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Migration, Knowledge Diffusion and the Comparative Advantage of Nations

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ABSTRACT

Migration, Knowledge Diffusion and the Comparative Advantage of Nations*

Do migrants shape the dynamic comparative advantage of their sending and receiving countries? To answer this question we study the drivers of knowledge diffusion by looking at the dynamics of the export basket of countries, with particular focus on migration. The fact that knowledge diffusion requires direct human interaction implies that the international diffusion of knowledge should follow the pattern of international migration. This is what this paper documents. Our main finding is that migration, and particularly skilled immigration, is a strong and robust driver of productive knowledge diffusion as measured by the appearance and growth of tradable goods in the migrants' receiving and sending countries. We find that a 10% increase in the stock of immigrants from countries exporters of a given product is associated with a 2% increase in the likelihood that the host country will start exporting that good "from scratch" in the following 10-year period. In terms of ability to expand the export basket of countries, a migrant with college education or above is about ten times more "effective" than an unskilled migrant. The results are robust to accounting for shifts in product-specific global demand, to excluding bilateral trade possibly generated by network effects, as well as to instrumenting for migration using a gravity model.

JEL Classification: F14, F22, F62, O33, D83

Keywords: migration, knowledge diffusion, comparative advantage, exports

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1 Introduction

Franschhoek valley, a small town in the Western Cape province of South Africa, is known today for its beautiful scenery and for its high-quality wineries. The town was founded in the late 17th century by French Huguenot refugees, who settled there after being expelled from France following King Louis XIV's revocation of the Edict of Nantes. As of today, the wineries in Franschhoek are among the main producers of South African wine exports. Is this story part of a much larger pattern that can be identified in the data?[1]

In this paper we explore the role of migrants in shaping the comparative advantage of both their sending and receiving countries. In particular, we document industry-specific productivity shifts in tradable goods as explained by the variation in the international movement of people. Our methodology exploits changes in the export baskets of countries. The key assumption is that, after controlling for product-specific global demand, firms in a country will be able to export a good only after they have become productive enough to compete in global markets. Of all international factor flows, the results point to migration as the strongest of those drivers. We find that migrants, and even more so, skilled immigrants, can explain variation in good-specific productivity as measured by the ability of countries to export those goods, for products that are intensively exported in the migrants' home/destination countries. In particular we find that, on average, a 10 percent increase in the stock of immigrants (emigrants) from countries exporters of a given product is associated with an up to 2 (1.6) percent increase in the likelihood the receiving (sending) country will export that same product from scratch in the next ten years. By exploiting the skill level of the migrants, our estimates imply that -evaluated at the sample averages- the marginal effect for a skilled immigrant (emigrant) is 10 (4) times larger than for an unskilled immigrant (emigrant). Also, in terms of expanding the export basket of countries, a skilled migrant is worth over US $100,000 of foreign direct investment (FDI), while an unskilled migrant is worth only about $25,000. We interpret our results as evidence of international knowledge diffusion.

To generate these findings, we undertake an empirical exercise that looks at how migration figures correlate with a country's extensive and intensive margins of trade. We use new appearances of products in a country's export basket to

[1] Hornung (2014) studies the Huguenot migration to Prussia and its effect on local productivity with historical data.

measure the extensive margin, while the intensive margin refers to the annual growth rate of a product that is already exported. For this purpose we put together different publicly available data sources that include bilateral data on migration, FDI and trade.

The empirical analysis takes into consideration a number of alternative explanations, unrelated to knowledge transmission channels, on how migration could be associated to good-specific productivity increases.

First, even if our focus is on migrants, we also control for FDI and trade, which tend to highly correlate with migration figures.

Second, migrant networks could generate lower transaction costs for bilateral trade in specific goods, thus inducing bilateral exports between the sending and receiving country of the migrants (i.e., Gould 1994; Rauch and Trindade 2002; Aubry and Rapoport 2015). Therefore, in order to deal with this possibility, we calculate all the specifications using an alteration of the dependent variable, which measures exports to the rest of the world *excluding* flows to countries where migrants are in or from. In this case, the increase in exports cannot be explained by its bilateral component.

Third, if a given country c receives migrants from countries that are exporters of a given product p, then there could be a local shift in demand for product p, given the plausible shift in aggregate preferences. This could result in a shift in local preferences, that could be simultaneously occurring in all other countries that also received the same type of migrants. This shift in preferences could result in a shift in global demand, which could be supplied by exports from the countries under consideration to the rest of the world. To rule out this possible explanation, we control for global demand of each good by adding product-year fixed effects. We also add country-year fixed effects which would control for all country-level time variant characteristics that would make a given country more likely to export and receive migrants at the same time.

Fourth, the changes in the extensive and the intensive margin could potentially be explained by an unobserved historical trend that would result in new or more exports of particular goods, independently of where migrants come from or go to. To rule out this possibility, we perform a "placebo" test, in which we find that increases in exports of a given product *cannot* be explained by immigration from, or emigration to countries that *do not* export that product.

Finally, even after including these controls, endogeneity concerns might remain. For instance, migrants can decide to relocate to countries with an ex-ante understanding of the industries that will flourish in that other location. To deal

with this possibility and with endogeneity concerns more generally, we instrument migration using estimates from a gravity model based on cultural and historic bilateral variables between the sending and receiving countries of the migrants, following Frankel and Romer (1999). To improve the fit between the estimated and actual values we estimate the gravity model using a poisson pseudo maximum likelihood estimator. The instruments provide an exogenous variation in the number of migrants from and to partner countries. Furthermore, for this methodology, we use the reconstructed dependent variable which *excludes* exports to countries where migrants are in or from, thereby further reducing endogeneity concerns.

This paper contributes to different streams of the literature. First, it belongs to the trade Ricardian literature which usually assumes as given the exogenous productivity parameters that define the export basket of countries which are generated in equilibrium.[2] However, a burgeoning literature deals with understanding the evolution of these productivity parameters, and consequently, of the actual export baskets of countries (e.g., Hausmann and Klinger 2007; Hausmann et al. 2014).

Second, by focusing on industry-specific productivity dynamics, this paper complements previous literature on the links between international factor flows and changes in *aggregate* productivity (e.g., Coe and Helpman 1993; Coe et al. 2009; Aitken and Harrison 1999, Javorcik 2004, Kugler 2006, Andersen and Dalgaard 2011, Kerr 2015).

Third, it belongs to the literature on international knowledge diffusion in that it looks at the role of migrants as a major input to productivity increases. In particular, it builds on Bahar et al. (2014) who suggest that the appearance of new industries in the export basket of countries can be partly explained by the local character of knowledge diffusion. That is, productivity inducing knowledge follows a highly geographically localized diffusion pattern, which is attributed to its "tacitness" (e.g., Jaffe, Trajtenberg and Henderson 1993; Bottazi and Peri 2003; Keller 2002; Keller 2004; Kerr 2008). Therefore, as suggested by Kenneth Arrow (1969), the transmission of this tacit or non-codifiable knowledge relies on human minds rather than on written words. Thus, if tacit knowledge can induce sector-specific productivity shifts as measured by new exports, then migrants, who are naturally carriers of tacit knowledge, would shape the

[2] A large part of the literature has focused on understanding the characteristics of this equilibrium and the mechanisms through which it is conceived (e.g., Eaton and Kortum 2002, Costinot et al. 2011).

comparative advantage of their sending and/or receiving countries. In other words, the fact that knowledge diffusion requires direct human interaction implies that the international diffusion of knowledge should follow the pattern of international migration. This is what this paper documents.

The rest of this paper is divided as follows: the next section describes the empirical strategy, the specifications to be estimated, and provides some theoretical intuition as to the how migration, trade and FDI to and from countries which are good at exporting a given good are likely to affect the probability to start exporting (or to exporting more of) that product. Section 2.2 describes the data and the construction of the sample. Section 3 presents the main results, and Section 4 presents a number of extensions and robustness checks. Section 5 concludes.

2 Empirical Strategy

2.1 Research Question and Empirical Challenges

We investigate the relationship between international migration flows and the dynamics of the export basket of the migrants' receiving and sending countries. In particular, we ask the following question: can migrants induce product-specific productivity shifts in their sending (destination) countries, for products already intensively exported in their destination (sending) countries?

For the sake of better understanding, we use the following hypothetical example. Suppose there are two countries in the world: France (a wine exporter), and South Africa (a rugby jerseys exporter). The analogous question then becomes whether the presence of more French in South Africa is associated with the ability of South Africa to export wine and whether this same presence is also associated with the ability of France to export jerseys.

There are a number of empirical challenges in studying the relationship between productivity and international factor flows. First, all flows are highly correlated among themselves. Moreover, several empirical studies have shown that migration networks are an important determinant of bilateral trade flows and of bilateral FDI flows.[3]

[3]On migration and trade, see, e.g., Gould, 1994; Rauch and Trindade, 2002; Combes, Lafourcade and Mayer, 2005; Iranzo and Peri 2009; Felbermayr and Jung, 2009; or Parsons and Vezina, 2014. On migration and FDI, see, e.g., Tong, 2005; Kugler and Rapoport, 2007; or Javorcik et al. 2011. See also Aubry and Rapoport (2015) on migration and the ratio of exports to FDI-related sales.

Hence, the positive correlation between international flows of capital, goods and labor is a matter of consideration to any study of this kind. In fact, in the sample for the year 2000, the correlation matrices between total bilateral migration, FDI and trade across countries are all positive and above 0.5 when log-transformed or above 0.17 when in per capita terms (see Tables 1 and 2). That is, countries that receive/send more migrants tend to also receive/send more FDI and export/import in larger quantities. Hence, to deal with this challenge, the empirical specification controls for all three factors simultaneously.

[Table 1 about here.]

[Table 2 about here.]

Second, we are interested exclusively in productivity shifts and not in demand-driven exports. The nature of our dataset allows us to introduce product-by-year and country-by-year fixed effects,[4] making it possible to rule out that the results could be driven by the global demand for particular goods (e.g., driven by shifts in preferences due to the arrival of migrants) or by a third, uncontrolled for variable (e.g., an openness shock) which could induce migration and exports at the same time.

In addition, we are also interested in understanding whether the increase in exports is due to lower transaction costs induced by migrant networks[5] or to productivity shifts. Since we are exclusively interested in the latter, we also use a correction of our dependent variable that excludes exports to the countries where migrants are in or from, as detailed below.

We also want to rule out the possibility that our results are driven by unobservable trends that are unrelated to migration. To deal with this, we run placebo tests that use on the right hand side migrants coming from and going to countries that *do not* export the product under consideration. If knowledge diffusion through migration is an essential part of the dynamics we document, we would expect no results from this placebo test.

Finally, we address endogeneity concerns that could be due, for example, to the fact that migrants could relocate themselves based on ex-ante knowledge regarding the growth potential of certain sectors. In order to reduce such concerns, we implement an instrumental variable approach based on Frankel and

[4]This implies a fixed-effect for each combination of product and year, as well as for each combination of country and year.

[5]The pro-trade and pro-FDI creating effect of migration has been interpreted as evidence that migration networks lower transaction costs between the migrants' home and host countries (see the references in Footnote 3).

Romer (1999). In particular, we construct estimated migration stocks using a gravity model based on common cultural and historical characteristics between the migrants' sending and receiving countries. The estimated figures are used to instrument for actual migration stocks.

Having estimated migration stocks using variables such as common colonizer, colony-colonizer relationship, common language and same religion, we create figures that are exogenous to the ability of a country to export a particular good to the rest of the world.[6] Using this exogenous variation we instrument for the actual migration stocks and find our results to be robust to this procedure.

2.2 Data and Sample

The bilateral migration data come from Artuc et al. (2015). The dataset consists of total bilateral working age (25 to 65 years old) foreign born individuals in 1990 and 2000, disaggregated by skills. Skilled migrants are considered to have completed some tertiary education at the time of the census.

Bilateral FDI stocks (positions) are from the OECD International Direct Investment Statistics (2012). This dataset tracks FDI from and to OECD members since 1985 until 2009. Using these data we compute 10-year stocks of capital flows for each country in 1990 and 2000.[7] Negative FDI stocks are treated as zeros.[8]

Bilateral trade data come from UN Comtrade with corrections implemented by Hausmann et al. (2011), from years 1984 to 2010. The dataset uses the 4-digit Standard Industry Trade Classification (SITC) to classify products. Thus, the list of products is fairly disaggregated. For instance, products in this classification are "Knitted/Crocheted Fabrics Elastic Or Rubberized" (SITC code 6553), or "Electrical Measuring, Checking, Analyzing Instruments" (SITC code 8748). The words product, good and industry interchangeably refer to the same concept throughout the paper. We use this trade dataset to construct two variables: first, total exports per product per country to the rest of the world, to be used to compute the dependent variable in the empirical specifications; and second, we also compute 10-year stocks for bilateral trade (imports and exports) to be used as an independent variable. Both the 10-year trade and FDI stocks

[6] Country-by-year fixed effects in the specification would deal with concerns that countries with particular languages or cultures, for instance, are more likely to gain comparative advantage in particular goods.

[7] For 1990 we use the stock from 1985 to 1990 due to limitations of the data.

[8] This follows the same methodology suggested by Aubry and Rapoport (2015). Only 1.7% of the original dataset is affected by this.

are deflated using the US GDP deflator (base year 2000) from the World Development Indicators (WDI) by the World Bank. Other information at the country level is also taken from the WDI.

Finally, we also incorporate variables from the GeoDist dataset (Mayer and Zignago, 2011) from CEPII on bilateral relationships such as common colonizer, colony-colonizer relationship and common language, as well as data on same religion between pairs of countries from The World Religion Dataset (Zeev and Henderson, 2014), to be used in our instrumental variable approach.

