
IMM_{ij}	0.262***	1.431***	0.421***	1.303***	1.041***
	(6.29)	*(6.37)*	*(13.13)*	*(7.80)*	*(12.12)*
IMM_{ij}^2	-0.005	-0.064***	-0.013***	-0.056***	-0.040***
	(1.56)	*(5.12)*	*(5.08)*	*(6.19)*	*(5.81)*
Obs	3989	3803	4147	3940	3940
R^2	0.707	-	0.745	-	-
Centred R^2	-	0.604	-	0.668	0.699
Anderson can. corr. LR	-	86.63***	-	86.67***	642.24***
Cragg-Donald Weak Identification	-	6.48**	-	6.72**	57.91**
DWH Test:					
$RGDP_i$	-	20.546***	-	0.512	-
$RGDP_j$	-	102.093***	-	113.126***	297.09***
IMM_{ij}	-	13.315***	-	9.883***	63.171***

Notes: All variables are in natural logarithms. T-stats in parentheses. ***, **, * is 1%, 5%, 10% significance level respectively. i denotes host, j denotes home. Excluded instruments used are log of per capita capital stocks in i and j, the relative age dependency ratio ($agedep_i/agedep_j$), their squares and cross-products. ^ treats RGDPi as exogenous. Anderson canonical correlations LR critical value has 8 degrees of freedom (no.of instruments – no. of regressors + 1). Cragg-Donald Weak identification test critical values as per Stock and Yogo (2002).

The degree of complementarity between immigration and trade depends on the size of the immigrant stock from *j* in *i*. Figure 1 illustrates this point, where the elasticities derived from the regression results are plotted with the size of the immigrant stock (in logs) on the x-axis. There is an interesting distinction between the effect on imports and exports. The elasticity is initially higher for imports (1.41) than for exports (1.04), but the former diminishes much faster than the latter. This finding stands in contrast to that of Gould (1994), who found the initial impact to be greater for exports but with the effect on imports diminishing less rapidly, while being consistent with those of Head and Ries (1998) for imports. A striking feature of Fig. 1 is that the elasticities become negative for both exports and imports once the immigrant stock reaches a saturation point. For imports this point is an immigrant population of just over 70,000 from *j* in *i*, whereas for exports the saturation point is just short of 450,000 immigrants from *j* in *i*. Further, it suggests that once immigrant communities reach a particular size they engage in import substitution to satisfy their

differentiated tastes by establishing production of previously imported goods in their host country, or their tastes are assimilated entirely by those of their host country[3].

Figure 1. Elasticity of Trade with respect to immigrant stocks



It is particularly interesting to shed some light on the potential integration effects of intra-European immigration. This is shown in Table 2 where the marginal impact of immigration from the EU 15 and the 12 new EU member states is only evaluated for those host countries that are part of the EU 15 and in the OECD (excluding Germany and the Netherlands). Immigration from the new accession states has a significantly higher impact on bilateral trade than immigration from the EU 15.

Table 2 presents the average elasticity of bilateral trade flows with respect to immigrant stocks evaluated on the basis of actual immigrant stocks for each country, grouped by region of origin. In total a 1 per cent increase in the stock of immigrants in each country *i* will lead to a 0.68 per cent increase in imports into *i* and 0.57 per cent increase in exports from *i* to *j*. There are significant differences in the marginal impacts of immigrants from different regions. African immigrants appear to have the highest marginal impact, 0.85 per cent increase in imports and 0.67 per cent increase in exports respectively for a 1 per cent increase in immigrants. Surprisingly the marginal impact of a 1 per cent increase in immigrants from China is not very much different from that of immigrants from other OECD countries (0.43 versus 0.4 for imports and 0.41 versus 0.39 for exports). One would expect the degree of differentiation between the two sub-groups to be such that Chinese immigration would have a significantly higher marginal effect, following the findings of Rauch and Trindade (2002). Overall, the greater the differences between origin region and host country, the greater the marginal effect of immigration on bilateral trade are.

[3] Alternatively the host country's tastes may be assimilated by those of the immigrant community.

Table 2 - Immigrant Effects on Bilateral Trade Flows: Average Elasticity per Region of Origin

Region	Obs	Imports 2SLS	Exports 2SLS	Exports 2SLS^
Total	4211	0.68	0.65	0.57
China	45	0.43	0.43	0.41
Indian Sub-Continent	162	0.65	0.62	0.55
South East Asia	220	0.62	0.59	0.53
Central & South America	446	0.69	0.66	0.58
Africa	985	0.85	0.79	0.67
OECD	671	0.40	0.40	0.39
EU	156	0.35	0.36	0.36
EU Accession	160	0.56	0.54	0.49

Notes: Average (mean) percentage change in imports and exports as a result of a 1% increase in immigrant stock from different regions. T-tests confirmed the majority of these means were statistically different from each other at the 95% confidence level. Exports 2SLS^ treats $RGDP_i$ as exogenous.

