The trade creation effect of immigrants: evidence from the remarkable case of Spain

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Abstract. This paper investigates the immigration-trade link using data on individual exporting transactions and immigrants in Spanish provinces between 1995 and 2008. We quantify the impact of new immigrants on the extensive margin (number of transactions) and intensive margin (average value per transaction) of exports. We find that immigrants significantly increase exports and that the effect is almost entirely due to an increase in the extensive margin. Consistent with the idea that immigrants reduce the fixed cost of exporting, we find stronger effects for differentiated goods and for countries that are culturally distant from Spain. JEL classification: F10, R12

L'effet de création de commerce des immigrants: résultats dans le cas remarquable de l'Espagne. Ce texte étudie le lien immigration-commerce international à l'aide de données sur les transactions individuelles d'exportation et sur les immigrants dans les provinces espagnoles entre 1995 et 2008. On quantifie l'impact des nouveaux immigrants à la marge extensive (nombre de transactions d'exportation) et à la marge intensive (valeur moyenne des transactions d'exportation) . On découvre que les immigrants déclenchent une augmentation significative des exportations, et que cet effet est presqu'entièrement attribuable à un accroissement à la marge extensive. En ligne avec l'idée que les immigrants réduisent les coûts fixes de l'exportation, on découvre des effets plus forts pour les produits différenciés et pour des pays qui sont distants culturellement de l'Espagne.

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1. Introduction

Since the pioneering work of Gould (1994) and Head and Reis (1998), economists have found empirical evidence that, controlling for bilateral transport costs, larger bilateral migration networks are associated with larger trade flows. Immigration networks, by providing channels of knowledge diffusion and enforcement mechanisms, reduce the information, communication, and set-up costs between locations (Rauch and Trindade 2002). Hence, their significant correlation with trade, uncovered by gravity-type regressions, can be legitimately seen as a trade-creation effect of immigrants through the reduction of trade costs.

Our paper goes beyond the existing literature in several important ways. First, as we can use micro-data on individual trade transactions for 50 Spanish provinces and 77 foreign countries over 14 years (1995–2008), we can decompose the effects of immigrants on the extensive margin of trade (number of transactions) and on the intensive margin of trade (average amount per transaction). Second, as in Rauch and Trindale (2002), we are able to use trade data for different types of goods, classifying them according to their elasticity of substitution across varieties. This allows us to identify the importance of networks in reducing information costs, which should be more relevant for more differentiated rather than for homogeneous goods. Third, as we can control for province-country bilateral fixed factors (costs, geography, and cultural similarity) and for country by time effects, we can run a very demanding regression and identify our trade-creation effects on the within-pair change in trade as consequence of changes in the stock of immigrants. To reinforce our causal interpretation, we use the instrumental variable approach based on historical immigrant enclaves. The tendency of people from the same country to settle in the same areas provides a supply-driven variation in the inflow of immigrants (see, e.g., Card 2001, 2007; Ottaviano and Peri 2006) that can be used as an instrument. Finally, we analyze whether the elasticity of trade creation to immigrants is constant or if it varies with the size of the immigrant community. By splitting the sample across provinces and over time, we can test whether the elasticity of trade to immigrants is significantly larger in provinces with larger shares of immigrants and/or in the period of larger presence of immigrants.

Our main findings are three. First, we find an average effect of immigrants on export that is statistically and economically significant. An increase by 10% of the immigrant community from a country in a Spanish province increases the exports to that country between 0.5% and 1%. Second, in most cases the largest part of the trade-creation effect is due to an increase in the number of trade transactions (extensive margin) with little to no effect on the volume of the average transaction (intensive margin). Third, there is a pattern of larger export creation for highly differentiated goods than for homogeneous goods towards most countries. However, export to regions likely to have very large initial fixed trade costs, such as Africa, increases equally with immigration in all goods categories, while for countries culturally similar, such as those in Latin

America, fixed trade costs might be small to begin with and immigrants do not produce much of an effect on export. Finally, we also find that the elasticity of export to immigrants has been particularly large in provinces with high density of immigrants, and it increased during the most recent period (2002–2008), when immigration reached a sizeable mass relative to the native population.

A useful way of rationalizing our findings is to use Chaney's (2008) theory as the foundation of our empirical gravity equation and as a theory of the relation between trade costs and margins of trade. According to the Chaney's model, a reduction in the fixed bilateral costs of trade (e.g., start-up costs) should not have any impact on the intensive margin, but it would increase total export through an increase in the extensive margin (number of firms). To the contrary, a decrease in the variable trade cost (e.g., ad valorem transport costs) would increase both margins of trade and its total volume. Moreover, according to Chaney (2008), a decrease in the fixed trade costs has a larger effect on the trade volume of more differentiated goods (those with low elasticity of substitution), because the contribution to exports of new entrants is larger for these goods, while a decrease in variable costs will affect all goods equally. Hence, the empirical findings that immigrants mainly affect the extensive margin of export and that they have a larger effect on differentiated goods can be consistently interpreted, within the context of the Chaney (2008) model, as evidence that a larger community of immigrants reduces the fixed costs (rather than the variable costs) of exporting to their countries of origin.

Several studies since Gould (1994) have analyzed the correlation between trade flows and stock of immigrants in the context of a gravity regression. Recently, the availability of data on trade between sub-national units (US states and Canadian provinces) and foreign countries and on the stock of immigrants by nationality, as well as a more solid theoretical foundation for the gravity equation of trade flows[1] have spurred a series of analysis that use local agglomerations of migrants and exports from the area to the countries of origin of immigrants. Those studies, whose sample, method of estimation and main estimates are summarized in table 1, have generally found a robust correlation between stock of immigrants and exports. The estimated elasticities, reported in column 2 of table 1, range between 0.01 and 0.40, with most estimates in the interval 0.1–0.2, which contains our main estimate of 0.11.[2] Most of the studies reported in table 1 use national

1 Anderson and Van Wincoop (2001); Helpman, Melitz, and Rubenstein (2008); and Chaney (2008).

2 Other studies of the impact of immigrants on trade (not reported in table 1) include Co, Euzent, and Martin (2004) and Herander and Saavedra (2005), for the U.S.; Bryant and Law (2004) for New-Zealand; White and Tedesse (2007) for Australia. These studies usually find complementarity between immigration and trade. For Spain, Blanes (2005) and Blanes and Martin-Muntaner (2006) investigate the impact of immigration on intra-industry trade during the 1990s, showing that the trade-immigration link is stronger among highly differentiated products. Other studies such as Combes, Lafourcade, and Mayer (2005) for France and Millimet and Osang (2007) for the US have analyzed the connections between regional migration and regional trade within countries.

TABLE 1
Estimated elasticity of export to immigrants: summarizing some influential contributions from the literature

Authors	Estimated elasticity of export to immigrants	Sample	Specification-method
Bandyopadhyay, Coughlin, and Wall (2008)	0.14	50 US states, 29 countries, 1990, 2000	Panel, OLS with country-time and trading partner pairs FE
Briant, Combes, and M. Lafourcade (2009)	0.07–0.10	93 French Departments, 1999–2001	Pooled cross section, 2SLS, country and Department FE
Dunlevy (2006)	0.24–0.47	50 US states, 87 countries, 1990–1992	Pooled cross-section, OLS with country and state FE
Dunlevy and Hutchinson (1999)	0.08	US, with 17 countries, 1870–1910	Pooled cross-section, simple gravity specification
Head and Ries (1998)	0.10	Canada and 136 trading partners, 1980–1992	Pooled cross-section, simple gravity specification
Girma and Yu (2002)	0.16	UK and 48 trading partners	Pooled cross-section, simple gravity specification
Rauch and Trindale (2002)	0.22–0.47	Ethnic Chinese in 120 countries	Pooled cros-section, simple gravity specification
Wagner, Head, and Reis (2002)	0.09	5 Canadian provinces, 160 countries, 1992–1995	Pooled cross-section, OLS with country FE

trade data (rather than provincial data) and a cross-sectional approach (rather than panel). Notice that some of the cross-sectional regressions (Dunlevy 2006; Rauch and Trindale 2002) find elasticities much larger than ours (between 0.2 and 0.4). Most of the estimates, however, are closer to our estimated range (around 0.10). Bandyopadhyay, Coughlin, and Wall (2008), authors of the only study using sub-national units (states) in a panel (as we do), find a coefficient of immigrants on export of 0.14, and Briant, Combes, and Lafourcade (2009), authors of the only study using sub-national units in a European country (but in a cross section) and instrumenting for immigration flows, find a coefficient of immigrants on exports between 0.07 and 0.10, very close to our range. Finally, the other three studies included in the review, Dunlevy and Hutchinson (1999) for the US, who use historical data (1870–1910), Girma and Yu (2002) for the UK, and Wagner, Head, and Ries (2002) for Canada find effects not far from 0.10 (0.08 the first, 0.09 the second, and 0.16 the third).