The final sample consists of 135 countries and 781 products.[9] We define two 10-year periods for the analysis due to the limitations imposed by the bilateral migration data, which are 1990-2000 and 2000-2010.

2.3 Empirical Specification

The aim of the paper is to study the dynamics of the extensive and intensive margin of trade (with exports to the rest of the world) given different levels of migration stocks, controlling for FDI and trade stocks. The specification also disentangles immigration and emigration.

Throughout the paper we will use the concept of Revealed Comparative Advantage (RCA) of Balassa (1965), which will be used to construct export-related variables both in the left-hand-side and right-hand-side of the specification. RCA is defined as follows:

$$RCA_{c,p} \equiv \frac{exp_{c,p} / \sum_{p} exp_{c,p}}{\sum_{c} exp_{c,p} / \sum_{c}\sum_{p} exp_{c,p}}$$

where $exp_{c,p}$ is the exported value of product p by country c. This is a yearly measure.

For example, in the year 2000, soybeans represented 4% of Brazil's exports, but accounted only for 0.2% of total world trade. Hence, Brazil's RCA in soybeans for that year was $RCA_{Brazil,Soybeans} = 4/0.2 = 20$, indicating that soybeans are 20 times more prevalent in Brazil's export basket than in that of the world.

The empirical specification is defined as follows:

[9] We exclude Former Soviet Union countries from the sample given their poor trade data in the period 1990-2000, as well as small countries with population below 1 million, following Bahar et al. (2014).

$$
\begin{aligned}
Y_{c,p,t\to T} &= \beta_{im}\sum_{c'} immigrants_{c,c',t}\times R_{c',p,t} + \beta_{em}\sum_{c'} emigrants_{c,c',t}\times R_{c',p,t} \\
&+ \beta_{FDI}\sum_{c'} FDI_{c,c',t}\times R_{c',p,t} + \beta_{trade}\sum_{c'} trade_{c,c',t}\times R_{c',p,t} \qquad (1)\\
&+ \gamma Controls_{c,p,t} + \alpha_{c,t} + \eta_{p,t} + \varepsilon_{c,p,t}
\end{aligned}
$$

The definition of the dependent, or left hand side (LHS) variable, $Y_{c,p,t\to T}$, alternates according to whether the specification is studying the intensive or the extensive margin of trade for a specific product p and country c. When studying the *extensive* margin, $Y_{c,p,t\to T}$ equals 1 if country c achieved a RCA of 1 or more in product p in the period of time between t and T conditional on having $RCA_{c,p,t} = 0$ at the beginning of the period. That is:

$$Y_{c,p,t\to T} = 1 \text{ if } RCA_{c,p,t} = 0 \text{ and } RCA_{c,p,T} \geq 1$$

To avoid noise on the dependent variable, we restrict $Y_{c,p,t\to T} = 1$ to two additional conditions: first, the country-product under consideration must keep its RCA value above 1 for five years after the end of the period, year T; and second, the country-product under consideration must have had RCA value equal to 0 during all five years before the beginning of the period, year t.

When studying the *intensive margin*, $Y_{c,p,t\to T}$ is the annual compound average growth rate (CAGR) in the exports value of product p, between years t and T, conditional on having $exports_{c,p,t} > 0$.[10] That is:

$$Y_{c,p,t\to T} = \left(\frac{exports_{c,p,T}}{exports_{c,p,t}}\right)^{1/T-t} - 1 \text{ if } exports_{c,p,t} > 0$$

The independent variables include the following:

- The stock of immigrants from, and of emigrants to other countries (denoted by c') at time t, weighted by a dummy $R_{c',p,t}$ which equals 1 if $RCA_{c',p,t} \geq 1$. In this sense, for each country c and product p, we include on the right hand side the total of immigrants from and emigrants to countries that export product p with a RCA above 1 at the beginning of the period.

- The sum of the stock of FDI and the sum of the stock of exports, using

[10] Appendix F presents robustness tests that use log-growth as the dependent variable, where $Y_{c,p,t\to T} = \frac{ln(exports_{c,p,T}) - ln(exports_{c,p,t})}{T-t}$

the same weighting structure as above. In Online Appendix Section D we also present regression results for specifications that separate between exports and imports, and between FDI inflows and outflows.

- Product-by-year fixed effects, to allow for a different constant for each combination of year and product. This will control for global demand for the product at that period of time. Thus, all dynamics in exports after this control are supply-induced and can therefore be attributed to productivity shifts.

- Country-by-year fixed effects to control for any country level time-variant characteristics that correlate with both national migration determinants and aggregate productivity levels such as income, size, institutions, etc.

- A vector of controls of baseline variables: the accumulated imports of product p in the previous period when estimating the extensive margin,[11] and, when estimating the intensive margin equations, we also include the baseline level of exports for that same product as well as the compound average growth rate (CAGR) of the export value in the previous period (in order to control for the previous growth trend).[12]

- A binary variable indicating whether $exports_{c,p,t-1} = 0$ (see footnote 12).

All level variables (migration, FDI, trade, and RCA levels) are transformed using the inverse hyperbolic sine (see MacKinnon and Magee, 1990).[13] This linear monotonic transformation behaves similarly to a log-transformation, except for the fact that it is defined at zero. The interpretation of regression estimators in the form of the inverse hyperbolic sine is similar to the interpretation of a log-

[11] This is to control for whether importing that particular good affects future exports of that same good through channels that are correlated with our other regressors.

[12] The CAGR during 1985-1990 for the 1990-2000 period, and 1990-2000 for the 2000-2010 period. In order to correct for undefined growth rates caused by zeros in the denominator, we compute the CAGR following the above equation using $exports_{c,p,t} + 1$ for all observations. Note that when studying the intensive margin the CAGR of export value in the dependent variable will always be defined, given that we limit the sample only to products which are being exported at the beginning of the period (that is, $exports_{c,p,t} > 0$). However, the CAGR in the previous period included as a control may have an undefined growth rate; therefore, to control for our own correction, we also add as an additional control a binary variable indicating whether $exports_{c,p,t-1} = 0$ (at the beginning of the previous period, i.e. 1985 or 1990), which correspond to the observations most likely to be distorted.

[13] Online Appendix Section I reproduces the result using per capita transformations of the right hand side variables before the log-type transformation, and finds that our results are robust to using these measures as opposed to total stock.

transformed variable.[14] Results are robust to using a regular log-transformation (after the proper correction to allow for zero values).

2.4 Conceptual Framework

The ways in which trade, migration and FDI affect the emergence of new sectors (extensive margin) or their future growth (intensive margin) is theoretically complex and there is no established comprehensive framework that can guide us here. Intuitively however, one would expect the potential for trade and factor flows to/from countries with a comparative advantage in certain goods to shape the export basket of a country to differ by type of flow (i.e., trade, FDI or migration), direction of the flow (in- or out), and margin of trade (extensive or intensive). We will explore these dimensions in our empirical analysis.

With regards to migration, we expect qualitatively similar effects for immigration and emigration, through the various channels detailed in our introduction. However, quantitatively, we expect stronger effects for immigrants (who directly carry with them tacit, embodied knowledge they can transfer through direct interaction) and for skilled workers (given that they both have more knowledge to be transferred, and a greater ability to transfer such knowledge). We see these two differential effects as important plausibility checks in our narrative. Emigration could theoretically still be a relevant channel, inasmuch as knowledge diffusion could happen through return migration, or through links and open communication between the emigrants and their co-nationals back home.[15] It is theoretically unclear, however, whether most of the effect should take place at the extensive or the intensive margin. On the one hand, knowledge diffusion at the intensive margin would seem stronger because the fixed costs associated with starting an industry have been already paid for; on the other hand, the fact that the knowledge brought by the migrants might be an input for such fixed cost calls for significant effects at the extensive margin as well. A complementary argument supporting the significance of migrants at the extensive margin (as opposed to other flows) relies on the well-documented fact that migrants are positively self-selected on risk-attitudes and entrepreneurial culture (e.g., Jaeger et al., 2010).

[14] The inverse hyperbolic sine ($asinh$) is defined as $log(y_i + \sqrt{(y_i^2 + 1)})$. Except for small values of y, $asinh(y_i) = log(2) + log(y_i)$.

[15] For example, Choudhury (2014) shows how Indian return migrants induce productivity improvements in their firm back home, after spending time in the multinational corporation headquarters abroad.

When it comes to trade, there is a vast literature which documents how strong trade links are drivers of knowledge diffusion (e.g., Coe et al. 2009). Thus, we expect a positive coefficient for trade in our estimations, because as Frankel and Romer (1999) claim, "*[t]he literal shipment of goods between countries does not raise income. Rather, trade is a proxy for the many ways in which interactions between countries raise income – specialization, spread of ideas, and so on. Trade is likely to be highly, but not perfectly, correlated with the extent of such interactions*". On the other hand, stronger trade links are also a driver of specialization, a force that could counteract the learning effect of trade. The same reasoning could equally apply to FDI, for which we could also expect a positive coefficient if foreign investment serves as a carrier of knowledge diffusion across countries (e.g., Javorcik 2004, Kugler 2006). At the same time, however, there could be confounding effects, if FDI outflows represent offshoring processes in which firms in country c move their production to overseas locations with strong comparative advantage in a given product (in order to benefit from agglomeration or other types of spillovers), thus explaining a decrease in c's exports of that product. Hence, while we have no priors on the dominating forces described above, it seems reasonable to assume that the effectiveness of FDI and trade as drivers of knowledge diffusion becomes stronger whenever the exporting fixed costs have been paid for by the country under consideration (i.e., when looking at the intensive margin). We also posit that these knowledge flows would dominate in inflows rather than in outflows of goods and capital. We return to this discussion when interpreting our results.

2.5 Instrumental Variables

2.5.1 Stage "zero"

To construct the instruments we start by predicting bilateral migration stocks. We follow the methodology devised by Frankel and Romer (1999) and employ a gravity model to compute predicted bilateral migration stocks based on common cultural and historical characteristics of the sending and receiving countries of the migrants.[16]

Thus, we estimate a gravity equation using the following specification:

[16]Some examples of other studies that use a gravity model to instrument for migration stocks are Felbemayr et al. (2010), Ortega and Peri (2014) and Alesina et al. (2016).

$$migrants_{c,c',t} = \alpha + \beta_{1990} X_{c,c'} + \beta_{2000} X_{c,c'} \times year\_2000_t + \theta_c + \theta_{c'} + \gamma_t + v_{c,c',t} \quad (2)$$

The left hand side variable, $migrants_{c,c',t}$, is the actual stock of migrants in country c from country c' at time t. The vector $X_{c,c'}$ includes exogenous variables that are common to countries c and c': dummy variables indicating a (former) colony-colonizer, a same colonizer, and a same language relationship,[17] as well as a continuous variable that measures the probability that two individuals in countries c and c' picked at random share the same religious beliefs.[18] The specification also includes receiving-country and sending-country dummies, as well as year dummies. Note that the specification interacts the variables in the $X_{c,c'}$ vector with year dummies to allow for differential effects of these dyadic variables across periods. We then proceed to predict bilateral migration stocks using *only* the coefficients β_{1990} and β_{2000}, and leaving aside the constant α and the coefficients of the fixed-effects θ_c, $\theta_{c'}$ and γ_t. We do this in order to avoid scale-driven correlation with the variables we will instrument for. We choose to estimate our gravity equation with the Pseudo-Poisson Maximum Likelihood (PPML) estimator.[19] Table 3 presents the results of estimating Specification (2) using the PPML estimator when using as dependent variable the stock of total, unskilled and skilled immigrants in columns 1 to 3, respectively.[20]

[Table 3 about here.]

Interesting results arise when comparing both estimations. First, in general, the stock of skilled migrants (column 3) is less affected by our dyadic cultural and historical variables compared to unskilled migrants (column 2), with no differential effects between years 1990 and 2000. Second, the stock of unskilled

[17] These data come from the GeoDist dataset (Mayer and Zignago 2011) from CEPII.

[18] These data were constructed using data from the Correlates of War Project at http://www.correlatesofwar.org (Zeev and Henderson, 2014).

[19] Santos Silva and Tenreyro (2006) suggest the application of a PPML estimator in gravity settings, given its better performance relative to linear models in settings where many zeros are present in the dependent variable. In fact, we also estimated our gravity model with different transformations of the dependent variable and the PPML model indeed provided the best fit (see Online Appendix Section A). A previous working paper version of this paper also included an estimation using the Heckman (1979) selection model using unemployment in the exporter's country as the selection variable. The results were robust and qualitatively similar to the ones achieved with the PPML model.

[20] For illustration purposes we only show results for immigrant stocks. Since the variables on the right hand side are symmetric, the results are the same if we would use emigrants instead.

migrants (column 2) becomes less inelastic to these variables in year 2000 compared to the estimates of year 1990. Overall, all variables have the expected sign across all specifications.

2.5.2 Construction of Instruments and First Stage

With the predicted bilateral migration stocks in hand we reconstruct the aggregate migration stocks using the same weighting procedure (detailed in Section 2.3). That is, for each combination of country c, product p and year t, we compute the total sum of predicted immigrants (emigrants) from (to) all other countries that export p with a RCA above 1. We also estimate the same figures for skilled and unskilled migration. Note, however, that our immigration and emigration stocks are completely symmetric. Thus, we have less instruments than endogenous variables if we were to include both immigrants and emigrants in the same regression model. For this reason, we limit our instrumental variable estimation to one endogenous regressor only (immigrants or emigrants).