Overall our results indicate that immigration and trade are complements, but the degree of their complementarity is dependant upon both the size of the existing immigrant community and where these immigrants come from. Indeed, our results suggest that the USA has reached a saturation point with some immigrant communities where immigration and trade are effectively substitutes. This is confirmed by Figure 2, which shows the decreasing marginal returns to immigration in the US with elasticities derived from the regression results are plotted with the size of the immigrant stock (in logs) on the x-axis. The pattern is broadly the same as that for the whole sample of host countries in Figure 1. The point at which imports and immigration become substitutes, i.e. where the elasticity becomes negative, is for an immigrant population from *j* of 68,290. The commensurate exports point is for an immigrant population of 346,750 from *j*. Figures 3 and 4 repeat the procedure for the UK and Ireland. The UK saturation point where imports and immigration become substitutes is an immigrant population of 72,518 from *j* and for exports a population of 321,168. For Ireland the various immigrant communities were yet to reach the size to allow for any substitution effect to take place for exports in the year in question, 2002, whereas only the number of Britons in Ireland were subject to substitution effect for imports with a population of 248,515.

Figure 2 Elasticity of Trade with respect to immigrant stocks for the USA

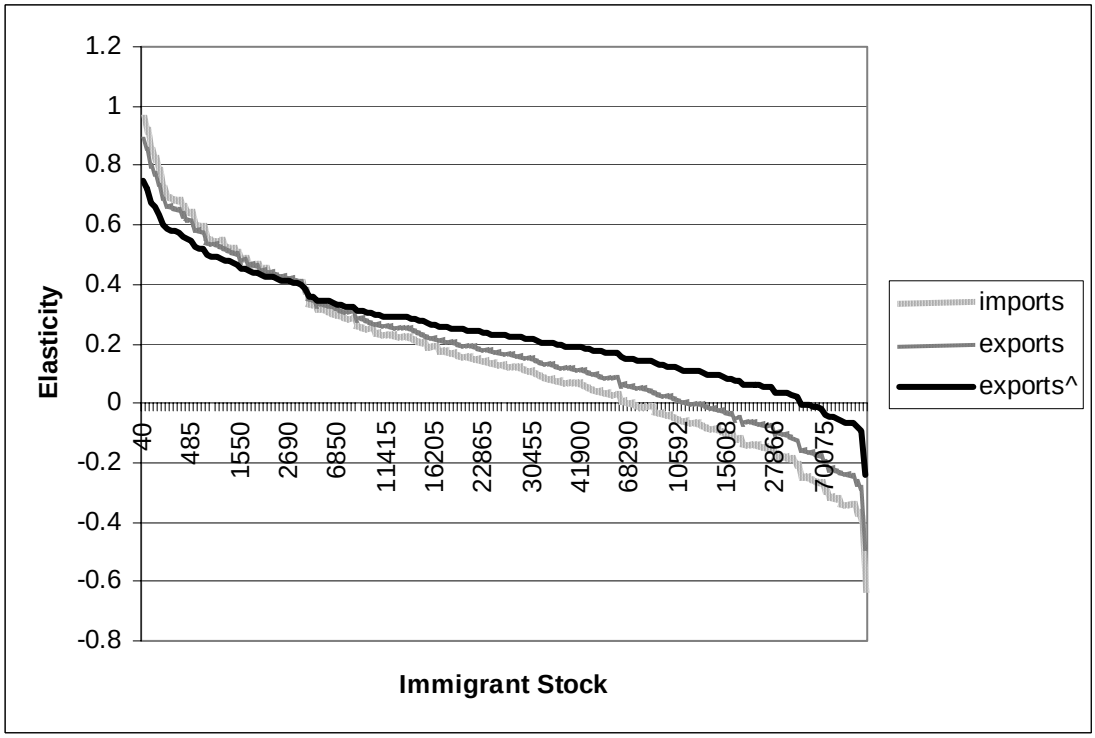


Figure 3 Elasticity of Trade with respect to immigrant stocks for the UK

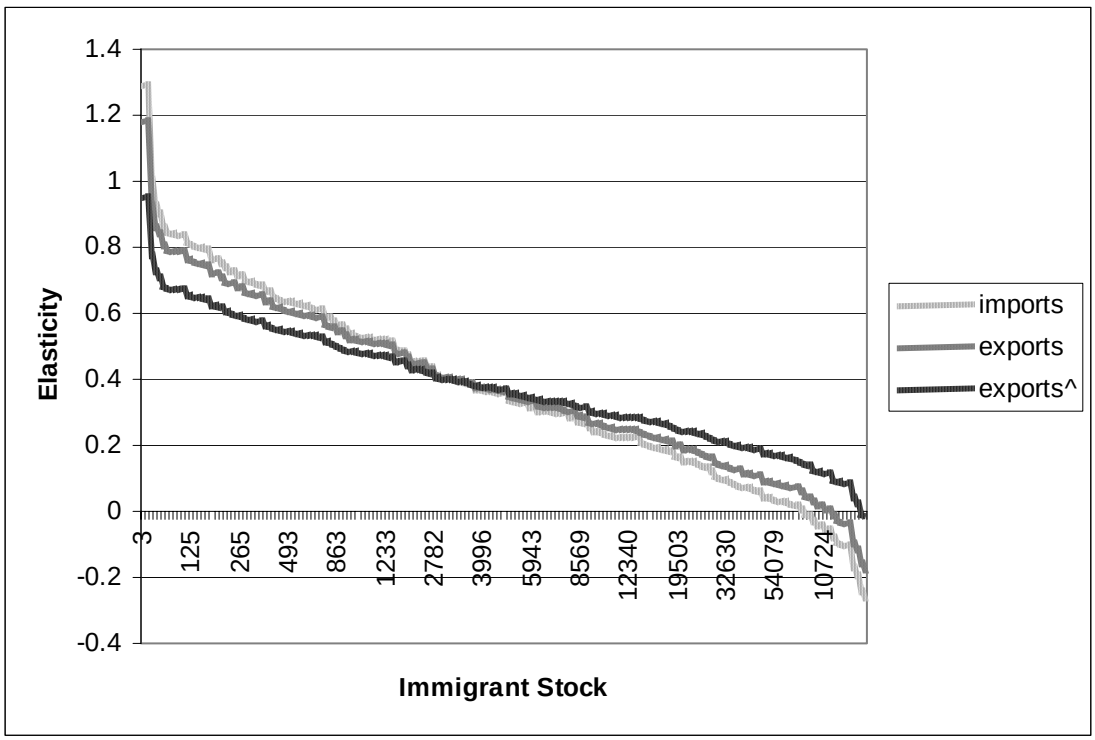
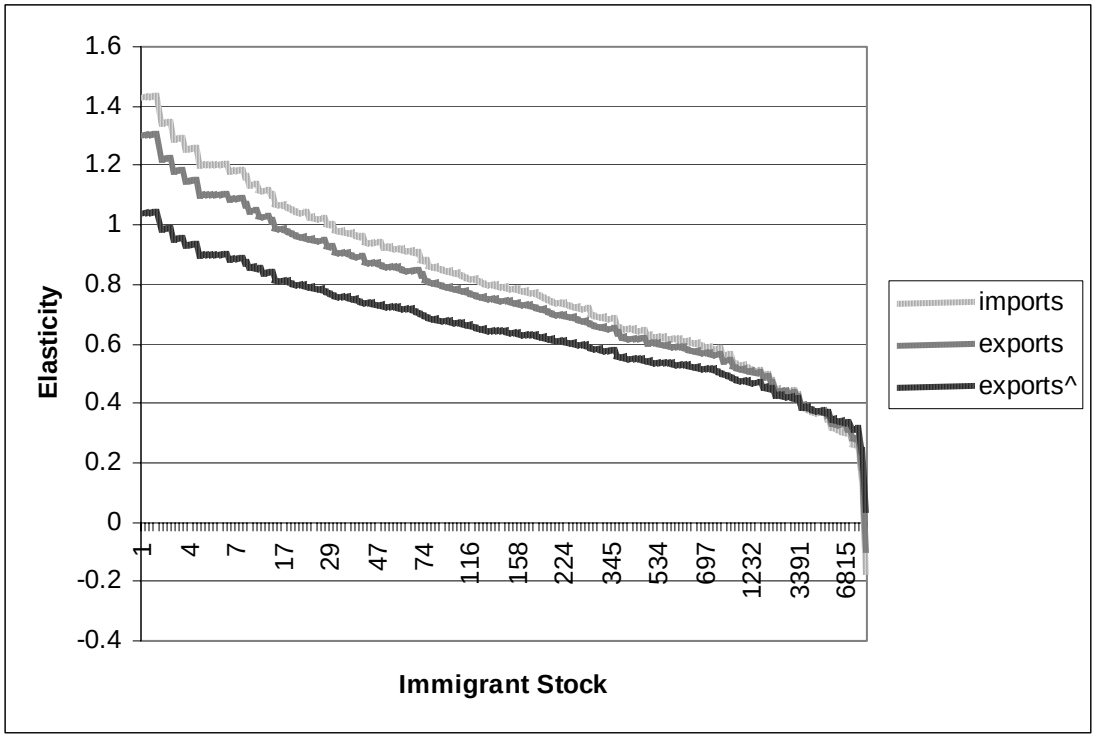


Figure 4 Elasticity of Trade with respect to immigrant stocks for the Ireland



6. Conclusions

The econometric analysis has shown that estimates obtained using OLS, as has been the standard practice in previous papers, yield biased and inconsistent results, which of course limits their usefulness in drawing policy conclusions.

Overall our consistent and unbiased results indicate that immigration and trade are complements, but the degree of their complementarity is dependant upon both the size of the existing immigrant community and where these immigrants come from. Indeed, our results suggest that the USA has reached a saturation point with some immigrant communities where immigration and trade are effectively substitutes. Further research should extend the analysis to different product groups in order to identify possible differences in the impact of migrants from different regions.

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