The rest of the paper is organized as follows. Section 2 presents the data on exports and immigration in Spain. Section 3 provides a theoretical foundation for the augmented-gravity specification that we use to evaluate the trade-creating impact of foreign-born residents and a framework to interpret the effects on the intensive and extensive margin and on goods with different degrees of

differentiation. Section 4 presents the benchmark empirical results, discusses several econometric issues and shows the decomposition of the trade-creation effects between the intensive and extensive margin and among types of goods (according to their substitutability/differentiation). In section 5 we explore some additional issues in the pro-trade effect of immigration: Did pro-trade effects of new immigrants change over time? Do they vary systematically with the countries of origin? Is the elasticity of trade to immigration changing with the size of immigrant network? Section 6 provides some concluding remarks.

2. Data

Our data set is obtained by merging two publicly available sources. The trade data originate from the ADUANAS-AEAT data set provided by the Ministerio de Economía y Hacienda. The information on the number of foreign-born residents by province and country of origin is obtained from the Statistical Yearbook published annually by the Spanish Statistical Office (INE). We define immigrants as Spanish residents born abroad with a foreign nationality.[3]

The trade data set reports all the individual transactions (shipments) with detailed information on the direction of trade (imports and exports), product, value (in thousands of Euros), weight, invoice currency, and type of product at the 8-digit Combined Nomenclature level between 52 Spanish provinces (Eurostat NUTS III definition) and 190 trading partners since 1993. The data are collected in order to measure the exports in the province of original shipment of the good.[4] The selection of trading partners in the final sample is driven by data on immigration and contains 77 countries, which accounts for around 94% of total Spanish exports (and close to 100% of immigration) over the period analyzed. Table A1 in the appendix lists the 77 countries of origin, grouped into 7 regional areas.[5]

We decompose total exports into the *number of transactions*, that we call the 'extensive' margin, and the *average value per transaction*, that we call the 'intensive' margin. Each export transaction is invoiced by an exporting firm to one foreign firm. Hence, an increase in the number of export transactions captures either new exporting firms or firms exporting a new product or new trading relations of existing firms with a new country or higher frequency in transactions between existing trading partners. The first three elements constitute the extensive

3 The trade data are publicly available at www.aeat.es/aeat/aeat.jsp?pg=aduanas/es_ES. The immigration stock data are publicly available at www.ine.es/prodyser/pubweb/anuarios_mnu.htm.

4 Although the original database reports all the firm-level shipments, it is not possible to identify the firms. For that reason we use the custom address of the transaction, that is, the province where the transaction was registered in order to aggregate the number of shipments and the value of shipments at the 8-digit Combined Nomenclature level and at the province level.

5 Table TA1 in the technical appendix reports the share of total Spanish trade with and the share of immigrants from each of those seven world areas.

margin of export at the firm-product level, while the last one is part of the intensive margin considering the firm-product as the unit. The correspondence between new exporting relations, considering the firm-product as the relevant unit and exporting transactions as we measure them, is not perfect. Still we define the number of transactions as our indicator of the extensive margin of exports, aware that it may produce a slight overestimate of such margin.

Trade flows in our data set are originally available at a very disaggregated product level (8-digit Combined Nomenclature classification). We match this classification with the one proposed by Broda and Weinstein (2006) to characterize the degree of differentiability of products. More specifically, they have calculated the import demand elasticities for 2,715 goods of the 5-digit SITC (rev. 3) system for the period 1990 and 2001. We first use the correspondence table between 8-digit Combined Nomenclature (CN8) and the 5-digit SITC provided by the European Statistical office (EUROSTAT).[6] We then group the products into three broad categories according to their elasticity of substitution as calculated by Broda and Weinstein (2006). Sectors with an elasticity below 2 across varieties are classified as highly differentiated; sectors with an elasticity between 2 and 3.5 are classified as moderately differentiated and sectors with an elasticity above 3.5 are classified as less differentiated. Sectors with low (high) elasticities of substitution correspond to goods that are more (less) differentiated.[7] Table 2 reports the summary statistics for exports in each category of goods as well as for the average number of transactions and the average value per transaction in representative years.[8] Over the period 1995–2008 the total value of exports has doubled between a typical Spanish province and a country of destination. While the number of transactions by province-country pair has increased steadily and has almost doubled by the end of the period, the average value per transaction decreased between 1995 and 2004 and then increased strongly over the period 2004–2008. By type of product, the number of transactions per province-country pair is larger and the average value per transaction is smaller for highly differentiated products than for moderately and less differentiated products.

Our explanatory variable of interest is the stock of immigrants by country of origin and province of destination. Immigration is a recent phenomenon in Spain but has increased very fast in recent years. In 2007 foreign-born represented about 10% of total population up from only 1% in 1993. The foreign population grew steadily at an average rate of 17% per year from 0.4 million in 1993 to 4 million in 2007. The average yearly growth rate was 13% over the period 1993–2001 and accelerated to 23% over the period 2002–2007. Table 3 shows the

6 Available at http://ec.europa.eu/eurostat/ramon.

7 Broda and Weinstein (2006) examine how well their estimates correspond to the classification proposed by Rauch (1999) to characterize the degree of product differentiability of products: commodities, reference-priced goods, and differentiated goods. They observe that the median elasticities of substitution are higher for commodities than for differentiated and reference priced goods.

8 Table TA2 in the technical appendix reports the same figures relative to imports.

TABLE 2
Export Values by year, type of product, and extensive/intensive margin

Year	All products	Highly differentiated products	Moderately differentiated products	Less differentiated products
Total value by province-country pair (thousands of current Euros)				
1995	21107	1863	5907	6760
1999	24931	2218	6527	8072
2004	34399	2840	9675	11235
2008	45427	3956	12235	14792
Number of transactions by province-country pair				
1995	300	101	84	76
1999	326	107	92	84
2004	476	153	141	118
2008	563	177	170	140
Average value per transaction by province-country pair (thousands of current Euros)				
1995	83	30	52	81
1999	96	29	48	69
2004	75	30	43	68
2008	137	47	118	130

SOURCE: Own elaboration using Spanish custom detailed international transaction data for a selection of 77 destination countries (94% of total exports in 2008)

top 30 countries of origin of the immigrants in 2007 and (in the last column) their ranking among top immigration countries in 1993. The comparison of the ranks gives an idea of the change in composition of immigrants by country of origin. In 2007 the top five immigrant countries measured by the number of foreign-born population were Morocco, Romania, Ecuador, Colombia, and United Kingdom. These five countries accounted for 53% of the total foreign population. The United Kingdom was the most important country of origin in 1993 (13.6%), but British immigrants (and those from other EU countries in general) have decreased in relative terms in the last 15 years. In 2007 the UK was only the fifth most important country of origin, with a share of 5% of the total immigrant population. Other Non-EU countries have also gained positions in the 2007 ranking. A number of countries from Central and Eastern Europe (Poland, Ukraine, and Russia) and from South America (Ecuador, Peru, and Bolivia) have also contributed in large numbers to increase the number of immigrants in Spain. Another interesting feature of the immigration in Spain is the uneven distribution of immigrants across Spanish provinces. Figure 1 shows the map of Spain where provinces are coloured according to their share of foreign-born in total population in the year 2007. While all but three provinces in 1995 have a share of foreign-born population below 4%, in 2007, there were 17 provinces with shares above 10%.[9]

9 Table TA3 in the technical appendix shows the names of the Spanish provinces and whether their share of immigrants was above 10%, between 4% and 10%, or below 4% in 2007.