The relevance of the instruments is fully testable. For illustrative purposes, Figures 1 present the analogous of a first stage in a 2SLS regression using South Africa in year 1990 as example.[21] The vertical axis measures the total migration stock (immigrants in the left panel and emigrants in the right panel) while the horizontal axis measures the *estimated* migration stock computed with the PPML gravity model. Each observation in the figure is a product, symbolized by its 4 digit SITC code, and it matches the actual vs. estimated immigrants from (left panel) and emigrants in (right panel) countries that export each product with a RCA above 1. It can be seen in the figure that there is an obvious positive correlation between the actual values and the expected ones based on the gravity model after the weighting procedure.

[Figure 1 about here.]

For the instruments to be valid, the exclusion restriction must be that *product specific* exports to the *whole world* are not correlated with common bilateral geographic, cultural or historical ties with its migrants' countries, once we control for country-year fixed effect. This means that, while it is a valid argument that the cultural or historical background of the country could be a source of comparative advantage for particular products, our country-by-year fixed effects

[21] The IV regression pools across all countries and periods in the sample. This figure limits the observation to one country and one period only for the sake of illustration.

would account for these concerns. This is an advantage of our country-product-year level dataset that allows us to control for country-year fixed effects without eliminating all the variation.

Furthermore, we assume that countries do not engage in *product specific* export-inducing agreements based on their cultural or historical ties, which are not captured via flows such as FDI or trade. This assumption relates also to an additional concern that might arise in our instrumentation methodology: that there is a component in aggregate bilateral trade which can be also explained by the same variables that explain aggregate bilateral migration, and that this component is still in our left hand side. But there are two reasons we put forward to relieve those concerns. First, our right hand side includes as a control the aggregate trade from/to the same set of countries where the migrants in the right hand side are in/from (i.e., all countries with RCA above 1 in the product under consideration). Thus, if indeed cultural and historical variables that explain aggregate bilateral migration also explain aggregate bilateral trade (which is of course very likely the case), then by controlling for *actual* aggregate bilateral trade to and from the same set of countries where migrants are in or from we overcome this problem. Second, one of our most important robustness test (in Section 3.1) reconstructs the left hand side variables such that they exclude exports to countries where (more than 500) migrants are in or from. Thus, by construction, in that specification we exclude product-level exports to all countries with a propensity to send or receive migrants, which are countries with same colonizer, same language, same religion and former colony-colonizer relationship. So if there is a concern that our product-level exports dependent variable to a given set of countries is partly explained by the same bilateral relationships that explain migration, then in that section we exclude product-level export flows to that same set of countries.

In all of our IV estimations we report the Kleibergen-Paap F statistic to be used to determine whether instruments are weak. This is as opposed to the Cragg-Donald statistic used when we assume i.i.d. errors. We measure the strength of our first stage comparing the Kleibergen-Paap F statistic to the critical value posed by Stock and Yogo (2002), which in our case is 16.78. We acknowledge that these critical values are not strictly usable in the case when we do not assume i.i.d., but in practice our Kleibergen-Paap F statistics are high enough that there are no reasons of concern about weak instrumentation.

2.6 Summary Statistics

The summary statistics for the variables to be used in the analysis are in Table 4. Panel A presents the summary statistics for the extensive margin sample (i.e., for all observations of c, p and t for which $RCA_{c,p,t} = 0$), while Panel B does so for the intensive margin sample (i.e., for all observations of c, p and t for which $exports_{c,p,t} > 0$).

[Table 4 about here.]

From Panel A we see that the unconditional probability of achieving a RCA above 1 (starting with a RCA equal to zero at the beginning of the period) for the average country-product is 1.6%. Similarly, from Panel B, the average country-product exports CAGR is about 4.8% in the data. The tables also include the sum of immigrants and emigrants for the average country and year weighted by whether the partner countries export the average product with RCA above 1. It presents the same weighted statistics for aggregated FDI and trade figures in million USD, after the deflation process explained above. Note that FDI and trade variables total inwards and outwards stock figures.

Also note that the average figures for emigrants are larger than for immigrants. This is because there are more migrants from poor countries (which tend to have lower RCA values on average) in rich countries (which tend to have higher RCA values on average). Therefore, the mean for weighted emigrants' figures is pulled up by cases of migrants from poor countries in rich countries, given that the weight in this case corresponds to the receiving country RCA values. Whereas for immigrants, the weight is based on the RCA values of the sending country.

3 Main Results

Table 5 presents results for Specification (1) using both OLS (columns 1-3)[22] and IV (columns 4-5). The upper panel estimates the extensive margin (measured by the likelihood of adding a new product to a country's export basket) while the lower panel estimates the intensive margin (measured by the annual growth in exports of a product already in the country's export basket). It is important to notice that the dependent variables in both panels are computed

[22] Online Appendix Section (B) presents results for the extensive margin using a Conditional Logit estimator instead, showing consistent results.

using exports of product p from country c to *the rest of the world*. In Table 5 we do not distinguish between skilled and unskilled migrants, rather we use the total immigrant/emigrant stocks as main variables of interest. As explained above, the migration, FDI and trade independent variables correspond to a sum over all partner countries c' weighted by the binary variable $R_{c',p,t}$ which equals 1 if $RCA_{c',p,t} \geq 1$. That is, the dependent variables vary at the country, year and product level. The upper panel of Table 5 uses country-product pairs which had zero exports in the baseline years (1990 and 2000), which corresponds to 83,100 observations.

[Table 5 about here.]

The results in columns 1 and 3 of Panel A indicate that a country with 10% increase in the stock of its immigrants from nations that are exporters of product p (with RCA>1) is associated with a 0.25 to 0.3 percentage point increase (depending on specification) in the probability of exporting product p with a RCA above 1 in the next ten years. This corresponds to a 1.5 to 2 percent increase based on the unconditional probability of 1.6%, as shown in the summary statistics. The corresponding figures for emigrants in columns 2 and 3 of Panel A are 0.14 to 0.27 percentage points, or a 0.8 to 1.6 percent increase in the unconditional probability. Note that a 10% increase in the stock of immigrants (emigrants) for the average country in our sample corresponds to 1,300 (5,500) individuals, suggesting that the marginal effect of immigrants is stronger than that of emigrants.[23]

Columns 4 and 5 show the IV results. Note that the reported Kleibergen-Paap F statistics are large enough to eliminate any concerns of weak instruments. The results are qualitatively similar to the OLS results, but higher in magnitude by a factor of 3 to 4. This is surprising as one would expect a positive

[23]Note that our estimates explicitly rule out economies of scale arising from agglomeration effects, via the product-by-year fixed effects. For example, suppose that workers scattered across the globe migrate to Silicon Valley, and make each other more productive by their proximity to and interaction with each other. This raises global production of, say, iPhones. But the mechanism is separate from any technical skill, tacit or otherwise, that the migrants brought with them. The mechanism is that the fixed cost of creating and producing iPhones makes it so that they can only be produced in a tech hub with agglomeration effects. Now, this raises the global production of iPhones in each year, which in the regressions in this paper would be absorbed into the product-by-year fixed effect. So this pure agglomeration effect is not captured by the regression coefficient on immigration to the US. But such agglomeration is nevertheless a way in which the comparative advantage of the US has been altered by migration. Because the regressions omit such effects, the coefficient estimates understate the overall effect of migration on comparative advantage. We are thankful to one of the referees for having made this point.

bias in the OLS estimates, not a negative one. This is because one would expect that unobserved forces that lead to export diversification would also serve as pull factors for migration.[24] Note however that while the magnitude of the estimates have increased, the standard errors have increased even more. This means that we cannot reject the hypothesis that the OLS and IV estimates are statistically different.[25]

Still, we identify two reasons why the IV estimates are larger than the OLS ones. First, the variation generated by the instrument is based on cultural proximity between the exporter and the source and destination countries of its immigrants/emigrants. Thus, if productivity-inducing knowledge transmission through migration is stronger for countries which are culturally close (i.e., it is easier to transfer knowledge in the same language, or in similar institutional settings), then this would inflate our IV estimates.[26] This would threaten the external validity of our exercise but not necessarily the validity of the instrument itself. Second, attenuation bias due to measurement error is a natural candidate to explain the lower OLS coefficients, but it is impossible to quantify, hence we cannot speculate whether it is large enough to generate the a gap we obtain between the OLS and the IV. Frankel and Romer (1999) encounter a similar problem in their estimation, and they write: *"we conclude that the most plausible explanation of the bulk of the gap between the IV and OLS estimates is simply sampling error. This implies that our most important finding is not that the IV estimates of trade's effects exceed the OLS estimates, but rather that there is no evidence that the IV estimates are lower. In addition, it implies that our IV estimates may be substantially affected by sampling error, and thus that the OLS estimates are likely to be more accurate estimates of trade's actual impact on income."* We are of course unable to quantify the various and conflicting biases in our IV estimation; therefore, while we believe the IV results somewhat serve to mitigate endogeneity concerns, we will limit our interpretation of the results to the OLS specifications.

Panel B of Table 5 uses a product-level CAGR for a 10-year period as the

[24] This would seem to be the case mostly for immigrants. In the case of emigrants, however, this reasoning would work the other way around (would generate incentives for people not to emigrate), thus contributing to a downward bias in the OLS emigrant figures.

[25] This is illustrated in Figure A1 in Online Appendix section C.

[26] That is, our estimates are measuring the Local Average Treatment Effect (LATE), which is always larger than the Intention To Treat (ITT) estimate. This interpretation is also backed by the fact that the differences between the OLS and IV estimates are stronger for skilled migrants, which are the ones with stronger ability to transfer knowledge (see Online Appendix Section C).

dependent variable, in order to study the intensive margin of trade. The number of observations is different than the sample used for Panel A because we are using all country-product-year combinations with export value above zero in the baseline year. The results suggest that the presence of immigrants (emigrants) from (in) countries exporters of product p, are associated with a larger future rate of growth in export value of product p in the country under consideration. In particular, Column 1 suggests that, for a given product p, a 10% increase in the stock of immigrants from and to countries exporting such product is associated with an increase in the future annual growth rate in export value for the receiving country of about 0.081 percentage points. The corresponding coefficient for emigrants in column 2 implies that a 10% increase in the stock of emigrants in countries exporters of p, is associated with an increase of 0.104 points in the CAGR for the next ten years. When enterring both immigrants and emigrants jointly into the specification, in Column 3, a 10% increase in the stock of immigrants (emigrants) from (in) countries exporters of product p tends to increase the receiving (sending) country's CAGR in product p by 0.065 (0.073) percentage points in the next ten years. Columns 4 and 5 show that the results are qualitatively consistent when using the IV estimator (as in Panel A, the Kleibergen-Paap F statistics are very large), and similarly to Panel A, the estimates are larger in magnitude than the OLS ones, though overlapping in their 95% confidence intervals.

An important aspect of the results concerns the signs and magnitudes of the control variables. Product Imports (i.e., the imports of product p during the previous period) seem to have very little explanatory power on both dependent variables (extensive and intensive margin). If anything, this variable enters negatively, implying that the more product p a country imported from the world in the previous period, the less likely such product will either emerge or grow faster (if already present) in the export basket of that country. This speaks to, most likely, trade specialization forces. In panel B, the growth-related controls have their expected sign: the initial level of exports correlates negatively with future growth consistently with convergence effects; the previous trend of growth explains little of the future trend; and starting off with zero exports at the beginning of the previous period negatively correlates with future growth.[27]

The results regarding trade and FDI caught our attention. In Panel A, FDI seems not to have any explanatory power on the emergence of future products,

[27]Remember that this variable aims at controlling for distorted previous period growth rates.

while trade carries a negative coefficient. Based on the framework discussed in Section 2.4, we posit that the sign for the trade coefficient is a natural result of specialization: trading with countries which are exporters of a particular product is negatively correlated with the likelihood of gaining comparative advantage in that same product. When it comes to FDI, it seems that no force dominates over the other when studying the extensive margin. However, when looking at Panel B we see that the signs for the trade coefficients have shifted to positive and for FDI shifted to negative (though very close to zero). Why would this be the case? As discussed in Section 2.4, we believe that when looking at the intensive margin, the knowledge diffusion forces of trade and FDI should be stronger because the fixed costs of starting off a new industry have been already paid for. That is, once firms are already exporting the product, they could appropriate new knowledge and technologies in a more efficient way and translate them into productivity increases. This is much harder when the product is not being exported to begin with.

Intrigued by these results we expanded our specification to include, as different terms, inflows and outflows of both FDI and trade to partner countries (see Table A5 in Online Appendix Section D). We find that both imports and FDI inflows have a positive, somewhat large, and significant coefficient at the intensive margin. Exports and FDI outflows show negative or often statistically-zero coefficients in the intensive margin, pointing to the specialization and offshoring explanations discussed in Section 2.4. Thus, when it comes to trade, in the aggregate, the knowledge diffusion force seems to dominate over the specialization force based on the results shown in Panel B of Table 5. At the same time, the aggregate figures for FDI also in Panel B seem to reflect spurious correlations which tend to disappear once we disaggregate between inflows and outflows.

All the specifications presented above include product-by-year fixed effects and country-by-year fixed effects. The former set of fixed effects would control for global demand for all products. Given that we are looking at exports to the rest of the world, the shifts we identify must therefore be country-specific supply shifts. The country-by-year fixed effects would control for time-variant and invariant country-characteristics, such as country-level aggregate demand and supply shocks, income, population, institutions, property rights regulation, etc., which would rule out that the results are driven by a third factor that positively correlates with both migration figures and aggregate productivity across countries.

3.1 Network effects and bilateral transaction costs

A valid concern would be that the partial correlations we are observing are being driven by bilateral trade: the country is exporting more of the product to those countries where the migrants are from or in. This relates to the evidence presented by Gould (1994), Rauch (1999) and others, including more recently by Aubry and Rapoport (2015), who find that migrants facilitate the creation of business networks which induce bilateral trade and capital flows. Under this possibility, it would be harder to attribute the results to a gain in productivity rather than to a decrease in bilateral transaction costs. In order to deal with this issue, we estimate again the above specification, but we exclude from the dependent variable all exports to countries where migrants are in or from. That is, we reconstruct the dataset such that the export value to the rest of the world for each product and country combination excludes exports to nations that send or receive that same country's migrants.

