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Networks, Firms, and Trade

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Abstract

Fixed costs associated with learning about demand and setting up distribution networks are expected to be lower when there are more potential contacts in the destination market, suggesting a greater probability of market entry and larger export revenues. The authors match historically-determined emigration stocks with detailed firm-level data from Portugal to examine the effect of migrant networks on these export outcomes. They find that larger stocks of emigrants in a given destination increase export participation and intensity. In addition, they show that the former of these effects tends to be more pronounced among firms that are more likely to have close ties with the emigrants. These results are consistent with a multiple-destination version of the Melitz (2003) model featuring market-specific entry costs and idiosyncratic firm-destination demand shocks.

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Networks, firms, and trade*

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1 Introduction

Recent research on firm-level exporting suggests that the idiosyncratic interplay between firms and markets plays an important role in shaping trade patterns. Examining detailed data on the exports of French firms, Eaton et al. (2011) show that while a multiple-destination Melitz (2003)-type model does a good job at explaining several empirical regularities, it fails to come to terms with some important features of the data: (1) firms do not enter markets according to an exact hierarchy; and (2) their sales where they do enter deviate from the exact correlations that the basic model would insist upon.[1] To account for these facts, they introduce market and firm-specific heterogeneity in entry costs and demand. But while the modified framework is more consistent with observed trade patterns, there is still little evidence on how specific potential sources of such heterogeneity in entry costs and demand affect the export performance of individual producers.

In this paper, we match historically-determined emigration stocks with detailed firm-level data from Portugal to examine the effect of migrant networks on export participation and intensity across markets and firms. Portugal offers unique features for this investigation. First, the motives and timing of the sizable emigration flows observed in the country during the *Estado Novo* authoritarian regime, along with their steep fall in the aftermath of the democratic revolution of 1974, mitigate the concern that emigration stocks might be endogenous to current trading relationships.[2] Second, emigration flows came predominantly from the Northern region of Portugal, suggesting that firms located there are more likely to have close ties with the emigrants. These historical features allow us to investigate not only whether migrant networks matter for export outcomes, but also if they constitute an important source of market and firm-specific heterogeneity in entry costs and demand.

While accounting for the effect of firm productivity heterogeneity and the customary gravity-type regressors, we find that larger stocks of emigrants in a given destination increase the likelihood of export participation. This effect is significantly more pronounced among firms that are more likely to have close ties with the emigrants – that is, among producers currently located in North of Portugal; and among firms that were already born when the bulk of emigration flows took place. Conditional on a firm serving a market, the presence of emigration stocks appears to be an important driver of how much it sells there: using two alternative methods to account for self-selection into export markets – a Tobit model and a Heckman selection model – we find that export revenues tend to increase systematically with the number of emigrants in the destination. Taken together, these findings suggest that migrant networks are an important source of market and firm-

[1] See also Lawless (2009), who provides related evidence for Ireland.

[2] In particular, the circumstances in which emigration flows took place alleviate concerns of reverse causality.

specific heterogeneity in entry costs and demand.

In addition to the work cited above, this paper is related to recent research using *aggregated* firm-level data to provide some evidence on how colonial ties and linguistic similarity influence trade flows. Crozet and Koenig (2010) decompose industry-level bilateral exports in France into the number of exporters and the average exports per firm, and employ each of these variables as the dependent variable in a gravity model. Their estimates suggest that a common language and colonial ties increase both the number of exporters and the average exports per firm.[3] Anderson (2007) uses data from Sweden to investigate the link between bilateral trade and familiarity (captured by dummy variables for Nordic, Baltic and English-speaking nations). He reports a positive relation, due primarily to the extensive margin.[4] Our paper differs from this line of research in several important respects, however. First, in addition to studying the role of colonial ties/common language, we provide evidence on whether and how migrant networks promote trade. Second, in doing so we use theory-grounded measures of export participation and intensity at the level of the individual producer (linked to information on firms' labor productivity and size). Third, and most importantly, we exploit the unique historical background underlying the generating process of our data to provide evidence that migrant networks constitute an important source market and firm-specific heterogeneity in entry costs and demand.

This paper is also related to recent work using country and product-level data to re-examine the microfoundations of the gravity equation in the context of heterogeneous-firm models, including Helpman et al. (2008) and Baldwin and Harrigan (2011). Relative to this strand of work, a key distinguishing feature of our empirical analysis is the ability to link information on emigration stocks with detailed data on firm-level export outcomes and other firm characteristics. In doing so, we also contribute to a rich literature on the effects of social networks on aggregate trade flows (Gould, 1994; Rauch, 1999; Rauch, 2001; Rauch and Trindade, 2002; Melitz, 2008; Guiso et al, 2009).