TABLE 3
Immigrants by country of origin

Ranking in 2007	Country of origin	Number of immigrants in 2007	% on total immigrants in 2007	Annual growth rate, 1993–2007 (%)	Ranking in 1993
(1)	Morocco	648735	16.3	18.9	(2)
(2)	Romania	603889	15.2	59.5	(46)
(3)	Ecuador	395808	9.9	49.5	(40)
(4)	Colombia	254301	6.4	30.2	(16)
(5)	United Kingdom	198638	5.0	8.9	(1)
(6)	Bulgaria	127058	3.2	43.7	(49)
(7)	Italy	124936	3.1	16.1	(7)
(8)	China	119859	3.0	21.7	(14)
(9)	Peru	116202	2.9	18.8	(10)
(10)	Portugal	101818	2.6	8.9	(4)
(11)	Argentina	96055	2.4	11.3	(6)
(12)	Germany	91670	2.3	7.0	(3)
(13)	Poland	70850	1.8	21.3	(21)
(14)	Dominican Rep.	70775	1.8	15.4	(11)
(15)	Bolivia	69109	1.7	37.0	(48)
(16)	France	68377	1.7	7.1	(5)
(17)	Ukraine	62409	1.6	48.9	(70)
(18)	Algeria	45825	1.2	21.2	(30)
(19)	Cuba	45068	1.1	19.1	(25)
(20)	Brazil	39170	1.0	16.8	(23)
(21)	Pakistan	36384	0.9	35.6	(58)
(22)	Venezuela	33262	0.8	12.0	(15)
(23)	Senegal	33217	0.8	17.1	(27)
(24)	Uruguay	31092	0.8	15.9	(24)
(25)	Netherlands	30055	0.8	7.0	(9)
(26)	Russia	29297	0.7	27.7	(44)
(27)	Philippines	25051	0.6	7.7	(12)
(28)	Chile	24841	0.6	10.8	(19)
(29)	Nigeria	23524	0.6	32.1	(60)
(30)	India	20776	0.5	9.1	(17)
	Top 30 countries	3638051	91.4		
	TOTAL	3979014	100	17.0	

SOURCE: Statistical Yearbook (Anuario Estadístico), various issues, published by INE

An interesting example of the evolution over time of immigration and trade is illustrated in figure 2. Before year 2000 trade with Western Europe had been constant or growing and very large and, similarly, immigrants from Western Europe were the most important group in relative terms. However, beginning with year 1998, the stock of immigrants from Western Europe decreased in relative importance. Figure 2, panel A, shows that immigrants from Western Europe, as a share of total foreign-born, decreased, beginning from 1998 to 2008, to only 40% of its 1998 value. Following such a trend, possibly with a few years of delay, figure 2, panel A also shows that Western Europe become a relatively less important trade partner. Its share in total trade decreased by 13% over the 1998–2008

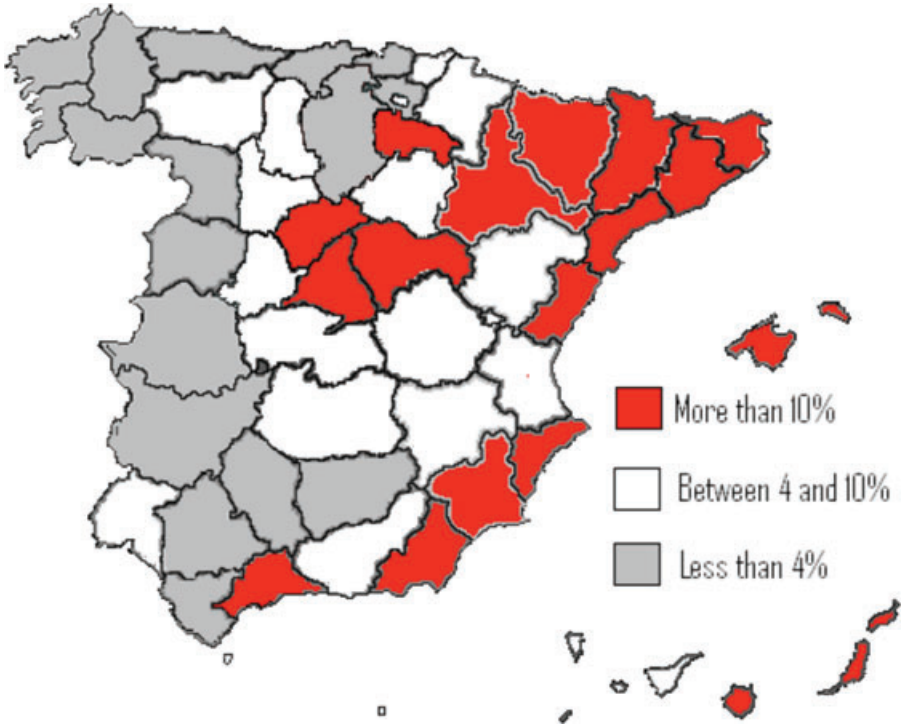

FIGURE 1 Percentage of foreign-born in total population, Spanish provinces, 2007

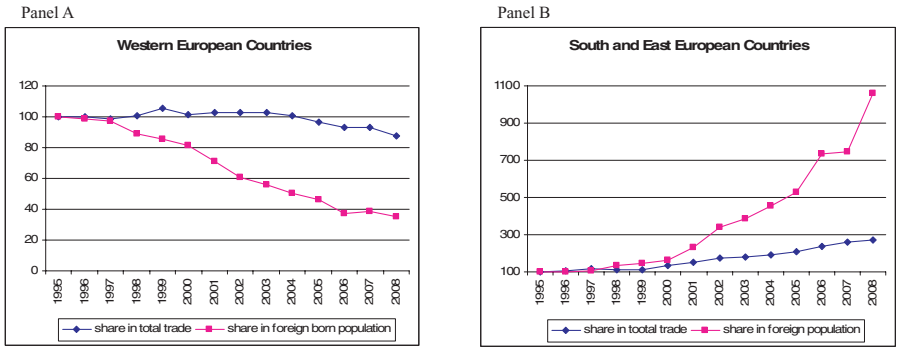

FIGURE 2 Trade with and immigration from Western Europe and South/Eastern Europe (1995 = 100)
NOTES: Total trade is the sum of imports and exports. Immigration is lagged one period. Each of the two measures is measured as share of total (trade volume or immigration) and is standardized so that the level in 1995 is equal to 100.

period. Conversely, panel B of figure 2 shows that immigration from Eastern Europe picked up dramatically between 1999 and 2008, increasing ten-fold, and trade with Eastern Europe also increased in relative importance. Its share relative to total trade increased by 170% over the same period. While such an example is only suggestive, it reveals a correlation and implies a specific elasticity: associated with a 1% increase in the total share of immigrants, the share of trade increased by around 0.2%. Obviously many other factors may have contributed to the joint shift of trade and migration from Western to Eastern Europe, and the role of migration on trade is not the only explanation for the observed correlation. We formally analyze in the rest of the paper the trade creation effect of immigrants.