A critical caveat is that the exclusion requires defining a threshold on the number of migrants in or from the partner countries. If one migrant is enough to activate this rule, we will probably clean all world trade given that it is very rare not to have one alien citizen of every country in most developed nations, which generate the largest share of world trade. In this sense, we define a number of arbitrary thresholds at 500, 1000, 2500 and 5000 migrants. For example, let's suppose we are looking at Canadian exports of television sets to the rest of the world in year 1990. We will exclude from that figure the exports of TV sets from Canada to countries that (1) have a number X of Canadians emigrants and (2) a number Y of their citizens are immigrants to Canada, as long as X+Y is larger than 500, 1000, 2500 and 5000. The assumption is that an effective business network that can reduce bilateral transaction costs requires more than 500, 1000, 2500 or 5000 migrants among the two countries.

Figure 2 shows the magnitude of the reduction of total trade figures after revising the exports figures as explained above. For instance, with the 500 threshold, world trade figures are reduced by about 92.5%; while using the 5000 threshold reduces total trade figures by about 83%.

[Figure 2 about here.]

Yet, this reduction in total trade is differential for each country: the largest countries, naturally, are the ones that are affected the most. Figure 3 represents the proportion of exports left for each country after excluding exports to coun-

tries where more than 500, 1000, 2500 and 5000 migrants are in or from. As can be seen, there is a clear negative relationship: the larger the country, the smaller the proportion left to reconstruct the left hand side.

[Figure 3 about here.]

Using 500 as the threshold, Figure 4 presents in the left panel the pre and post correction country-product exports in year 2000. Naturally, for all points the corrected exports amount (horizontal axis) is below the original (vertical axis). The right panel plots the kernel density of the country-product exports to the rest of the world before and after the correction, showing that the distribution has shifted to the left when excluding exports to countries where more than 500 migrants are in or from. However, the distribution remains qualitatively similar.

[Figure 4 about here.]

Indeed, the results show consistent patterns with the previous ones. For instance, Table 6 shows results using the 500 threshold (the most conservative one).

[Table 6 about here.]

Excluding bilateral trade amounts from the dependent variable allow us to rule out lower bilateral transaction costs as driving the results shown above. Moreover, all migration-related estimators have positive and statistical significance when doing this exercise, as shown in Table 6. For Panel A, the estimates are quite similar in magnitude to those in Table 5. For instance, according to Column 3, a 10% increase in the stock of immigrants (from countries exporters of p with a comparative advantage) is associated with an increase of about 1.4% in the likelihood the receiving country will export product p with RCA above 1 in the next ten years.[28] In the case of emigrants, the corresponding figure is 1.1%.

Panel B also shows qualitatively similar results for the intensive margin. For instance, according to Column 3 of Panel B, a 10% increase in the stock of immigrants (emigrants) from (in) countries that have a RCA above 1 in product p is associated with an increase of 0.19 (0.16) percentage points in the receiving (sending) country's CAGR for product p for the next ten years.

[28] In this case, as specified in Table 4, we use 1.5 as the unconditional probability of adding a new product as the baseline value for this calculation.

In both panels, the IV figures in Columns 4 and 5 are consistent with the OLS results, considering the discussion in the previous section.

One important issue to notice is that the estimates in Panel B of Table 6 are larger in magnitude that the corresponding ones in Table 5. Table 6 eliminates variation from the dependent variable, and because of this, we would expect to have smaller, not larger estimates. However, again, while the estimates have increased in size by a magnitude of 2 to 3, so have the standard errors. Additionally, we have implicitly eliminated from our dependent variable all exports mostly to countries where many migrants live in. These countries that attract many migrants are, mostly, developed nations. The variation in our left hand side, therefore, represents exports mostly to developing countries, which tend to grow faster during the years in the sample, and thus, exports to these countries potentially grow faster too, which is reflected in our estimates.

3.2 Placebo Test

As an additional test, we present results of a "placebo test", in order to lower concerns that the results are generated by uncontrolled trends in the data. Thus, we replicate Specification (1), but this time using the weighting parameter $R_{c',p,t} = 1$ if $RCA_{c',p,t} = 0$. That is, we exploit variation in migration in and from countries that are not exporters of product p, to understand whether this correlates with the ability of the sending/receiving country of those migrants to export good p in the future.

The results are presented in Table 7.

[Table 7 about here.]

The upper panel of Table 7 shows that the estimates for the migration variables across all specifications and disaggregations become statistically insignificant and often negative, as opposed to the results of the previous section. That is, when countries receive migrants from or send migrants to other nations that *do not* export a product at the beginning of the period, the likelihood of gaining comparative advantage on such products is unaffected or even lower. We see a similar pattern in the lower panel of the same table, where nations exporters of p with migrants from or to countries that *do not* export p, tend to experience a negative export value growth rate for p in the next ten years (i.e., they lose market share).

Thus, the placebo test shows that it is not receiving (sending) immigrants (emigrants) per se that might affect the likelihood of products to emerge or grow faster, but rather the fact that these migrants come from (go to) countries that have a comparative advantage in that particular good. This is particularly important to make the case that we are not documenting that migrants play a role through their personal characteristics, such as IQ or innate ability, but through their product specific knowledge.[29]

4 Extensions

Based on the evidence of the previous section, we claim that our results are not driven by bilateral migrant networks nor are explained by unobservables increasing productivity trends unrelated to migrants. In this section we present a number of additional extensions to our main results: disentangling the results for skilled/unskilled migrants, using a continuous RCA is our weighting procedure, are checking the robustness of our results to different cuts in the sample. Note that in all of these extensions we use dependent variables excluding exports to countries where migrants are in or from according to the 500 migrants threshold defined in Section 3.1.

4.1 Skill Levels

So far we have estimated our specifications using the total amount of immigrants or emigrants as the main input. However, our dataset allows us to disentangle migrants by their skill level. Skilled immigrants are those that have achieved tertiary education, whereas unskilled are those who have not. Table (8) presents OLS results for Specification 1 using in Columns 1-3 the stock of unskilled migrants (weighted by $R_{c',p,t}$ as described above) and Columns 4-6 use skilled migrant stocks. Similarly to the previous results, Panel A refers to the extensive margin (emergence of new industries) and Panel B refers to the intensive margin (future growth of already existing exports).

[Table 8 about here.]

[29] Table A6 in the Online Appendix replicates this test with skilled migrant stock figures, and finds that, indeed, it is not the skill levels of the migrants that drive the relationship documented above, but rather the comparative advantage of the countries they are in or from.

The results in Panel A suggest that a 10% increase in the stock of skilled (unskilled) immigrants from countries exporters of product p is associated with an increase of 1.67% (1.47%) in the likelihood the receiving country will export product p with RCA above 1 in the next ten years. The corresponding figures for emigrants are 0.93% for skilled and 1.07% for unskilled. Notice, however, that the average figures for skilled vs unskilled immigrants and emigrants in our sample drastically differ. For instance, a 10% increase in the (weighted) stock of skilled immigrants for the average country is only 150.8, whereas the average for the (weighted) stock of unskilled immigrants is about 1200. Similar differences in the sample averages exist for skilled vs. unskilled emigrant stocks: a 10% increase in the weighted stock of skilled (unskilled) emigrants amounts to 1,300 (4,200) individuals. So even if the point-estimates are very similar in magnitude, the marginal effects per migrant are strikingly larger for skilled than for unskilled migrants – by a factor of almost 10 for immigrants and by a factor of 4 for emigrants.

The results in Panel B show estimates using as the dependent variable the future ten year CAGR, and the results are consistent with the ones in Panel A, with the exception of the coefficient for skilled emigrants that loses statistical significance when added jointly with skilled immigrants in Column 6. All in all, while the estimates using both skilled and unskilled migration figure are similar, the marginal effects for skilled migrants are considerably higher than the ones for unskilled migrants.

The results for FDI and trade are consistent with the ones in previous tables. When comparing the marginal effects of immigrants and of FDI in Panel A, we find that, in terms of their ability of expanding a country's export basket, an unskilled immigrant is worth USD $25,000 of FDI while a skilled immigrant is worth over USD $100,000.[30]

4.2 Continuous Weights

In Specification (1) we define the weights, $R_{c',p,t}$ as binary variables which take the value 1 if $RCA_{c',p,t} \geq 1$, and zero otherwise. This implies that, for example, an immigrant coming from a country in which cameras have a $RCA = 1$ is weighted in the same way as an immigrant coming from another country with

[30] To compute this we calculate $\frac{\beta_M}{\beta_{FDI}} \frac{\overline{FDI}}{\overline{Immigrants}}$; where β_M is the point-estimate for immigrants and β_{FDI} is the point-estimate for FDI in columns 1. $\overline{FDI}$ and $\overline{Immigrants}$ are the mean values of FDI and for migrants from Table 4.

a RCA in cameras of 2.

In this section we extend that definition to allow for a continuous weights on the right hand side variables. That is, we estimate the following specification where the weights are given by the continuous RCA:

$$\begin{aligned} Y_{c,p,t\to T} &= \beta_{im}\sum_{c'} immigrants_{c,c',t}\times RCA_{c',p,t} + \beta_{em}\sum_{c'} emigrants_{c,c',t}\times RCA_{c',p,t} \\ &+ \beta_{FDI}\sum_{c'} FDI_{c,c',t}\times RCA_{c',p,t} + \beta_{trade}\sum_{c'} trade_{c,c',t}\times RCA_{c',p,t} \\ &+ \gamma Controls_{c,p,t} + \alpha_{c,t} + \eta_{p,t} + \varepsilon_{c,p,t} \end{aligned} \tag{3}$$

The estimation presented in Table (9) shows results that are consistent with previous estimations, even when using a continuous weighting scheme to aggregate the right hand side variables.

[Table 9 about here.]

This weighting scheme allow us to estimate whether there are "diminishing returns" to the RCA of partner countries when it comes to the power of immigrants and emigrant stocks in explaining the emergence of new sectors. With this specification, and by adding some quadratic terms, we measure the change in the explanatory power of immigrants in the emergence of a new product varying the intensity with which their home countries export the same product. The results are summarized in Figure (5), which shows a concave relationship.

[Figure 5 about here.]

4.3 Sub-sample analysis and other robustness checks

In order to study the above documented relationships in more detail, we reestimate Specification (1) across different cuts of our sample. We do this to understand whether there are differential trends across several dimensions and also to understand whether a particular set of observations in the sample is driving the observed overall results. In this exercise we standardize the immigrants and emigrants figures to have zero mean and unit standard deviation. Table 10 summarizes this exercise.

The left panel of Table 10 reports estimates for β_{im} (immigration) while the right panel reports the estimates for β_{em} (emigration), focusing on the extensive margin (thus, observations are limited to having an initial RCA equal to zero). In particular, the re-estimation uses on the right hand side figures for both

unskilled migrants (estimators reported under $\beta^{Unskilled}$) and skilled migrants (estimators reported under $\beta^{Skilled}$).

[Table 10 about here.]

The first row uses all 83,100 observations (the same sample as presented in the upper panel of Table 5). $\beta_{im}^{Unskilled}$ is estimated to be 0.005 while $\beta_{im}^{Skilled}$ is estimated to be 0.006. Both estimates are statistically significant. This actually means that one standard deviation above the mean for the stock of (un)skilled immigration (from countries exporters of p) associates to an increase of 0.005 (0.006) percentage points in the likelihood of the receiving country exporting product p in the next ten-year period.

The table also reports that the estimator for skilled immigration is, effectively, 10.55 times that of unskilled immigration. This number does not only take into account the ratio between $\beta_{im}^{Skilled}$ and $\beta_{im}^{Unskilled}$, but also the fact that one standard deviation in the value of skilled immigration is much lower (about one tenth) in the sample than one standard deviation in the value of unskilled immigration (see Table 4).[31] We find that when it comes to emigrants, the skilled emigration figure is less robust to this transformation of the right hand side variables (it loses its already weak statistically significance shown in Table 8). This is consistent with the figures for emigration for most of the different cuts in the sample, for both skilled and unskilled emigration.

An important result of this table is that it shows that our results are being driven by the cases where the exporter country is a developing (non-OECD) country. That is, developing countries benefit from immigration when it comes to the emergence of new sectors. From lines 4 and 5 in the table we find that our results are significant during the different time periods in the sample.

As a robustness test, we also present results dividing the sample into goods above and below the median in terms of their capital intensity, using the measures by Shirotori (2010) . The results hold for all goods in the capital intensity scale, ruling out the results being driven by the forces suggested by Rybczynski (1955). In particular, skilled immigration has a similar effect on both non-capital and capital intensive goods.

Finally, we also divide the sample into differentiated goods and homogenous and reference-priced goods, using Rauch's (1999) more conservative definition. The results suggest that the partial correlations are positive and significant

[31] Thus, the ratio is computed by calculating $\frac{\beta_{im}^{Skilled}}{\beta_{im}^{Unskilled}} \times \frac{stdev(immigrant^{Unskilled})}{stdev(immigrant^{Skilled})}$.

among both categories. This provides further evidence that migrant networks (by generating markets for differentiated products) are not explaining our results.

5 Concluding Remarks

This paper presents evidence suggesting that migrants can shape the comparative advantage of nations, a relationship that has not been documented in the literature so far. Our results contribute to the growing literature that explains why certain countries experience industry-specific productivity shifts, and to the international trade literature that aims at understanding, in a Ricardian framework, the dynamics of comparative advantage (e.g., Costinot et al. 2011, Kerr 2015). It also contributes to the literature on international knowledge diffusion by studying the possible drivers of knowledge across borders, using product-level exports figures as a measure of knowledge acquisition.