3. Foundations of the empirical model

The basic gravity-equation that we estimate to identify the impact of immigrants on exports describes the logarithm of aggregate export X_{ijt} from province i to country j for period t as follows:

$$\ln(X_{ijt}) = \phi_{jt} + \theta_t + \delta_{ij} + \ln(Y_{it}\, Y_{jt}) + \alpha \ln(IMM_{ijt}). \tag{1}$$

The term ϕ_{jt} represents a set of importing country by time effects, θ_t is a set of year dummies,[10] δ_{ij} are province-country pair dummies, Y_{it} and Y_{jt} are, respectively, the country and province gross output[11] and IMM_{ijt} is the total stock of immigrants from country j in province i in year t. While this specification is quite demanding, as it controls for a very large set of fixed effects, its advantage is that it can be interpreted as obtained from the recent model of Chaney (2008). For each sector, that model[12] delivers the following equation describing the determinant of exports X_{ijt}:

$$\ln(X_{ijt}) = Const + \ln\left(w_{it}^{-\gamma}\, Y_{it}\right) + \ln\left(Y_{jt}\theta_{jt}^{\gamma}\right) - \gamma \ln(\tau_{ijt}) - \left(\frac{\gamma}{\sigma - 1} - 1\right) \ln(f_{ijt}). \tag{2}$$

The term $\ln(w_{it}^{-\gamma}\, Y_{it})$ captures the exporting-country wages (w_{it}) and the exporting-country income Y_{it}. They capture the competitiveness and the domestic market size for the exporting country. The term $\ln(Y_{jt}\theta_j^{\gamma})$ captures the importing country aggregate income (Y_{jt}) and its remoteness from the rest of the

10 Notice that, when we will estimate equation (1), the pure time fixed effect θ_t will be absorbed by the country-year pair effect ϕ_{jt}.

11 Gross regional output and Gross Domestic Output are used to measure the variables Y_{it} and Y_{jt}, respectively. Gross domestic output is obtained from World Development Indicators (WDI 2008 online database) and gross regional output is reported in Regional Accounts (INE). Regional values have been scaled to match Spanish GDP in WDI.

12 See Chaney (2008, 1714).

world, (θ_{jt}^{γ}).[13] The term τ_{ijt} captures iceberg (proportional) transport costs (per unit of export) and f_{ijt} captures the fixed costs for firms of province i to export in country j. This equation is derived by aggregating the exports of firms with heterogeneous productivity. By assuming that the bilateral variable costs, τ_{ijt}, are relatively constant over time, we can absorb the term $\gamma \ln(\tau_{ijt})$ into a set of province-country dummies δ_{ij}. We can also absorb the effect of remoteness $\ln(\theta_{jt}^{\gamma})$ into the country by time effects ϕ_{jt}, and the term $\ln(\bar{w_{it}}^{\gamma})$, assumed common to all provinces, will be captured by the time effect θ_t. Hence, the first four terms of equation (2) reduce to the corresponding four terms of equation (1). Once we account for these factors, the last term of equation (2),

$$\left(\frac{\gamma}{\sigma - 1} - 1\right) \ln(f_{ijt}),$$

is the channel through which immigrants affect trade. The presence of immigrants from country j in province i allows firms in province i to know about rules and opportunities in country j and may reduce the information costs and the costs of setting up business there. Immigrants themselves may become exporters and face much lower set-up costs in their countries of origin. Hence, an effect of immigrants on fixed costs f_{ijt} is likely. On the other hand, variable costs, τ_{ij}, proportional to the value of export, are usually associated with transport and tariff-costs which are less susceptible of being affected by immigrants. We can represent the relation between fixed costs and stock of immigrants as follows: $\ln(f_{ijt}) = \ln f(\ln(Immigrants_{ijt}))$, with $\partial \ln f / \partial \ln(\text{Immigrants}) < 0$. Hence, the coefficient

$$\alpha = -\left(\frac{\gamma}{\sigma - 1} - 1\right) \partial \ln f / \partial \ln(Immigrants) > 0$$

in equation (1), is predicted by the model to be larger than zero and captures the effect of immigrants on total exports through a reduction of fixed costs. While the idea that the network of immigrants reduces the fixed (set-up) costs of trade, f_{ijt}, rather than the variable (proportional) costs, τ_{ijt}, is reasonable, the advantage of using the model by Chaney (2008) is that it allows us to test two further implications of reducing fixed costs that would differ from those of reducing variable costs. First, the model predicts that the elasticity of total trade to fixed bilateral costs depends inversely on σ, the elasticity of substitution across goods. To the contrary, the elasticity to variable costs depends only on γ that is a measure of the dispersion of productivity across firms. Hence, if we separate trade flows into *differentiated* and *homogeneous* goods, the above equation would imply a larger coefficient on $\ln(f_{ijt})$ in the first case, while the coefficient on $\ln(\tau_{ij})$ would be the same in the two cases. Second, the model in Chaney (2008) predicts that

13 Remoteness is defined as a weighted average of the bilateral distances of a source country and its trading partners with weight equal to the GDP of the trading partners.

if we decompose the total effect of fixed costs f_{ijt} on total exports X_{ijt}, between the effect on the intensive margin of trade and on the extensive margin of trade we obtain no effect on the first and the full effect is on the second margin.[14] To the contrary, a change in variable costs would increase both the intensive and the extensive margins of trade. In his notation (Chaney 2008, 1717):

$$-\frac{d\ln X_{ijt}}{d\ln f_{ijt}} = \underbrace{0}_{\substack{\text{Intensive margin}\\ \text{Elasticity}}} + \underbrace{\frac{\gamma}{\sigma-1}-1}_{\substack{\text{Extensive margin}\\ \text{Elasticity}}} = \frac{\gamma}{\sigma-1}-1. \tag{3}$$

The intuitive rationale for the decomposition is as follows. The amount sold by each exporting firm in each country j (that is optimal in monopolistic competition) depends on its own productivity and on the demand of the good in country j that in turn depends on that country income Y_j, its remoteness θ_j^{γ}, and the variable trade costs τ_{ij}. However, as in any model with CES utility (and constant elasticity demand), the optimal price and quantity produced by a firm does not depend on the fixed trade costs. Nevertheless, the productivity threshold for the exporting firm does depend on the fixed trade costs; hence, changing those will affect only the extensive margin (number of exporting firms), not the amount exported by each individual firm.[15]

In sections 4 and 5 we estimate equation (1) separately on highly, medium, and less differentiated goods, and we also separate the effect of immigrants on the extensive and on the intensive margin of exports estimating two separate equations with the same right-hand side as (1) but with $\ln(N_{ijt})$ and $\ln(\overline{x}_{ijt})$ as dependent variables. The first regression, respectively, identifies the effect on the number of exporting relations N_{ijt} (extensive margin) and the second identifies the effect on the average value of an existing export relation $\overline{x}_{ijt}$ (intensive margin). Recall that $\ln(X_{ijt}) = \ln(N_{ijt}) + \ln(\overline{x}_{ijt})$. As measure of immigrants, IMM_{ijt}, we use the total number of foreign-born individuals residing in province i at time $t-1$ and born in country j.[16] These estimates, besides their empirical relevance,

14 The intensive margin in the Chaney model is defined as the increase in average product per firm for the existing trading firms (rather than for all firms). The extensive margin is the increase in total export due to new firms. These are similar but not identical to our definition of intensive margin as the change in average value per export transaction ($\overline{x}_{ijt}$) and extensive margin as the change in number of export transactions (N_{ijt}).

15 The decomposition of the effect of *variable costs* on the two margins (Chaney 2008, 1716) is as follows:

$$-\frac{d\ln X_{ijt}}{d\ln \tau_{ijt}} = \underbrace{\sigma-1}_{\substack{\text{Intensive margin}\\ \text{Elasticity}}} + \underbrace{\gamma-\sigma-1}_{\substack{\text{Extensive margin}\\ \text{Elasticity}}} = \gamma.$$

Hence, its variation would affect both the extensive and the intensive margin of trade.

16 Similarly, to reduce simultaneity issues we use total income at time $t-1$ to measure the variable $\ln(Y_{it}Y_{jt})$.