Our main result is that migrants, serving as international drivers of productive knowledge, can shape the comparative advantage of nations. In all our specifications we include controls for a set of variables that leave us with empirical evidence suggestive that this is the mechanism in place. The instrumental variables approach also somehow reduces remaining endogeneity concerns.

This finding is particularly important to understand some known characteristics of knowledge diffusion. First, the short-ranged character of knowledge diffusion can be explained by the fact that knowledge is partly embedded in people, which tend to move in a more localized manner than goods or capital. Second, the fact that the diffusion of knowledge and technology is more widespread today than decades ago (i.e., the diffusion process has accelerated over time) can be explained by the fact that people flows, such as migration or short term travel, have also increased rapidly.

The nature of our exercise and data puts some limits on our ability to understand the precise mechanisms and the specific type of knowledge that drive the documented relationships.[32] Migrants might play a role in knowledge diffusion by bringing new and better labor and/or management techniques to firms that employ them or, more generally, to the societies that host them (e.g., Choudhury, 2014). Migrants might also play a role in boosting productivity through innovation and patenting of new technologies for particular products

[32] Nonetheless, we are able to rule out the well-known role of migration in reducing bilateral transaction costs as being the main driver of our results.

(e.g., Hunt and Gauthier-Loiselle, 2010; Bresschi and Lissoni, 2012) or by becoming entrepreneurs themselves (e.g., Wahba and Zenou, 2012).

All in all, we should also expect industry-specific knowledge to diffuse through channels other than migration, but in which people are at the center of the story: short-term travel, internet interactions, etc. The study of these channels, as well of the exact mechanisms through which migration induces knowledge diffusion, are part of our future research agenda.

The importance of our results, however, go beyond the pure relationship between migration and productivity. They also serve to understand the ways and means through which knowledge diffuses around the globe. After all, the limitations of knowledge diffusion stand at the center of the discussion on convergence, productivity and even inequality. Thomas Piketty in his book "Capital in the Twenty-First Century" (2014) claims that "*knowledge and skill diffusion is the key of the overall productivity growth as well as the reduction of inequality both within and between countries.*" Moreover, he suggests that *"the principal force for convergence –the diffusion of knowledge– is only partly natural and spontaneous. It also depends in large part on educational policies, access to training and to the acquisition of appropriate skills, and associated institutions".* We would like to add international migration to this list.

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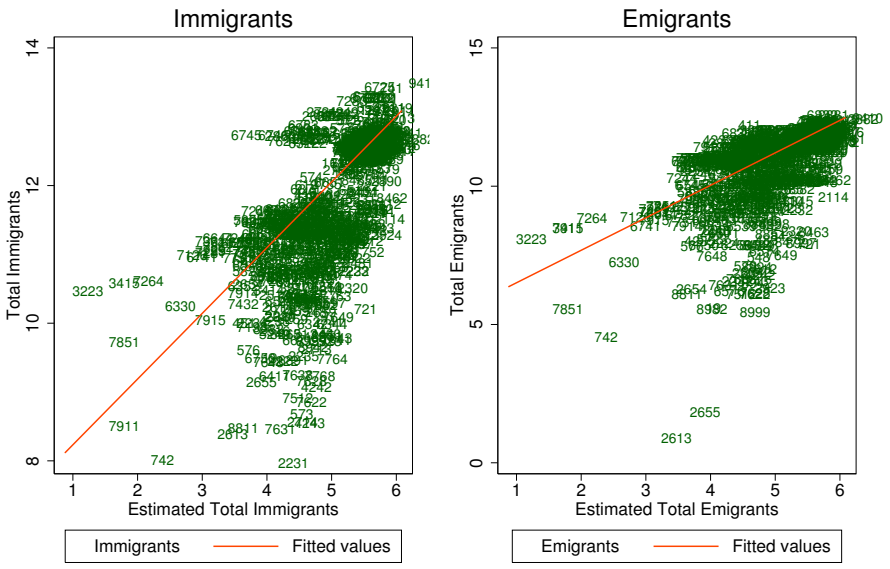
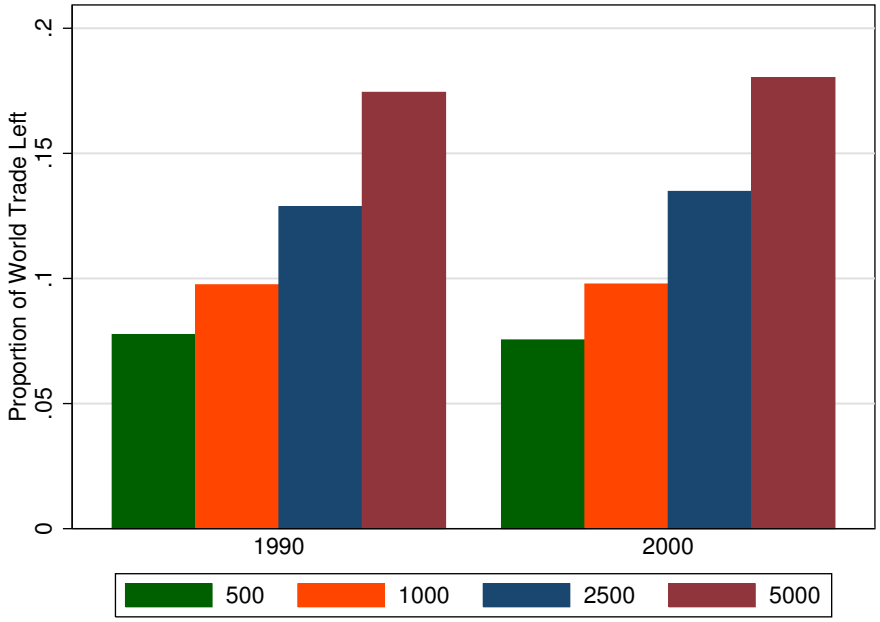
Figure 1: First Stage, South Africa Year 1990



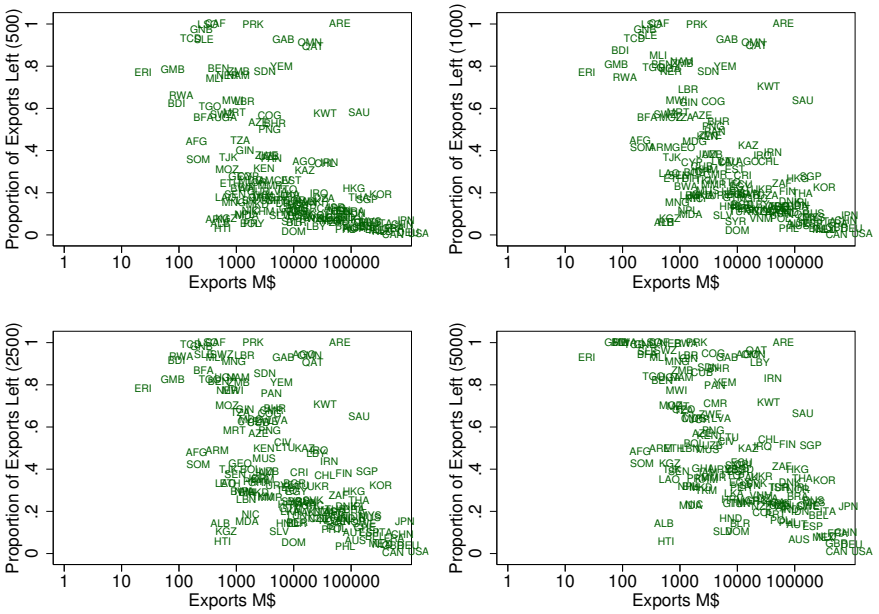
This figures presents an example of the first-stage of our instrumental variables approach, using South Africa in year 1990 as an example. The vertical axis measures the total migration stock (immigrants in the left panel and emigrants in the right panel) while the horizontal axis measures the *estimated* migration stock computed with the PPML gravity model. Each observation in the figure is a product, symbolized by its 4 digit SITC code, and it matches the actual vs. estimated immigrants from (left panel) and emigrants in (right panel) countries that export each product with an RCA above 1.

Figure 2: Proportion of World Trade Left



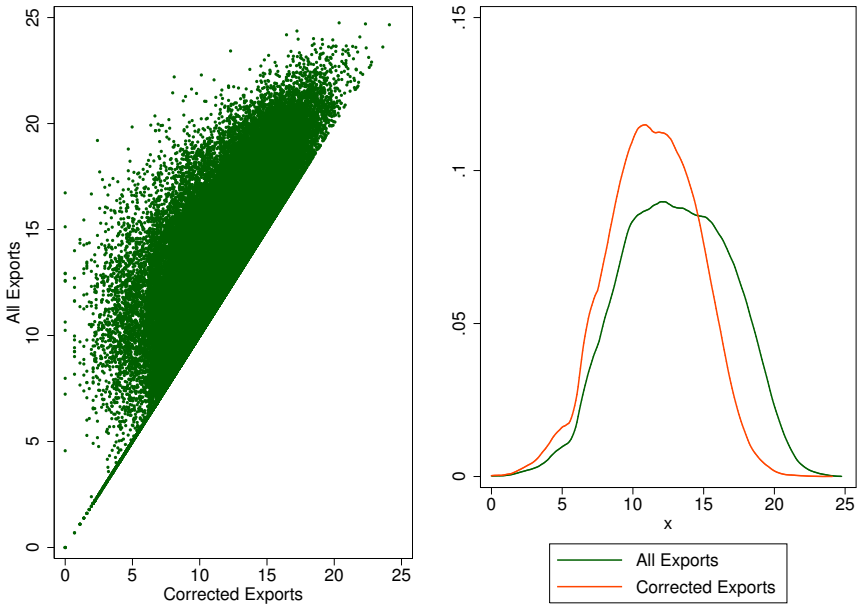
Each bar in this figure shows the remaining US dollar value of World Trade left in the dataset once we exclude exports to countries where more than 500, 1000, 2500 and 5000 migrants are in or from.

Figure 3: Proportion of Trade Left by country (Year 2000)



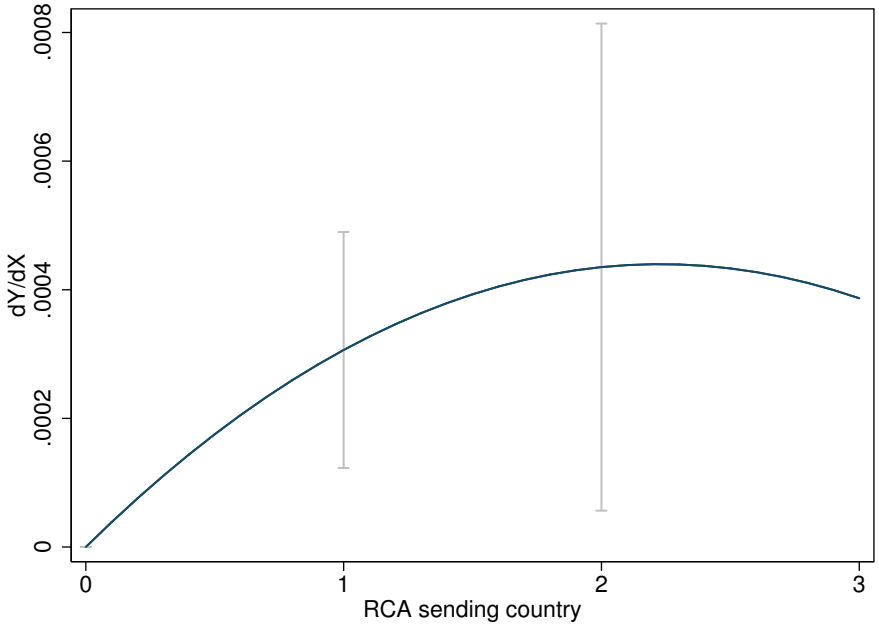
Each dot is a country. The horizontal axis represents total exports in millions of USD in year 2000, and the vertical axis the proportion of those total exports left in the left hand side variable after correcting it by excluding exports to countries where there are more than 500, 1000, 2500 and 5000 combined migrants.

Figure 4: Distribution of left hand side before and after correction (500 migrants)



In the left panel, each dot represents exports before and after the correction for each country-product pair in year 2000. The right panel plots the kernel densities for country-product exports before and after the correction for year 2000. This figure is based on the correction by excluding exports to countries where 500 or more migrants are in or from.

Figure 5: Diminishing Marginal Returns to RCA of Partner Countries



This graph estimates the marginal effect of immigrants on the probability the receiving country exports a new product in the next ten years, as a function of the RCA value of that product in the immigrant's country of origin in the baseline year.

Table 1: Correlation Matrix International Flows (log)

Variables	Migrants (total, log)	Immigrants (log)	Emigrants (log)	FDI (log)	Trade (log)
Migrants (total, log)	1.000				
Immigrants (log)	0.746	1.000			
Emigrants (log)	0.817	0.354	1.000		
FDI (log)	0.500	0.529	0.261	1.000	
Trade (log)	0.665	0.595	0.439	0.858	1.000

Table 2: Correlation Matrix International Flows (per capita)

Variables	Migrants (total) p.c.	Immigrants p.c.	Emigrants p.c.	FDI p.c.	Trade p.c.
Migrants (total) p.c.	1.000				
Immigrants p.c.	0.812	1.000			
Emigrants p.c.	0.633	0.062	1.000		
FDI p.c.	0.173	0.247	-0.031	1.000	
Trade p.c.	0.382	0.482	0.015	0.539	1.000

Table 3: PPML Gravity Models Results

Dependent Variable: Bilateral Migrant Stocks			
	Total	Unskilled	Skilled
Colony-Colonizer Relationship	1.9760	2.0654	1.8049
	(0.187)***	(0.205)***	(0.153)***
Common Colonizer	1.5313	1.4284	1.5023
	(0.270)***	(0.268)***	(0.392)***
Common Language	0.7876	0.7394	1.0387
	(0.162)***	(0.174)***	(0.151)***
Same Religion	0.7528	0.6732	1.0515
	(0.271)***	(0.300)**	(0.182)***
Colony-Colonizer Relationship X Yr2000	-0.1850	-0.2450	0.0565
	(0.106)*	(0.119)**	(0.143)
Common Colonizer X Yr2000	-0.3665	-0.3194	-0.1465
	(0.105)***	(0.114)***	(0.191)
Common Language X Yr2000	0.1861	0.1937	0.0683
	(0.085)**	(0.103)*	(0.062)
Same Religion X Yr2000	-0.2281	-0.1917	-0.1236
	(0.158)	(0.183)	(0.106)
Constant	10.8338	11.7279	4.8678
	(1.008)***	(1.041)***	(0.741)***
N	42924	42924	42924
r2	0.83	0.85	0.78

This table estimates Specification (2) using the stock of total, unskilled and skilled migrants in columns 1-3, respectively. The table reports results using the PPML estimator. All specifications include sending country, receiving country and year fixed effects. SE clustered at the receiving country level presented in parenthesis.

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 4: Summary Statistics

Variable	N	Mean	sd	Min	Max
Panel A: Extensive Margin Sample ($RCA_{c,p,t} = 0$)					
New Product (RCA>1)	83,100	0.016	0.13	0.0	1.0
New Product (RCA>1, Exc. Bilateral)	83,100	0.015	0.12	0.0	1.0
Immigrants (Weighted)	83,100	13,235.6	85,032.8	0.0	3,402,118.0
Emigrants (Weighted)	83,100	54,869.7	202,426.7	0.0	6,327,320.0
Immigrants (Unskilled, Weighted)	83,100	11,726.6	80,730.6	0.0	3,229,274.0
Emigrants (Unskilled, Weighted)	83,100	42,009.3	183,606.5	0.0	5,403,605.0
Immigrants (Skilled, Weighted)	83,100	1,508.6	7,936.3	0.0	441,937.0
Emigrants (Skilled, Weighted)	83,100	12,860.4	37,185.1	0.0	1,078,064.0
FDI (total, mn USD)	83,100	508.1	15,174.1	0.0	2,239,724.0
Trade (total, mn USD)	83,100	9,541.8	33,089.9	0.0	3,043,429.2
Panel B: Intensive Margin Sample ($exports_{c,p,t} > 0$)					
Growth Exports	127,770	0.048	0.30	-0.9	4.4
Growth Exports (Exc. Bilateral)	127,770	0.283	0.74	-0.8	7.1
Baseline Exports	127,770	13.951	3.73	0.9	25.4
Immigrants (Weighted)	127,770	173,986.4	603,542.4	0.0	16,141,297.0
Emigrants (Weighted)	127,770	198,285.6	474,692.2	0.0	6,382,937.0
Immigrants (Unskilled, Weighted)	127,770	125,695.5	419,994.7	0.0	10,473,909.0
Emigrants (Unskilled, Weighted)	127,770	142,677.7	395,434.2	0.0	5,437,193.0
Immigrants (Skilled, Weighted)	127,770	48,290.7	221,855.7	0.0	5,667,388.0
Emigrants (Skilled, Weighted)	127,770	55,607.8	120,300.0	0.0	1,460,609.0
FDI (total, mn USD)	127,770	128,033.7	577,972.5	0.0	11,705,466.0
Trade (total, mn USD)	127,770	248,414.3	608,942.9	0.0	9,570,523.0

This table presents the sample summary statistics for the variables used in the paper. The upper panel presents the sample used in the estimations of the extensive margin, where we limit the sample to those country-product observations that have RCA=0 in the beginning of the 1990-2000 and 2000-2010 periods. The lower panel presents results used in the estimations of the intensive margin, where we limit our observations to those country-products with exports above zero at the beginning of the 1990-2000 and 2000-2010 periods.

Table 5: Main Results (OLS and IV)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0030		0.0025	0.0094	
	(0.001)***		(0.001)***	(0.004)**	
Emigrants		0.0027	0.0014		0.0120
		(0.001)***	(0.001)**		(0.005)**
Total FDI	0.0009	0.0010	0.0009	0.0007	0.0008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0061	-0.0059	-0.0066	-0.0098	-0.0114
	(0.003)**	(0.003)*	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
N	83100	83100	83100	83099	83099
r2	0.15	0.15	0.15	0.14	0.14
KP F Stat				83.16	93.07
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0081		0.0065	0.0222	
	(0.001)***		(0.001)***	(0.004)***	
Emigrants		0.0104	0.0073		0.0370
		(0.002)***	(0.002)***		(0.007)***
Total FDI	-0.0005	-0.0005	-0.0005	-0.0007	-0.0009
	(0.000)*	(0.000)**	(0.000)**	(0.000)***	(0.000)***
Total Trade	0.0107	0.0076	0.0044	-0.0034	-0.0211
	(0.004)***	(0.005)	(0.005)	(0.006)	(0.010)**
Baseline Exports	-0.0419	-0.0415	-0.0420	-0.0432	-0.0427
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	0.0037	0.0038	0.0039	0.0041	0.0048
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Previous Exports Growth	-0.0058	-0.0059	-0.0058	-0.0055	-0.0057
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Zero Exports in t-1	-0.0872	-0.0870	-0.0871	-0.0871	-0.0863
	(0.007)***	(0.007)***	(0.007)***	(0.007)***	(0.007)***
N	127770	127770	127770	127770	127770
r2	0.34	0.34	0.34	0.34	0.33
KP F Stat				105.94	62.22

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table 6: OLS and IV Results, excluding bilateral exports (500 migrants threshold)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0027		0.0021	0.0103	
	(0.001)***		(0.001)***	(0.003)***	
Emigrants		0.0027	0.0016		0.0131
		(0.001)***	(0.001)***		(0.004)***
Total FDI	0.0009	0.0010	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0066	-0.0066	-0.0072	-0.0109	-0.0127
	(0.003)**	(0.003)**	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.10
KP F Stat				83.16	93.07
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0219		0.0184	0.0449	
	(0.003)***		(0.003)***	(0.009)***	
Emigrants		0.0242	0.0154		0.0752
		(0.004)***	(0.004)***		(0.015)***
Total FDI	-0.0011	-0.0011	-0.0012	-0.0015	-0.0018
	(0.001)**	(0.001)**	(0.001)**	(0.001)***	(0.001)***
Total Trade	0.0275	0.0234	0.0142	0.0040	-0.0322
	(0.008)***	(0.010)**	(0.009)	(0.012)	(0.021)
Baseline Exports (Exc. Bilateral)	-0.0962	-0.0958	-0.0963	-0.0969	-0.0965
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0045	-0.0043	-0.0040	-0.0037	-0.0024
	(0.002)**	(0.002)*	(0.002)*	(0.002)*	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0021	-0.0024	-0.0021	-0.0018	-0.0023
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1640	-0.1650	-0.1632	-0.1608	-0.1607
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46
KP F Stat				107.27	63.01

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table 7: OLS, Placebo Test

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	-0.0009		-0.0005	-0.0054	
	(0.001)		(0.001)	(0.002)***	
Emigrants		-0.0012	-0.0010		-0.0039
		(0.001)**	(0.001)*		(0.001)***
Total FDI	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Trade	0.0015	0.0015	0.0015	0.0019	0.0018
	(0.001)**	(0.001)**	(0.001)**	(0.001)***	(0.001)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.11	0.11	0.11	0.11	0.11
KP F Stat				35.66	77.01
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	-0.0102		-0.0034	-0.0379	
	(0.002)***		(0.002)*	(0.006)***	
Emigrants		-0.0195	-0.0174		-0.0366
		(0.002)***	(0.002)***		(0.006)***
Total FDI	-0.0012	-0.0012	-0.0012	-0.0009	-0.0010
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0061	-0.0051	-0.0049	-0.0029	-0.0031
	(0.001)***	(0.001)***	(0.001)***	(0.001)*	(0.001)**
Baseline Exports (Exc. Bilateral)	-0.0952	-0.0953	-0.0953	-0.0958	-0.0955
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0039	-0.0038	-0.0038	-0.0033	-0.0035
	(0.002)*	(0.002)*	(0.002)*	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0028	-0.0029	-0.0029	-0.0026	-0.0030
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1664	-0.1645	-0.1646	-0.1641	-0.1621
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46
KP F Stat				99.68	132.15

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. The migration independent variables sum all migrants from and in countries with *no exports* for product p. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 8: By Skill Levels

Panel A: Extensive Margin						
	Unskilled			Skilled		
	(1)	(2)	(3)	(4)	(5)	(6)
Immigrants	0.0028		0.0021	0.0029		0.0025
	(0.001)***		(0.001)***	(0.001)***		(0.001)***
Emigrants		0.0026	0.0016		0.0023	0.0014
		(0.001)***	(0.001)***		(0.001)***	(0.001)*
Total FDI	0.0009	0.0010	0.0009	0.0009	0.0010	0.0009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0066	-0.0066	-0.0072	-0.0065	-0.0062	-0.0070
	(0.003)**	(0.003)**	(0.003)**	(0.003)**	(0.003)*	(0.003)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
N	83100	83100	83100	83100	83100	83100
r2	0.12	0.12	0.12	0.12	0.12	0.12
Panel B: Intensive Margin						
	Unskilled			Skilled		
	(1)	(2)	(3)	(4)	(5)	(6)
Immigrants	0.0216		0.0175	0.0217		0.0213
	(0.003)***		(0.003)***	(0.003)***		(0.003)***
Emigrants		0.0249	0.0165		0.0089	0.0023
		(0.004)***	(0.004)***		(0.005)*	(0.004)
Total FDI	-0.0011	-0.0010	-0.0012	-0.0011	-0.0009	-0.0011
	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)*	(0.001)**
Total Trade	0.0267	0.0205	0.0117	0.0312	0.0421	0.0296
	(0.008)***	(0.010)**	(0.009)	(0.007)***	(0.009)***	(0.009)***
Baseline Exports (Exc. Bilateral)	-0.0962	-0.0959	-0.0964	-0.0960	-0.0956	-0.0960
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0044	-0.0041	-0.0039	-0.0048	-0.0050	-0.0048
	(0.002)**	(0.002)*	(0.002)*	(0.002)**	(0.002)**	(0.002)**
Previous Exports Growth (Exc. Bilateral)	-0.0021	-0.0023	-0.0021	-0.0022	-0.0024	-0.0022
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1640	-0.1647	-0.1630	-0.1653	-0.1668	-0.1653
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46	0.46

Columns 1-3 show OLS estimations for specification (1) using unskilled migrant figures as the main variables of interest while columns 4-6 uses skilled migrant figures. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table 9: OLS and IV, Continuous RCA Weights

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0003		0.0002	0.0030	
	(0.000)***		(0.000)*	(0.001)**	
Emigrants		0.0003	0.0003		0.0042
		(0.000)***	(0.000)**		(0.002)**
Total FDI	0.0006	0.0006	0.0006	0.0005	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Trade	-0.0003	-0.0003	-0.0003	-0.0005	-0.0006
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)*
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0005
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.09	0.05
KP F Stat				84.40	26.92
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0037		0.0031	0.0069	
	(0.000)***		(0.000)***	(0.001)***	
Emigrants		0.0037	0.0027		0.0121
		(0.000)***	(0.000)***		(0.003)***
Total FDI	0.0021	0.0018	0.0018	0.0018	0.0006
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)
Total Trade	0.0015	0.0015	0.0012	0.0010	0.0001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)
Baseline Exports (Exc. Bilateral)	-0.0969	-0.0964	-0.0970	-0.0976	-0.0974
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0026	-0.0028	-0.0025	-0.0022	-0.0020
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0017	-0.0021	-0.0017	-0.0013	-0.0018
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1628	-0.1627	-0.1615	-0.1609	-0.1572
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.47	0.47	0.47	0.46	0.46
KP F Stat				197.00	62.32

Columns 1-3 show OLS estimations for specification (3) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. The migration independent variables sum all migrants from and in countries with *no exports* for product p. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 10: Skilled vs. Unskilled Migration on the Extensive Margin

		Immigrants			**Emigrants**		
	N	$\beta_{im}^{Unskilled}$	$\beta_{im}^{Skilled}$	Ratio	$\beta_{em}^{Unskilled}$	$\beta_{em}^{Skilled}$	Ratio
All Observations	83100	0.005**	0.006***	**10.55**	0.003**	0.002	**3.51**
Non OECD	79205	0.002**	0.003***	**19.12**	0.002*	0.001	**2.83**
OECD	3895	0.016	0.007	**0.88**	0.010	0.004	**1.68**
Period 1990-2000	50143	0.008**	0.008*	**12.07**	0.003*	0.003	**5.77**
Period 2000-2010	32957	0.002*	0.003***	**12.83**	0.003	0.000	**0.21**
Above Median Capital Intensity	30378	0.005**	0.004**	**9.88**	0.002	0.002	**5.09**
Below Median Capital Intensity	33778	0.004***	0.004***	**11.18**	0.004**	0.003	**4.12**
Differentiated Goods	37759	0.006**	0.006**	**13.11**	0.002	0.002	**3.88**
Homogenous and Reference-Priced Goods	34653	0.004**	0.004**	**10.28**	0.004***	0.003*	**4.00**

This table summarizes OLS regressions for different cuts of the sample. The reported beta coefficients are standardized. The dependent variable in all specifications is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. Significance levels reported based on SE clustered at the country level.