TABLE 4
Trade-creation effect of immigrants on export flows: 50 Spanish provinces, 77 countries, 1995–2008

	Trading partner pair and country-year dummies		Trading partner pair and year dummies		Origin, destination, and year dummies and geography	
	(1)	(2)	(3)	(4)	(5)	(6)
ln IMM	**0.110***	**0.102***	**0.275***	**0.254***	**0.132***	**0.122***
	(0.012)	(0.015)	(0.008)	(0.010)	(0.016)	(0.017)
ln ($Y_i Y_j$)	**0.316***	**0.330***	**1.165***	**1.170***	**0.839***	**0.840***
	(0.141)	(0.142)	(0.009)	(0.009)	(0.090)	(0.090)
NID		0.015		−0.040		−0.061
		(0.036)		(0.036)		(0.051)
ln distance					**−0.254***	**−0.252***
					(0.110)	(0.110)
Contiguity					**0.911***	**0.921***
					(0.299)	(0.299)
EU/EFTA					0.085	0.089
					(0.258)	(0.258)
Language/colonial ties					**−1.588***	**−1.593***
					(0.392)	(0.392)
Trading pair dummies	Yes	Yes	Yes	Yes		
Country-year dummies	Yes	Yes				
Year dummies			Yes	Yes	Yes	Yes
Country and province dummies					Yes	Yes
Adjusted R^2	0.848	0.848	0.808	0.808	0.783	0.783
Observations	51600	51600	51600	51600	51600	51600

NOTES: The dependent variable in each regression is the logarithm of exports in Euros plus one between province *i* and country *j*.
Specifications (1) and (2) include 2,800 trading-pair dummies and 988 country-year dummies. Specification (3) and (4) include 2800 trading-pair dummies and 13 year dummies. Specifications (5) and (6) include 77 country dummies, 50 province dummies and 13 year dummies.
* Significant at 5% level

would allow us to discriminate, within the context of the Chaney (2008) model, whether the immigrant network operates through reducing fixed or variable trade costs.

4. Main results

Table 4 shows the basic results of estimating equation (1) and two less demanding alternative specifications. The preferred specification (1) accounts for a full set of 2,800 trading partners-pair effects (which capture bilateral time-invariant transport costs due to distance, geography, culture, and national and local institutions) and 988 country-year effects (accounting for all importing-country aggregate shocks) over the period 1995–2008. It is estimated in column (1) of table 4. In this specification the estimated effect of immigration on trade is identified

only by the variation within a trading-pair over time. The estimated elasticity is very significant and equal to 11%. As some of the cells have either no immigrants or no trade, we add one unit to the dependent variable X_{ijt} and to the explanatory variable IMM_{ijt} before taking logs. To account explicitly for a different baseline level of exports in cells with no immigrants in column (2) we include a dummy variable, NID_{ijt}, which takes value of 1 if $IMM_{ijt} = 0$ and a value of 0 otherwise. The estimated coefficient on NID_{ijt} is not statistically significant and the change in the coefficient of $\ln(IMM_{ijt})$ relative to column (1) is small (-0.02) and not statistically significant. This implies that there is no discontinuous change in the impact of immigrants on exports going from no immigrants to some of them or increasing their number when some are already present. Quantitatively, the estimate of column (1) implies that doubling the number of immigrants from a country in a province would increase the exports of the province to that country by around 8% ($2^{0.110} \approx 1.079$). In columns (3) and (4) of table 4 we omit country-by-year effects ϕ_{jt} in equation (1) (with or without the zero-immigration dummy). This would be equivalent to assuming that the 'remoteness' measure of the importing country ($\ln(\theta_j^{\gamma})$ in equation (2)) does not change much over time. We still allow trade-pair specific costs and include year effects. The estimates of the coefficient on $\ln(IMM_{ijt})$ are significantly higher than those in our preferred specification, which suggests that some time-varying characteristics of the countries of origin have an impact on trade and are correlated with $\ln(IMM_{ijt})$ and, if not controlled for, can bias the estimated effect up. In columns (5) and (6) we eliminate trading-pair fixed effects and explicitly include a set of time-invariant bilateral cost variables (log of distance, a contiguity dummy, a common language dummy, and a EU-EFTA dummy) as well as province plus country fixed effects.[17] This specification is similar to those used to estimate gravity regressions in the cross-sectional regressions (e.g., Head and Ries 1998; Rauch and Trindale 2002). While such specifications (with or without the no immigrant dummy) omit many fixed effects (that should be included, according to Chaney's model) they produce estimates on the variable of interest ($\ln(IMM_{ijt})$) not too different from those in columns (1) and (2).

In table A2 of the appendix we explore how sensitive the estimated coefficient on $\ln(IMM_{ijt})$ is to the exclusion of zero-trade observations, using several alternative estimation methods. While in our main specification we add one Euro to all exports and hence include all observations, it is common practice to estimate gravity equations using only non-zero observations (Bandyopadhyay, Coughlin, and Wall 2008). Column (1) in table A2 shows the estimates obtained from the basic specification (table 4, column 1) including or not the 0 export cells (rows one and two, respectively), column (2) shows the estimates from the alternative specification (table 4, column 3), column (3) uses a Tobit estimator censored at 0 to estimate the coefficients, and column (4) shows the results using a Poisson

17 Geodesic distance between Spanish provinces and countries have been constructed following the same methodology proposed by www.cepii.fr. See the technical appendix for details.

estimator (to be preferred, according to Santos-Silva and Tenreyro 2006). The results shown in table A2 imply that the estimated effect with or without the inclusion of zero observations is close, with slightly larger estimates when the zeros are included. For instance, in the basic specification the effect of immigration on exports is estimated to be 0.11 when the zero-export cells are included, and 0.068 when they are excluded. The Tobit specification, truncated at 0 and the Poisson specification (that estimates the dependent variable in levels rather than in logarithm) estimate elasticity between 0.10 and 0.14.

While our basic approach, based on a panel regression with a large set of dummies, is already much more demanding relative to the one usually implemented in the literature, we take another step to ascertain that we are identifying the causal trade-creation effect of immigrants: we implement an instrumental variable approach. While never applied to the trade and migration literature, this approach is common in the literature that analyzes the wage and employment impact of immigrants (e.g., Card 2001; Ottaviano and Peri 2006; Card 2009). In particular, in order to instrument the changes in immigrants in a particular province we use the imputed net inflow of immigrants calculated as follows. Using the distribution of immigrants by nationality and across provinces in 1993 (well before the extraordinary expansion of immigration flows), we attribute to each group in each province the net growth of immigrants from that nationality to Spain. If immigrants tend to settle, at least initially, where other persons of the same nationality are already settled, then this constructed inflow of immigrants will be correlated to the actual one. On the other hand, as it is based on the distribution of immigrants across provinces as of 1993, the constructed flows are not affected by any province-specific demand shock during the considered period.[18] Column (1) of table 5 presents the results of the first stage of the two-step least square estimation, using the described instrument. In our preferred specification, including country-year dummies in the first stage, we obtained a coefficient on the constructed immigration (instrument) of 0.554 with an standard error of 0.003. The instrument has an F-statistic of more than 300 and hence is very strong. In the second stage (column 2 of table 5), the estimated effect of immigrants on export is about 0.05 and is significantly different from 0. As would be implied by the presence of endogeneity (and omitted variable) bias, the 2SLS estimate is smaller than the OLS one. However, it is still significant and precisely estimated. An exogenous change in the stock of immigrants by 1% would produce an increase in trade from the province to the country of origin of those immigrants by 0.05%. In column (3) of table 5 we also include among the controls the lagged value of trade flows. Owing to autocorrelation of bilateral trade flows, such specifications would identify the effect on new immigrants only

18 For some countries of origin of immigrants the initial year is 1996 or 1997. See table A1 for the list of countries.

TABLE 5
Instrumental variables estimation

	First stage of the IV (1)	Second stage of IV (instrumented ln IMM) (2)	Including lagged dependent variable (3)
ln ($Y_i Y_j$)	**0.403***	**0.367***	0.184
	(0.005)	(0.146)	(0.118)
ln $(Trade)_{t-1}$			**0.475***
			(0.007)
ln IMM		**0.049***	**0.063***
		(0.016)	(0.010)
Imputed IMM (instrument)	**0.554***		
	(0.003)		
Trading pair dummies		Yes	Yes
Country-year dummies	Yes	Yes	Yes
F-test	302.04		
Prob > F	0.00		
Adjusted R^2	0.848	0.853	0.883

NOTES: The dependent variable in each specification is equal to the logarithm of the total value of exports in Euros plus one between province *i* and country *j*. The Instrument used in specification (1) for the variable ln (IMM) is the imputed presence of immigrants of a certain nationality in the province. This is obtained by allocating the total immigration to Spain by nationality of origin, for each year, proportional to the initial size of each nationality in the province. The standard errors are heteroscedasticity-robust and clustered by province-country pair.
* Significant at 5% level

on the change in trade flows from one year to the other. The effects on export are estimated to be still significant, having an elasticity close to 0.06.[19]

Tables 4 and 5 provide robust and consistent evidence that a causal effect from immigrants to export flows exists for Spanish provinces and its elasticity is between 0.05 and 0.11.[20] We now decompose the effect of immigration on exports by estimating specification (1) and using as dependent variable, alternatively, $\ln N_{ijt}$ (the number of export transactions between province *j* and country *i*) or $\ln \overline{x}_{ijt}$ (the average value in Euros of each transaction between province *j* and country *i*). We consider the part of trade due to changes in $\ln N_{ijt}$ as the effect on

19 As we have included trading-partner fixed effects in our estimation and a lagged dependent variable, we are aware of the potential Nickell bias that may arise. We rely on the length of the time dimension of the panel (T=14 years) to reduce such bias that depends inversely on T (Nickell 1981).

20 The structural model described in the previous chapter produces an estimating equation relative to export from Spanish provinces. This is what we estimate and present in the paper. We also estimated similar specifications for Spanish imports. Those estimates are shown in tables TA4–TA9 in the technical appendix. As a general conclusion, we find that the effect of migrant network on imports is usually smaller and less precisely estimated than on export. On one hand, immigrants may be crucial to reduce information costs of exporting to less developed countries but not importing from them, as exporters from those countries already know Spain well. On the other hand, it is more difficult to identify the province of actual final use of the imported goods, so that the data on import may be affected by larger measurement error that would produce an attenuation bias on the coefficient.

TABLE 6
Decomposition of the effects of immigrants on exports: the extensive and intensive margin and the extent of product differentiation

	OLS estimates			IV estimates		
	Total value (1)	Extensive margin (2)	Intensive margin (3)	Total value (4)	Extensive margin (5)	Intensive margin (6)
Panel A: All goods						
Ln (IMM)	**0.110***	**0.082***	**0.028***	**0.049***	**0.083***	−0.034
	(0.011)	(0.005)	(0.009)	(0.023)	(0.010)	(0.018)
Panel B: Highly differentiated products (elasticity of substitution less than 2)						
Ln (IMM)	**0.097***	**0.073***	**0.023***	**0.130***	**0.113***	0.017
	(0.011)	(0.005)	(0.008)	(0.023)	(0.010)	(0.018)
Panel C: Medium differentiated products (elasticity of substitution between 2 and 3.5)						
Ln (IMM)	**0.122***	**0.088***	**0.034***	**0.115***	**0.061***	**0.054***
	(0.013)	(0.006)	(0.009)	(0.030)	(0.014)	(0.020)
Panel D: Low differentiated products (elasticity of substitution above 3.5)						
Ln (IMM)	**0.098***	**0.080***	0.018	**0.113***	**0.095***	0.019
	(0.012)	(0.005)	(0.010)	(0.025)	(0.012)	(0.018)

NOTES: Each cell reports the estimates of the coefficient on the variable ln(Imm) from equation (1) in the text. All regressions include trading-pair dummies and country-year dummies. Specifications (1) and (4) use as dependent variable the total value of export from the Spanish province to the country, specifications (2) and (5) use as dependent variable the number of transactions between province *j* and country *i*, whose variation we call the extensive margin, and specifications (3) and (6) use as dependent variable the average value per transaction between province *j* and country *I* –whose variation we call the intensive margin. Standard errors are heteroscedasticity-robust and clustered by trading-pair.
* Significant at 5% level

the extensive margin of trade and the part due to changes in $\ln \overline{x}_{ijt}$ as the effect on the intensive margin of trade.

Table 6, panel A shows the effects of immigrants on exports (estimated using OLS in column 1 and 2SLS in column 4) and its decomposition on the extensive margin (reported in column 2 for OLS and column 4 for 2SLS) and on the intensive margin (reported in columns 3 and 6). In columns 1–3 we estimate the model using the OLS estimator. In columns 4–6 we use the 2SLS method with imputed immigrants as instrument. The sum of the estimated coefficients on the intensive and extensive margins of trade must be equal to the estimated coefficient on the total value of trade in each specification (Bernard et al. 2007). Considering all traded goods together (table 6, panel A) we find that immigrants affect mostly the extensive margin of exports and very little, if at all, the intensive margin. By reducing the cost of doing business in the country of origin of immigrants, the community of expatriates in a Spanish province increases the number of transactions from that province to the country. This is consistent with the interpretation that migration networks decrease the fixed bilateral trade costs. In both the OLS

and the 2SLS estimates, 82–100% of the positive total effect is explained by the effect on the extensive margin. Also, in both the OLS and the 2SLS estimates, the effects are estimated precisely, so that we can reject any effect on the intensive margin that is larger than 0.03.

Panels B, C, and D of table 6 separate the estimates between non-differentiated, moderately differentiated, and highly differentiated goods.[21] Again, the largest effect of immigration on exports in each category of goods takes place through the extensive margin. The effect on the extensive margin is always significant and quantitatively larger than the effect on the intensive margin that is significantly different from 0 in only three out of six cases. Hence, independent of the type of traded goods, immigrant networks seem to operate by extending the number of new trade relations with the country of origin of immigrants.

By separating goods according to their degree of differentiation, the estimates of table 6 can also be used to test another implication of immigration affecting fixed trade costs: its effect should be larger for more differentiated goods. Panels B through D of table 6 show the elasticity of trade to immigration for those three types of goods. Our point estimates support only in part this implication. The 2SLS estimates are ranked, in magnitude, as predicted, an elasticity of immigration being equal to 0.13 on highly differentiated exports, to 0.115 on medium differentiated exports, and to 0.113 on less differentiated exports. The differences, however, are not too large and not statistically significant. On the other hand, the OLS estimates show that the effect of immigration is larger for moderately than for highly and less differentiated exports. Taken together, the estimates by type of good do not contradict, (but do not provide strong support, either) for the model predictions. A more accurate analysis (in the next section), however, reveals that these effects, especially those obtained with the OLS method, can be explained when we allow the effect of immigrants on trade to be different, depending on their region of origin.

5. Extensions

In this section we examine other dimensions of our data that may affect the export-immigration nexus. Two issues are of particular interest to us. First, we want to test if the trade-creation effect of immigrants is particularly large for countries of origin whose level of development is lower and whose cultural distance from Spain is larger. Both instances would contribute to increasing the initial fixed costs of trade so that immigrants may have a larger impact in reducing it. Second, we would like to know if the elasticity of trade-creation to immigrants is roughly constant or if it depends (and how) on the size of the

21 The definition follows Broda and Weinstein (2006) and is specified in section 2.

specific immigrant community (non-linear relation) or on the overall density of immigrants in the province or on the period considered.

Dunlevy (2006) shows that immigration effect on US exports is less important when Spanish or English is the language of the origin country. Girma and Yu (2002), Dunlevy (2006), and Briant, Combes, and Lafourcade (2009) have noticed that the largest trade-creation effect of immigrants in the UK, US, and France, respectively, tend to be towards those countries whose institutions are less developed and whose cultural and development distance is larger. These findings push us to inquire into the trade-creation effect of immigrants (for different types of goods and on the two margins), differentiating between world regions. Our expectation is that in trading with countries where there are severe problems of inefficiency, lack of enforcement, as well as differences in habits and cultural norms relative to Spanish ones, such as African countries, the initial fixed trade costs are very high. Hence, the presence of immigrant networks could have a large effect in decreasing the costs and increasing trade even when trading a simple homogeneous good. On the other hand, in trade with developed (and similar) European countries, where initial fixed costs of trade are not too large, the presence of a network of immigrants should mostly affect the transmission of more sophisticated type of information, likely to be more relevant in the trade of complex and differentiated goods.[22] Finally, in trade with countries with similar language and norms (such as Latin American countries) the fixed costs of trade could be low to begin with and therefore the effect of immigrants on it and on the volume of trade could be small.