Online Appendix for *Migration, Knowledge Diffusion and the Comparative Advantage of Nations*

Dany Bahar & Hillel Rapoport

February 10, 2016

A Estimation of Gravity Models

Table A presents the results for our gravity model estimations using different transformation of the dependent variable, according Specification (2) (see Section 2.5 in the main body of the paper).

[Table A1 about here.]

It can be seen how, as noted by Santos Silva and Tenreyro (2006), the PPML results are very different than the OLS ones, and provides the best fit with an R-squared of 0.67. Among all results, however, we see some constant patterns. We notice almost no statistical differences between the relationships between years 1990 and 2000, as evidenced by the interacted variables.

B Conditional Logit Estimation

Table presents results of Specification (1) using the Conditional Logit estimator. It limits the sample to the period 2000-2010 for computational purposes. The results are qualitatively consistent with the Linear Probability Model estimations presented in the main body of the paper.

[Table A2 about here.]

C OLS vs IV Estimates

As noted in the main body of the text, we find an overlap in the 95% confidence interval of the OLS and IV estimates. This is represented in Figure A1 which compares the OLS and IV estimators for the immigrant variable in different forms (all, skilled and unskilled). It can be seen that in spite of the gap in the

magnitude of the estimator, we cannot reject the hypothesis that the OLS and IV estimators are different.

[Figure A1 about here.]

Additionally, Tables A3 and A4 present results for the OLS and IV estimations for unskilled and skilled migration, respectively. We posit that, if indeed one of the reasons the IV estimates are much larger than the OLS ones because the transmission of knowledge is stronger across culturally close countries, the gap in the magnitude must be larger for skilled than for unskilled migrants. It can be seen this is the case by comparing the results in columns 1 and 4 for immigrants and those in columns 2 and 5 for emigrants, across both tables.

[Table A3 about here.]

[Table A4 about here.]

D Disentangling FDI and Trade into Inflow and Outflow Figures

In the main specifications used in the paper we use as right hand side variables total FDI and Trade figures, weighted as explained in Specification (1). Table A5 replicates the results of Table 5 separating the FDI and Trade figures into inflow and outflow.

[Table A5 about here.]

E Placebo Test on Skilled Migrants

Table A6 presents results in the same format as in Table 7 using skilled migrants as the main variable of interest (as opposed to total -unskilled plus skilled-migrants).

[Table A6 about here.]

F Substituting CAGR with Log-Growth as the dependent variable

Throughout the paper, when studying the intensive margin, we define the dependent variable as the ten year CAGR for a given product, as defined in Section 2.3. Table A7 shows the results are robust to constructing the dependent variable using log-growth, such that:

$$Y_{c,p,t\to T} = \frac{ln(exports_{c,p,T}) - ln(exports_{c,p,t})}{T-t} \text{ if } exports_{c,p,t} > 0$$

[Table A7 about here.]

Note that the results of Table A7 estimates the instrumental variables model, and excludes from the constructed dependent variable all bilateral trade to the countries where migrants are in or from, whenever immigrants plus emigrants exceeds 500 people.

G Including Hausmann and Klinger (2007) Density Variable

Table A8 presents results which include as control the "density" of the country in the product at the beginning of the period. The variable "density", which distributes between 0 and 1, was developed by Hausmann and Klinger (2006) and used in Hidalgo et al. (2007). It measures the intensity with which a country exports products that are strongly co-exported by other countries who also export the product under consideration. In other words, the density of a product proxies for the existence of other exports that share similar technologies or inputs (as measured by their co-occurrence across countries). Density strongly affects the likelihood that a country adds the product to its export basket (Hausmann & Klinger, 2007; C. A. Hidalgo et al. 2007). We use density to control for the likelihood that a country would export a new good given the initial composition of its export basket.

[Table A8 about here.]

H Excluding Bilateral Exports

To clear any doubt of endogeneity in our instrumental variables implementation, which estimates bilateral migration stocks through a gravity model, our dependent variable $Y_{c,p,t\to T}$ excludes all exports to countries when migrants are in or from. This methodology also allow us to rule out a story in which our results are driven by lower bilateral trade transaction costs induced by the presence of migrants, as Aubry and Rapoport (2015) suggest.

This constraint, as explained above, requires from us to define an arbitrary threshold on the amount of migrants above for which bilateral exports should be excluded from exports to the rest of the world to construct $Y_{c,p,t\to T}$. In the main body of the paper we choose to exclude all bilateral exports to countries for which there are over 500 combined immigrants and emigrants. This reduces world trade by about 93% (see Figure 2).

Tables A9 to A11 present results using as thresholds 1000, 2500 and 5000 migrants, to complement the result in the main body of the paper that uses the 500 threshold.

[Table A9 about here.]

[Table A10 about here.]

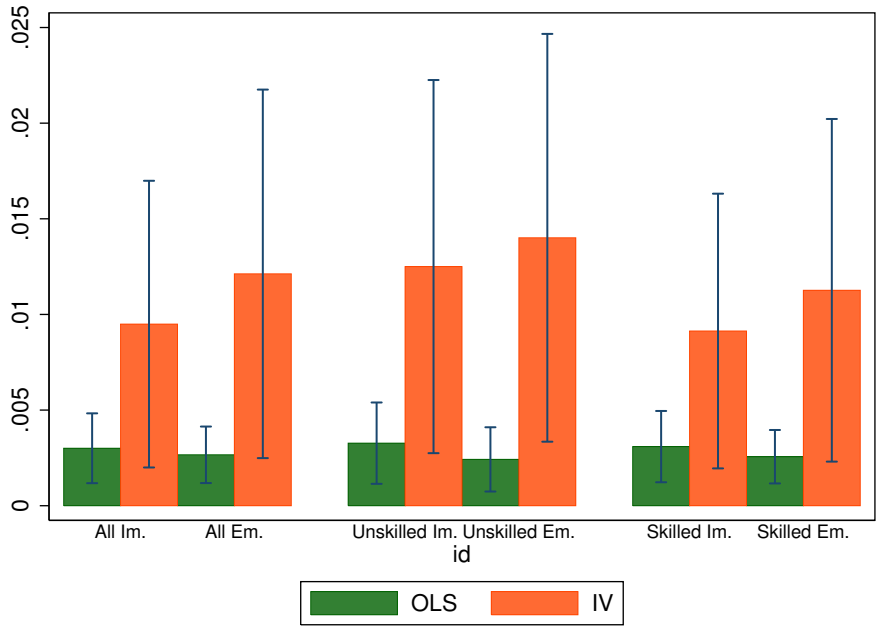
[Table A11 about here.]

I Per Capita Estimation

Table A12 presents results using per-capita transformation (in terms of country c) for the immigrants, emigrants, trade and FDI right hand side constructed measures, before applying the log-type transformation. We find our results are robust to this correction. However, using this transformation, we have a weak instruments problem (see columns 4 and 5).

[Table A12 about here.]

Figure A1: OLS vs. IV immigrants estimates with the correspondent standard errors



This figure shows the OLS and IV estimators for immigrants (all, skilled and unskilled) with 95% confidence intervals marked in light gray color.

Table A1: Gravity Models Results

Dependent Variable: Bilateral Migrants Stocks				
	OLS ln(y)	OLS ln(y+1)	OLS asinh(y)	PPML
Colony-Colonizer Relationship	1.9295	2.6688	2.7493	2.0164
	(0.304)***	(0.396)***	(0.417)***	(0.478)***
Common Colonizer	1.5388	1.8510	2.0050	2.6024
	(0.248)***	(0.257)***	(0.278)***	(0.372)***
Common Language	1.8134	1.7058	1.8528	2.1190
	(0.146)***	(0.150)***	(0.163)***	(0.260)***
Same Religion	1.9837	2.3224	2.5072	1.7814
	(0.299)***	(0.308)***	(0.329)***	(0.279)***
Colony-Colonizer Relationship X Yr2000	-0.1516	0.2603	0.2749	-0.3043
	(0.090)*	(0.088)***	(0.095)***	(0.102)***
Common Colonizer X Yr2000	0.0069	-0.2560	-0.2839	-0.3902
	(0.107)	(0.084)***	(0.095)***	(0.096)***
Common Language X Yr2000	0.1539	0.1159	0.1098	0.2524
	(0.077)**	(0.088)	(0.099)	(0.086)***
Same Religion X Yr2000	0.0592	-0.1382	-0.1598	-0.0069
	(0.177)	(0.200)	(0.221)	(0.167)
Constant	2.7746	1.3693	1.6049	5.4656
	(0.301)***	(0.205)***	(0.221)***	(0.515)***
N	21976	42924	42924	42924
r2	0.55	0.53	0.53	0.67

This table presents results on the estimation of the gravity model of migration stocks following specification (2). Columns 1-3 present results using a different transformation of the dependent variable as described in the top of each column. Column 4 presents result using the Pseudo-Poisson Maximum Likelihood estimator. All specifications include sending country, receiving country and year fixed effects. SE clustered at the receiving country level presented in parenthesis.
$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A2: Conditional Logit Estimation (Extensive Margin)

Dependent Variable: New Export Product, Excluding Bilateral Trade									
	All			Unskilled			Skilled		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrants	0.0894		0.0631	0.0898		0.0595	0.1172		0.1086
	(0.037)**		(0.036)*	(0.037)**		(0.036)	(0.042)***		(0.042)***
Emigrants		0.1229	0.0862		0.1225	0.0885		0.0836	0.0427
		(0.061)**	(0.061)		(0.056)**	(0.055)		(0.080)	(0.082)
Total FDI	-0.0116	-0.0116	-0.0121	-0.0115	-0.0114	-0.0119	-0.0125	-0.0117	-0.0130
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Total Trade	-0.1202	-0.1426	-0.1643	-0.1243	-0.1505	-0.1716	-0.1233	-0.0961	-0.1415
	(0.132)	(0.135)	(0.137)	(0.133)	(0.136)	(0.138)	(0.128)	(0.132)	(0.134)
Product Imports	0.0371	0.0382	0.0378	0.0370	0.0382	0.0378	0.0371	0.0376	0.0374
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
N	15157	15157	15157	15157	15157	15157	15157	15157	15157
r2_p	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

This table presents the estimation of the extensive margin using a Conditional Logit estimator using the period 2000-2010. The dependent variable in all specifications is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country and product fixed effects. SE clustered at the country level presented in parenthesis.
$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A3: OLS and IV Results, Unskilled Migrants

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0028		0.0021	0.0098	
	(0.001)***		(0.001)***	(0.003)***	
Emigrants		0.0026	0.0016		0.0121
		(0.001)***	(0.001)***		(0.004)***
Total FDI	0.0009	0.0010	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0066	-0.0066	-0.0072	-0.0108	-0.0124
	(0.003)**	(0.003)**	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.10
KP F Stat				82.12	92.32
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0216		0.0175	0.0430	
	(0.003)***		(0.003)***	(0.009)***	
Emigrants		0.0249	0.0165		0.0680
		(0.004)***	(0.004)***		(0.014)***
Total FDI	-0.0011	-0.0010	-0.0012	-0.0014	-0.0016
	(0.001)**	(0.001)**	(0.001)**	(0.001)***	(0.001)***
Total Trade	0.0267	0.0205	0.0117	0.0038	-0.0301
	(0.008)***	(0.010)**	(0.009)	(0.012)	(0.020)
Baseline Exports (Exc. Bilateral)	-0.0962	-0.0959	-0.0964	-0.0969	-0.0966
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0044	-0.0041	-0.0039	-0.0037	-0.0024
	(0.002)**	(0.002)*	(0.002)*	(0.002)*	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0021	-0.0023	-0.0021	-0.0018	-0.0022
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1640	-0.1647	-0.1630	-0.1609	-0.1605
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46
KP F Stat				105.90	65.37

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table A4: OLS and IV Results, Skilled Migrants

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0028		0.0021	0.0098	
	(0.001)***		(0.001)***	(0.003)***	
Emigrants		0.0026	0.0016		0.0121
		(0.001)***	(0.001)***		(0.004)***
Total FDI	0.0009	0.0010	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0066	-0.0066	-0.0072	-0.0108	-0.0124
	(0.003)**	(0.003)**	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.10
KP F Stat				82.12	92.32
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0216		0.0175	0.0430	
	(0.003)***		(0.003)***	(0.009)***	
Emigrants		0.0249	0.0165		0.0680
		(0.004)***	(0.004)***		(0.014)***
Total FDI	-0.0011	-0.0010	-0.0012	-0.0014	-0.0016
	(0.001)**	(0.001)**	(0.001)**	(0.001)***	(0.001)***
Total Trade	0.0267	0.0205	0.0117	0.0038	-0.0301
	(0.008)***	(0.010)**	(0.009)	(0.012)	(0.020)
Baseline Exports (Exc. Bilateral)	-0.0962	-0.0959	-0.0964	-0.0969	-0.0966
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0044	-0.0041	-0.0039	-0.0037	-0.0024
	(0.002)**	(0.002)*	(0.002)*	(0.002)*	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0021	-0.0023	-0.0021	-0.0018	-0.0022
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1640	-0.1647	-0.1630	-0.1609	-0.1605
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46
KP F Stat				105.90	65.37