In table 7, therefore, we estimate the effects of immigration on exports (still using specification (1)) separately across regions of immigration (and trade), across goods, and separating intensive and extensive margins.[23] The results reveal a pattern that for the most relevant regions is very consistent with our priors and with the interpretation of migrants reducing fixed trade costs. For trade between Spanish provinces and European countries reported in the first two rows of table 7 (Western and Eastern/Southern Europe, which together account for more than 70% of Spanish exports) the pattern of the coefficients is exactly as predicted by a reduction of fixed costs. Considering the total effect of immigrants, the coefficient is largest on the export of highly differentiated goods, it is intermediate on the export of moderately differentiated goods, and it is smallest on the export of less differentiated goods. The differences, especially between the coefficients in columns (1) and (7) are very significant. Moreover the estimated coefficients

22 Bandyopadhyay, Coughlin, and Wall (2008) investigate the individual immigration effect of 29 foreign countries on US exports and find that it is important only for a subset of 6 foreign countries. However they do not explain why the immigration-trade nexus works for some countries and not for others.

23 In table 7 we report only the OLS estimates, as for several regions (e.g., Europe or OECD) the immigration instrument is quite weak and we obtain very large standard errors; also, some negative results are hard to interpret and probably reflect mostly noise.

TABLE 7
Effect of immigration on exports by region

	Highly differentiated			Moderately differentiated			Less differentiated		
	Total (1)	Extensive (2)	Intensive (3)	Total (4)	Extensive (5)	Intensive (6)	Total (7)	Extensive (8)	Intensive (9)
EU/EFTA	**0.094***	**0.045***	0.049	0.089	**0.052***	0.037	0.025	**0.055***	−0.030
	(0.041)	(0.015)	(0.033)	(0.052)	(0.023)	(0.037)	(0.041)	(0.018)	(0.030)
East Europe	**0.110***	**0.055***	**0.055***	0.031	0.024	0.006	−0.001	−0.008	−0.009
	(0.033)	(0.015)	(**0.024**)	(0.033)	(0.020)	(0.024)	(0.032)	(0.015)	(0.023)
Africa	**0.174***	**0.118***	**0.056***	**0.165***	**0.094***	**0.079***	**0.182***	**0.128***	**0.054***
	(0.023)	(0.011)	(0.016)	(0.027)	(0.014)	(0.017)	(0.027)	(0.011)	(0.020)
Latin America	−0.008	0.009	−0.017	0.005	0.005	0.001	0.033	−0.002	−0.031
	(0.029)	(0.011)	(0.022)	(0.031)	(0.012)	(0.024)	(0.030)	(0.012)	(0.023)
Asia	0.038	**0.045***	−0.007	−0.047	0.011	−0.058	−0.059	0.002	−0.061
	(0.053)	(0.020)	(0.039)	(0.054)	(0.020)	(0.041)	(0.054)	(0.021)	(0.036)
Rest OECD	0.016	**0.041***	−0.024	**0.111***	**0.043***	0.068	0.016	**0.041***	−0.024
	(0.056)	(0.021)	(0.030)	(0.047)	(0.019)	(0.038)	(0.056)	(0.021)	(0.043)
Middle East	0.046	0.011	0.036	**0.204***	**0.072***	**0.132***	−0.025	−0.007	−0.018
	(0.074)	(0.028)	(0.056)	(0.073)	(0.027)	(0.058)	(0.073)	(0.029)	(0.053)

NOTES: Each cell reports the elasticity of export to immigrants estimated using specification (2) with total exports or number of transaction or value per transaction as dependent variable. All regressions include trading-pair dummies and country-year dummies. The sample is restricted, for each row, to countries in the region only. Specifications (1)–(3) include only trade in highly differentiated goods; (4)–(6) include trade in moderately differentiated goods and (7)–(9) include only less differentiated goods. The method of estimation is OLS. The standard errors are heterocedasticity robust and clustered by trading-pair.

*Significant at 5% level

are statistically significant only for highly differentiated goods. Also, in most estimates of the first two rows the effect on the extensive margin is larger and more statistically significant than the effect on the intensive one. The impact of immigration on exports to the other OECD and Asian countries (which together cover another 10% of total Spanish exports) is also broadly consistent with an effect on fixed costs: the impact of immigrants is greater on exports of moderately and highly differentiated products than of less differentiated products; however, moderately (rather than highly) differentiated products seem to experience the strongest effect. Also, the estimated effect through the extensive margin is usually larger than the effect on the intensive margin and significantly so. The effect for Africa and Latin America is different, but confirms our idea that larger (smaller) effects for all types of goods should be found for countries with initially very high (very low) trade costs. For Latin America (about 3% of Spanish exports) none of the estimated coefficients is statistically significant, suggesting that exports do not benefit much from ethnic networks of these immigrants. The importance of historical links between Spain and its former colonies as well as the common language and culture could justify very low initial fixed trade costs and no significant cost-reducing effect of immigrants. To confirm this idea we also run (not reported in the tables) a specification like (1) in table 4 with an extra term that interacts a Spanish language dummy with $\ln(IMM_{ijt})$. The coefficient on this variable identifies the differential effect on total trade creation of immigrants from Spanish-speaking countries relative to other countries. The estimate of the coefficient on this interaction is -0.106 (standard error 0.026), while the estimate of the coefficient on $\ln(IMM_{ijt})$ remains almost unchanged at 0.125 (standard error 0.013). This means that the trade-creation effect of immigrants from Spanish-speaking countries is essentially zero ($0.125 - 0.106$) consistent with the idea that the common language/culture is associated with low initial trade costs and no cost-reducing effect of immigrants. To the contrary for Africa, the region with the largest cultural differences with Spain and the lowest level of development, the networks of immigrants have the largest effect in reducing fixed trade costs, not only for trade of differentiated products but for all types of trade. This is why we observe a positive and similar effect of immigrants on trade of all types of goods. Still, confirming that this effect is mostly on fixed costs, the trade-creation effect is always larger on the extensive margin.

Combining the estimates in table 7, we see ten significantly positive estimates of the effects of immigrants on export of highly differentiated goods, nine significant effects on export of moderately differentiated goods, and only five significant effects for the less differentiated goods. The decomposition of immigrants and trade by region helps us to correctly interpret the effects of immigration on export and how they may depend on the initial level of country-specific fixed costs, so that larger reductions (due to immigrants) are likely associated with countries with initially large fixed costs. The estimated magnitudes from table 7 also suggest that the rise in immigration from Eastern Europe and the decline of immigration

from Western Europe (shown in figure 2) can explain about half of the increase and decrease of trade with those two regions, respectively. Immigration, therefore, was likely a causal determinant of exports from Spain and a significant one from the quantitative perspective.

Another aspect that is interesting to explore is whether the elasticity of trade-creation to immigrant networks varies with the immigrant density in the province or with the size of the specific immigrant community or with the considered period or length of stay of the immigrants. Equation (1) assumes that there is a simple log-linear relation between the volume of exports X_{ijt} and the size of the immigrant's network IMM_{ijt}. However, the cost-reducing role played by the community of immigrants may need a minimum scale or a minimum density in the province to be effective, or the community may need some time to establish itself and act as trade mediator. On the other hand, it may be possible that the best opportunities for trade-creation are the first to be exploited by new immigrants, and as the size of the community increases, the density of immigrants grows, and time passes, there are decreasing beneficial effects of immigration on trade. Empirically, such issues could be addressed in several ways. In panel A of table 8 we look at the trade-creation effect of immigrants in earlier years (when the immigrant communities were very small in Spain) versus later years. In panel B we also look at that effect splitting the sample between provinces with low ($< 4\%$), intermediate (between 4% and 10%) or high ($> 10\%$) percentage of immigrants.[24] The results show that the elasticities tend to be larger in provinces with higher immigrant density and in the later period. In particular, notice that the effect of immigrants on total exports and on the extensive margin was significantly larger in the period 2002–2008 (elasticity of total effect of 0.20) than earlier (elasticity of total effect of 0.085). Similarly, the trade-creating effect of immigrants in provinces with a very small presence of immigrants (less than 4% of the population) is quite small and insignificant, while in communities where immigrants account for 10% or more of the population the effect on export is 0.12 (before 2002) and 0.26 (after 2002). These results suggest that the trade-creation effect of immigrants possibly increases (and certainly does not decrease) with larger immigration density and as immigrant communities establish themselves over time.[25] We conducted two further checks of these hypotheses. First, to inquire if the elasticity of trade-creation with respect to immigrants changes with the size of the country-specific community in the province (rather than with the overall immigrant density in the province) we rank immigrant communities

24 Table 8 shows the estimates using OLS method. The 2SLS estimates, not reported and available upon request, are quite consistent with those, showing a pattern of increase coefficient in the second sub-period and significantly positive coefficient only for provinces with immigrants above 4% of the population.