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A5: Main Results, disentangling FDI and Trade (OLS and IV)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0028		0.0022	0.0106	
	(0.001)***		(0.001)***	(0.004)***	
Emigrants		0.0028	0.0017		0.0137
		(0.001)***	(0.001)***		(0.005)***
Total FDI (in)	-0.0012	-0.0012	-0.0012	-0.0012	-0.0010
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total FDI (out)	0.0026	0.0027	0.0026	0.0019	0.0018
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Total Imports	-0.0048	-0.0047	-0.0053	-0.0086	-0.0096
	(0.003)*	(0.003)*	(0.003)*	(0.004)**	(0.004)**
Total Exports	-0.0018	-0.0019	-0.0020	-0.0026	-0.0035
	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.10
KP F Stat				83.08	87.37
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0205		0.0176	0.0402	
	(0.003)***		(0.003)***	(0.009)***	
Emigrants		0.0217	0.0134		0.0694
		(0.004)***	(0.004)***		(0.016)***
Total FDI (in)	0.0235	0.0221	0.0227	0.0236	0.0192
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Total FDI (out)	0.0009	0.0004	0.0002	0.0002	-0.0027
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Total Imports	0.0503	0.0534	0.0434	0.0326	0.0193
	(0.010)***	(0.010)***	(0.010)***	(0.013)***	(0.017)
Total Exports	-0.0275	-0.0319	-0.0316	-0.0304	-0.0480
	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.010)***
Baseline Exports (Exc. Bilateral)	-0.0968	-0.0965	-0.0969	-0.0974	-0.0970
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0043	-0.0042	-0.0039	-0.0036	-0.0025
	(0.002)**	(0.002)**	(0.002)*	(0.002)*	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0016	-0.0019	-0.0017	-0.0014	-0.0019
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1633	-0.1642	-0.1626	-0.1606	-0.1603
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.47	0.46	0.47	0.46	0.46
KP F Stat				107.27	59.12

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table A6: Placebo Test, Skilled Migration

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	-0.0010		-0.0005	-0.0053	
	(0.001)		(0.001)	(0.002)**	
Emigrants		-0.0013	-0.0010		-0.0039
		(0.001)**	(0.001)*		(0.001)***
Total FDI	0.0000	0.0001	0.0001	0.0001	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Trade	0.0015	0.0015	0.0015	0.0019	0.0018
	(0.001)**	(0.001)**	(0.001)**	(0.001)***	(0.001)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	83100	83100	83100	83099	83099
r2	0.11	0.11	0.11	0.11	0.11
KP F Stat				35.23	67.52
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	-0.0125		-0.0058	-0.0423	
	(0.003)***		(0.003)**	(0.007)***	
Emigrants		-0.0202	-0.0175		-0.0359
		(0.003)***	(0.003)***		(0.006)***
Total FDI	-0.0012	-0.0011	-0.0010	-0.0008	-0.0009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0063	-0.0054	-0.0052	-0.0037	-0.0039
	(0.001)***	(0.001)***	(0.001)***	(0.001)**	(0.001)***
Baseline Exports (Exc. Bilateral)	-0.0952	-0.0952	-0.0953	-0.0958	-0.0954
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0039	-0.0038	-0.0037	-0.0035	-0.0035
	(0.002)*	(0.002)*	(0.002)	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0028	-0.0030	-0.0029	-0.0026	-0.0030
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1664	-0.1647	-0.1646	-0.1643	-0.1626
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	0.46
KP F Stat				130.77	192.90

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table A7: OLS and IV, Intensive Margin Using Log-Growth

Dependent Variable: 10 Year Average Log-Growth, Excluding Bilateral Trade					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0029		0.0022	0.0108	
	(0.002)*		(0.002)	(0.006)*	
Emigrants		0.0041	0.0030		0.0180
		(0.002)*	(0.002)		(0.009)**
Total FDI	0.0004	0.0004	0.0003	0.0002	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Trade	0.0022	0.0007	-0.0004	-0.0057	-0.0142
	(0.005)	(0.006)	(0.006)	(0.007)	(0.011)
Baseline Exports	-0.0195	-0.0194	-0.0196	-0.0203	-0.0201
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Previous Exports Log-Growth (Exc. Bilateral)	-0.2916	-0.2916	-0.2916	-0.2913	-0.2916
	(0.007)***	(0.007)***	(0.007)***	(0.007)***	(0.007)***
Zero Exports in t-1	0.0010	0.0010	0.0011	0.0016	0.0019
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
N	127770	127770	127770	127770	127770
r2	0.35	0.35	0.35	0.35	0.35
KP F Stat				105.52	62.09

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. The table estimates the future log-growth of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.
$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A8: OLS and IV (Adding Density as a Control)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0025		0.0019	0.0100	
	(0.001)***		(0.001)***	(0.003)***	
Emigrants		0.0026	0.0017		0.0126
		(0.001)***	(0.001)***		(0.004)***
Total FDI	0.0009	0.0010	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0063	-0.0064	-0.0069	-0.0106	-0.0122
	(0.003)**	(0.003)**	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)	(0.000)
Baseline Density	0.2806	0.2990	0.2839	0.2170	0.2869
	(0.113)**	(0.118)**	(0.113)**	(0.097)**	(0.111)***
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.11
KP F Stat				83.56	93.47
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0179		0.0145	0.0274	
	(0.003)***		(0.003)***	(0.009)***	
Emigrants		0.0220	0.0151		0.0451
		(0.004)***	(0.004)***		(0.014)***
Total FDI	0.0003	0.0003	0.0001	0.0001	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Total Trade	0.0069	0.0007	-0.0061	-0.0024	-0.0242
	(0.007)	(0.009)	(0.008)	(0.012)	(0.018)
Baseline Exports (Exc. Bilateral)	-0.1013	-0.1011	-0.1013	-0.1015	-0.1014
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0024	-0.0021	-0.0020	-0.0021	-0.0013
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	0.0020	0.0019	0.0020	0.0021	0.0019
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Zero Exports in t-1 (Exc. Bilateral)	-0.1583	-0.1589	-0.1575	-0.1571	-0.1569
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
Baseline Density	1.8932	1.9300	1.8918	1.8648	1.9121
	(0.177)***	(0.180)***	(0.177)***	(0.174)***	(0.179)***
N	127770	127770	127770	127770	127770
r2	0.47	0.47	0.47	0.47	0.47
KP F Stat				103.74	65.25

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A9: OLS and IV Results, excluding bilateral exports (1000 migrants threshold)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0027		0.0021	0.0097	
	(0.001)***		(0.001)***	(0.003)***	
Emigrants		0.0027	0.0016		0.0124
		(0.001)***	(0.001)***		(0.004)***
Total FDI	0.0009	0.0009	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0062	-0.0062	-0.0068	-0.0103	-0.0119
	(0.003)*	(0.003)*	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.10
KP F Stat				83.16	93.07
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0217		0.0189	0.0417	
	(0.003)***		(0.003)***	(0.008)***	
Emigrants		0.0214	0.0124		0.0698
		(0.004)***	(0.004)***		(0.015)***
Total FDI	-0.0013	-0.0012	-0.0014	-0.0016	-0.0019
	(0.000)***	(0.000)**	(0.000)***	(0.000)***	(0.001)***
Total Trade	0.0290	0.0277	0.0183	0.0086	-0.0249
	(0.007)***	(0.010)***	(0.009)**	(0.011)	(0.020)
Baseline Exports (Exc. Bilateral)	-0.0957	-0.0953	-0.0958	-0.0963	-0.0960
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0041	-0.0040	-0.0038	-0.0035	-0.0023
	(0.002)**	(0.002)*	(0.002)*	(0.002)*	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0035	-0.0037	-0.0035	-0.0032	-0.0035
	(0.002)*	(0.002)*	(0.002)*	(0.002)	(0.002)*
Zero Exports in t-1 (Exc. Bilateral)	-0.1602	-0.1612	-0.1597	-0.1580	-0.1578
	(0.011)***	(0.011)***	(0.011)***	(0.011)***	(0.011)***
N	127770	127770	127770	127770	127770
r2	0.47	0.47	0.47	0.47	0.47
KP F Stat				106.92	62.97

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 1000 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A10: OLS and IV Results, excluding bilateral exports (2500 migrants threshold)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0028		0.0023	0.0098	
	(0.001)***		(0.001)***	(0.004)***	
Emigrants		0.0024	0.0013		0.0125
		(0.001)***	(0.001)**		(0.005)***
Total FDI	0.0009	0.0009	0.0009	0.0007	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0057	-0.0055	-0.0062	-0.0098	-0.0114
	(0.003)*	(0.003)*	(0.003)*	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0006	-0.0006
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.11
KP F Stat				83.16	93.07
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0200		0.0173	0.0426	
	(0.003)***		(0.003)***	(0.008)***	
Emigrants		0.0203	0.0120		0.0712
		(0.004)***	(0.004)***		(0.014)***
Total FDI	-0.0012	-0.0012	-0.0013	-0.0016	-0.0019
	(0.000)**	(0.000)**	(0.000)***	(0.000)***	(0.001)***
Total Trade	0.0281	0.0264	0.0178	0.0051	-0.0291
	(0.007)***	(0.009)***	(0.008)**	(0.011)	(0.020)
Baseline Exports (Exc. Bilateral)	-0.0952	-0.0948	-0.0953	-0.0960	-0.0956
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0029	-0.0028	-0.0025	-0.0022	-0.0009
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0068	-0.0070	-0.0067	-0.0063	-0.0067
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Zero Exports in t-1 (Exc. Bilateral)	-0.1405	-0.1411	-0.1400	-0.1383	-0.1379
	(0.011)***	(0.011)***	(0.011)***	(0.011)***	(0.011)***
N	127770	127770	127770	127770	127770
r2	0.48	0.48	0.48	0.48	0.48
KP F Stat				106.70	62.80

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 2500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A11: OLS and IV Results, excluding bilateral exports (5000 migrants threshold)

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0031		0.0026	0.0101	
	(0.001)***		(0.001)***	(0.004)***	
Emigrants		0.0026	0.0013		0.0128
		(0.001)***	(0.001)**		(0.005)***
Total FDI	0.0009	0.0009	0.0008	0.0006	0.0007
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0058	-0.0055	-0.0063	-0.0098	-0.0115
	(0.003)*	(0.003)*	(0.003)**	(0.004)**	(0.005)**
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	-0.0007
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	0.11
KP F Stat				83.16	93.07
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.0195		0.0170	0.0390	
	(0.003)***		(0.003)***	(0.008)***	
Emigrants		0.0190	0.0109		0.0653
		(0.004)***	(0.004)***		(0.013)***
Total FDI	-0.0011	-0.0011	-0.0013	-0.0015	-0.0018
	(0.000)***	(0.000)**	(0.000)***	(0.000)***	(0.001)***
Total Trade	0.0273	0.0265	0.0179	0.0073	-0.0240
	(0.007)***	(0.009)***	(0.008)**	(0.010)	(0.019)
Baseline Exports (Exc. Bilateral)	-0.0949	-0.0944	-0.0950	-0.0956	-0.0953
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Product Imports	-0.0022	-0.0021	-0.0018	-0.0015	-0.0004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Previous Exports Growth (Exc. Bilateral)	-0.0085	-0.0088	-0.0085	-0.0081	-0.0085
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Zero Exports in t-1 (Exc. Bilateral)	-0.1286	-0.1289	-0.1281	-0.1272	-0.1259
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.012)***
N	127770	127770	127770	127770	127770
r2	0.49	0.49	0.49	0.49	0.48
KP F Stat				106.67	62.63

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

Table A12: OLS and IV Results, using Per Capita transformations in RHS

Panel A: Extensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.1652		0.1443	0.8471	
	(0.088)*		(0.082)*	(0.789)	
Emigrants		0.1868	0.1802		7.3581
		(0.054)***	(0.052)***		(4.857)
Total FDI	0.0010	0.0010	0.0010	0.0010	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Trade	-0.0051	-0.0056	-0.0057	-0.0055	-0.0300
	(0.003)*	(0.003)*	(0.003)*	(0.003)*	(0.023)
Product Imports	-0.0007	-0.0007	-0.0007	-0.0007	0.0002
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.001)
N	83100	83100	83100	83099	83099
r2	0.12	0.12	0.12	0.11	-0.52
KP F Stat				8.62	1.39
Panel B: Intensive Margin					
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Immigrants	0.3160		0.3020	1.7213	
	(0.134)**		(0.147)**	(1.318)	
Emigrants		0.5923	0.5814		-62.1967
		(0.242)**	(0.239)**		(270.883)
Total FDI	-0.0007	-0.0008	-0.0008	-0.0006	0.0075
	(0.001)	(0.001)	(0.001)	(0.001)	(0.034)
Total Trade	0.0478	0.0435	0.0417	0.0387	0.7096
	(0.008)***	(0.008)***	(0.008)***	(0.012)***	(2.844)
Baseline Exports (Exc. Bilateral)	-0.0956	-0.0956	-0.0956	-0.0959	-0.0898
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.027)***
Product Imports	-0.0052	-0.0049	-0.0049	-0.0054	-0.0328
	(0.002)**	(0.002)**	(0.002)**	(0.002)**	(0.120)
Previous Exports Growth (Exc. Bilateral)	-0.0023	-0.0024	-0.0023	-0.0020	-0.0043
	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)
Zero Exports in t-1 (Exc. Bilateral)	-0.1673	-0.1670	-0.1672	-0.1681	-0.1706
	(0.012)***	(0.012)***	(0.012)***	(0.012)***	(0.030)***
N	127770	127770	127770	127770	127770
r2	0.46	0.46	0.46	0.46	-1.08
KP F Stat				12.26	0.05

Columns 1-3 show OLS estimations for specification (1) while columns 4-5 show results for IV regressions, using a per capita transformation of the right hand side variables. Panel A presents results of the emergence of new sectors (extensive margin), while Panel B estimates the future CAGR of existing industries (intensive margin). The dependent variable in all specifications and both panels is constructed using exports of country c to the whole world excluding to countries c' where total migration between c and c' exceeds 500 people. All specifications include country-by-year and product-by-year fixed effects. SE clustered at the country level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$