25 This is consistent with previous studies such as Herander and Saveedra (2005), who found that the effect of migrants on trade requires a minimal size of the network in order to produce a measurable effect on the volume of trade

TABLE 8
Effects of immigrants on exports: separating periods and initial province-density of immigrants

	Total value (1)	Extensive (2)	Intensive (3)
Panel A: Time dimension: before and after 2002			
Period 1995–2001	**0.085***	**0.069***	0.016
	(0.019)	(0.008)	(0.014)
Period 2002–2008	**0.197***	**0.131***	**0.066***
	(0.017)	(0.008)	(0.012)
Panel B: By provinces: grouped by immigrants as % of the total population in 2007			
Period 1995–2001			
<4%	0.023	**0.048***	−0.025
	(0.034)	(0.013)	(0.026)
[4–10%]	0.067	**0.055***	0.012
	(0.036)	(0.015)	(0.027)
>10%	**0.122***	**0.083***	0.039
	(0.031)	(0.014)	(0.023)
Period 2002–2008			
<4%	0.055	**0.076***	−0.022
	(0.034)	(0.016)	(0.025)
[4–10%]	**0.146***	**0.093***	**0.054***
	(0.034)	(0.015)	(0.025)
>10%	**0.260***	**0.168***	**0.112***
	(0.026)	(0.014)	(0.018)

NOTES: Each cell reports the elasticity of export to immigrants estimated using specification (2) with total exports (column 1), number of transaction (column 2) or value per transaction (column 3) as dependent variable. All regressions include trading-pair dummies and country-year dummies. The sample is split by years in the upper part of the table and two regressions are run separately for each period. In the lower part the sample is split by year and province according to the density of immigrants in 2007. Method of estimation is OLS. Standard errors are heteroscedasticity robust and clustered by trading-pair.
*Significant at 5% level

(defined by country of origin and province) by size and estimate an elasticity of trade creation specific to each quartile of the distribution. All the estimated coefficients from an OLS specification as (1) in table 4 (not reported) are between 0.11 and 0.13 and are not significantly different from each other. Second, to distinguish the role of long-term and new immigrants in trade creation we separate the stock of immigrant in each community (country of origin by year) in year t into the stock at $t-4$ (four years earlier) and the net flow in the last four years. We then estimate a specific elasticity of export to each of the two variables. The correspondence between these two variables and long-term and new immigrants is imperfect, as immigrants move inside Spain (so net inflow in a province does not correspond to inflow in the country). However, as we do not know the composition of immigrants by date of entry (within a province and country of origin), this is the best we can do. The OLS estimates of the basic specification produce a coefficient on the stock at $(t-4)$ of 0.125 (standard error

0.015) and on the new flow over the last four years of 0.044 (standard error of 0.013). These estimates are consistent with the presence of a stronger effect on trade from the more established community of immigrants. In conclusion, the increase in size of the specific immigrant communities does not seem to affect the impact of immigration on trade, while the larger density in the province and the increased length of stay seem to encourage the trade-creating effect.

6. Conclusions

This paper uses the rapid and large increase of immigrants from several countries into Spanish provinces that took place in the years between 1995 and 2008, especially after 2002, to estimate the causal effect of immigrants on exports, separating the intensive and extensive margins and differentiating between types of goods. The estimates of those effects on total export, export margins, and export by type of good can be used to verify if the presence of immigrants is consistent with trade creation, owing to a reduction in fixed trade costs. Using a panel of bilateral trade flows for 50 Spanish provinces and 77 countries and corresponding data for immigrant stocks by Spanish province and country of origin, we find a very strong and robust elasticity of export to immigrants close to 0.10. Instrumenting immigration flows with flows constructed using the distribution of immigrants in 1993, we also find a very significant elasticity, closer to 0.05. The decomposition of the export-creating effect of immigrants between increased number of export transactions and average value of export per transaction shows that most of the effect is due to an increase in the number of transactions.[26] Finally, the analysis of trade-creation effects across categories of goods, once we allow different effects for different regions, shows that in most of the cases, particularly in the relation with developed countries (Europe and OECD), the network of immigrants affects mostly the trade of differentiated goods. On the other hand, in the trade with the least developed countries (Africa) the effects of immigrants applies rather uniformly to the export of any good, suggesting that, in trading with those countries, the most important effect is that of decreasing the high initial fixed costs of trade independent of the nature of traded goods. As the surge of immigrants came to a halt and reversed in 2009, owing to the economic and financial crisis in Spain, it is possible that some of these trade-creation effects will be reversed. As immigrants go back to their countries, this may contribute to a reduction in the volume of trade between Spain and the rest of the world. In a proper calculation of costs and benefits of immigration this trade-creating effect should certainly be accounted for.

26 While our data allowed us to identify number of transactions, and value per transaction, defining in this way an extensive and intensive margin of export, it would be very interesting (but so far impossible with the Spanish data) to do the exercise decomposing the margins at the firm-product rather than transaction level.

TABLE A1
Countries included in the study (77 countries and 7 regional groups)

Western Europe	Southeast Europe	Africa	Latin America	Asia	Rest of OECD	Middle East
Austria	Bosnia*	Angola*	Argentina	Bangladesh	Australia	Egypt*
Belgium	Bulgaria	Algeria	Bolivia	China	Canada	Iran*
Denmark	Croatia *	Cape Verde	Brazil	Pakistan	Japan	Israel*
Finland	Czech*	Gambia	Chile	India	Korea	Jordan
France	Hungary	Ghana**	Colombia	Philippines	Mexico	Lebanon*
Germany	Poland	Guinea**	Costa Rica	Thailand*	N. Zealand	Syria
Greece	Serbia*	Guinea-B*	Dom. Rep.		Turkey*	
Ireland	Romania	Guinea Eq.	Ecuador		USA	
Italy	Russia*	Mali **	El Salvador			
Netherlands	Ukraine*	Morocco	Guatemala			
Norway		Mauritania	Honduras			
Portugal		Nigeria	Nicaragua			
Sweden		Senegal	Panama			
Switzerland		Sierra Leone**	Peru			
UK		Tunisia*	Paraguay			
			Uruguay			
			Venezuela			
N = 15	N = 10	N = 15	N = 17	N = 6	N = 8	N = 6

NOTE: We included only those countries for which we could reconstruct a consistent and uninterrupted series of observations on the stock of immigrants in each Spanish province between 1993 and 2007.
* Series starts in 1996; ** series starts in 1997.

TABLE A2
Robustness checks: dealing with 0-trade observations

	Basic specification log $(y + 1)$ (1)	Origin and destination fixed effects log $(y + 1)$ (3)	Tobit log $(y + 1)$ (4)	Poisson (y) (5)	Number of observations (6)
Exports ≥ 0	**0.110***	**0.132***	**0.146***	**0.105***	51600
	(0.012)	(0.016)	(0.008)	(0.008)	
Exports > 0	**0.068***	**0.119***	**0.120***	**0.104***	46133
	(0.013)	(0.014)	(0.007)	(0.007)	

NOTES: The dependent variable is the logarithm of exports plus one. The first row indicates whether we include all observations in the estimation or only those strictly positive. Standard errors are heteroscedasticity robust and clustered by trading-pair.
* Significant at 5% level.

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