The remainder of the paper is organized as follows. Section 2 outlines a multi-country heterogeneous-firm trade model, and uses it to discuss the specific channels whereby migrant networks may impact on firms' bilateral exports. Section 3 provides historical background and discusses the timing and drivers of Portuguese emigration flows. Section 4 describes the data employed, before section 5 presents preliminary evidence based on country-level data. Section 6 examines the effect of networks on export participation and intensity at the level of the firm, emphasizing the role of firm age and location in shaping

[3] Importantly, Crozet and Koenig (2010) also use firm-level data to estimate key parameters of the model of Chaney (2008), but in doing so restrict the focus to the effect of geographic distance on trade.

[4] An important caveat, however, is that the measure of familiarity employed by Anderson (2007) exhibits high colinearity with geographic distance.

the former of these relationships. Section 7 concludes.

2 Networks and trade with heterogeneous firms

To guide our empirical analysis, we present a multiple-destination variant of the Melitz (2003) model featuring market-specific fixed entry costs and idiosyncratic firm-destination demand shocks. The version we use draws heavily on Chaney (2008), Lawless (2009), Eaton et al. (2011) and Crozet et al. (2011).

Consider a world composed of multiple asymmetric nations. In each country c, consumer preferences for a differentiated good are characterized by a Dixit-Stiglitz sub-utility function of the form

$$U_c = \left(\int_{j \epsilon \Omega_c} [a_c(j) q(j)]^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where $q(j)$ denotes quantity of variety j demanded in country c, Ω_c denotes the set of varieties j, and $\sigma > 1$ the constant elasticity of substitution between any pair of varieties. The $a_c(j)$ are firm-destination demand shocks, a feature that we borrow from Eaton et al. (2011) and Crozet et al. (2011). We assume that $a_c(j)$ represent firm j's network of connections with consumers in country c.

Each firm produces a single horizontally-differentiated variety j by means of a Ricardian technology with unit cost $\frac{w}{\varphi(j)}$, where w is the wage level common to all firms and $\varphi(j)$ is a firm-specific productivity parameter, randomly drawn from a distribution with cumulative density function $G(\varphi)$. To export to market c producers must incur both a fixed cost, F_c, and a variable cost, τ_c. The latter is modeled as an "iceberg" transportation cost, where if one unit of a good is shipped to country c only a fraction $\frac{1}{\tau_c}$ arrives to the final destination. Fixed costs of exporting can stem from a wide variety of activities, for example establishing business contacts and distribution networks, undertaking marketing efforts, or overcoming bureaucratic barriers. The presence of information networks provided by emigrants is likely to reduce several of these entry costs (Rauch and Trindade, 2002). For simplicity, we assume that F_c varies between markets, but not across firms in the same market. Hence $a_c(j)$ are the sole parameters capturing the presence of firm-specific social networks in a given destination, while F_c captures networks effects that are common to all firms in a market. A valid interpretation is that, by incurring F_c, a firm with more contacts in country c – that is, a firm with a larger $a_c(j)$ – is able to reach a larger number of potential buyers there.

The sub-utility (1) is assumed to enter a Cobb-Douglas full utility, which implies that consumers of country c spend an exogenous total amount, X_c, on the differentiated good. If firm j serves market c, its market share in that country is given by:

$$\frac{x_c(j)}{X_c} = \frac{(p_c(j)/(a_c(j))^{1-\sigma}}{\int_{i\epsilon\Omega_c}(p_c(i)/(a_c(i))^{1-\sigma}di} \tag{2}$$

where $x_c(j)$ and $p_c(j)$ denote export revenues and prices, respectively, both of which are inclusive of trade costs. Firm j maximizes a destination-specific profit function given by:

$$\pi_c(j) = (p_c(j) - \frac{w}{\varphi(j)}\tau_c)q_c(j) - F_c \tag{3}$$

As is standard in Dixit-Stiglitz monopolistic competition models, firms obtain a constant mark-up $\sigma/(\sigma-1)$ and charge the CIF price:

$$p_c(j) = \frac{\sigma}{\sigma-1}\frac{w}{\varphi(j)}\tau_c \tag{4}$$

Using (4) and (2), we derive export revenue from market c conditional on entry:

$$x_c(j) = \left(\frac{\varphi(j)}{w}\right)^{\sigma-1} a_c(j)^{\sigma-1} X_c \tau_c^{1-\sigma} P_c^{\sigma-1} \tag{5}$$

where P_c is the price index in country c. If firm j serves country c, the net contribution of this destination to profits is given by:

$$\pi_c(j) = x_c(j)/\sigma - F_c \tag{6}$$

Heterogeneity in firm efficiency and firm-destination demand shocks imply that not all firms will find it profitable to export to country c. From (2) and (6), the probability of exporting is given by:

$$\mathbf{P}[E_c(j)=1] = \mathbf{P}[\left(\frac{\varphi(j)}{w}\right)^{\sigma-1} a_c(j)^{\sigma-1} X_c \tau_c^{1-\sigma} P_c^{\sigma-1} > \sigma F_c]$$

which may equivalently be expressed as:

$$\mathbf{P}[E_c(j)=1] = \mathbf{P}[(\sigma-1)\ln(\frac{\varphi(j)}{w}) + (\sigma-1)\ln a_c(j) + \ln X_c + (\sigma-1)\ln P_c - (\sigma-1)\ln\tau_c - \ln(\sigma F_c) > 0] \tag{7}$$

Using (5), we can write the FOB export revenue in market c as:

$$\ln x_c^{\text{fob}}(j) \equiv \ln(\frac{x_c(j)}{\tau_c}) = (\sigma-1)\ln(\frac{\varphi(j)}{w}) + (\sigma-1)\ln a_c(j) + \ln X_c + (\sigma-1)\ln P_c - \sigma\ln\tau_c \tag{8}$$

Equations (7) and (8) deliver a number of familiar predictions about the effect of firm efficiency and destination-market attributes on export participation and intensity. All else equal, more productive firms are more likely to enter a given destination and to sell more there. For given productivity, export participation and intensity are expected to increase with the destination's size and price level, and decrease with variable trade costs.

Our main interest lies on the effect of migrant networks on export participation and intensity. From (7) we see that by reducing F_c networks are expected to increase the likelihood of export participation. We also see that, for a given level of efficiency and fixed entry costs, firms with stronger networks in a given destination – i.e. firms with larger $a_c(j)$ – are more likely to sell there. Finally, (8) reveals that export intensity is independent of F_c, but may nevertheless rise with migrant networks due to idiosyncratic firm-destination demand shocks, $a_c(j)$.

3 Historical background

Several historical features of Portugal facilitate the analysis of the impact of social networks on firm-level export outcomes. We provide a brief summary of such a background, emphasizing the aspects that are more relevant for the empirical analysis.

Current stocks of Portuguese emigrants are largely rooted in *Estado Novo*, the authoritarian regime that ruled the country between 1933 and 1974. The limits on individual rights and freedoms imposed by the regime, together with large income differentials relative to developed countries, created strong pressures for emigration. Yet, as emphasized by Baganha (2003), for decades such pressures were fiercely controlled by the regime's highly restrictive emigration policy. In the early 1960s, however, *Estado Novo*'s attitudes towards emigration took a surprising turn. Following a shift in industrial policy favoring the development of more capital intensive industries in the Lisbon area, the regime was faced with an excess of unskilled labor supply in the Northern region and began to favor emigration of redundant unskilled workers (Baganha, 2003). By 1965, several obstacles to emigration had been removed and emigration was no longer a crime punishable by law. Largely in response to this policy shift, between 1960 and 1974 over 1.5 million, predominantly low-skilled, Portuguese left the country in search of better economic and political conditions in more developed nations (Figure 1). Following the Carnation Revolution in 1974, which overthrew *Estado Novo,* emigration flows fell sharply reflecting the combined effect of the introduction of democracy and, initially, more restrictive policies towards immigration in several recipient countries. As a result, and also in light of limited return migration from more developed countries, stocks of emigrants have remained largely stable over the past three decades.[5] The motives and timing of Portuguese emigration flows alleviate concerns of reverse causality in the relationship between migrant networks and export outcomes. In addition, the concentration of emigration flows in time and space

[5] Despite the limited emigration flows observed in Portugal since 1975, the Global Migrant Origin Database (described below) recorded a total of 1.95 million Portuguese emigrants in the year 2000. This amounts to nearly 19% of the population living in Portugal, which has remained fairly stable in recent years.

allow us to investigate if migrant networks constitute an important source of market and firm-specific heterogeneity in entry costs and demand.

Portugal further provides an interesting setting for re-examining the effect of common language/colonial ties on export participation and intensity. Portuguese-speaking nations belong to three different continents and differ markedly in terms of size. They are also at different stages of economic development. Brazil was the first country to become independent in 1822. The other nations became independent in the wake of the Carnation Revolution of 1974. Table 1 reports the independence dates, official languages, and number of Portuguese migrants in each of these countries. Table A.2 in the Appendix displays the distribution of Portuguese migrants across the full set of export destinations.

4 Data

Our empirical analysis draws on a rich firm-destination data set that combines information from several sources:

Export flows. Our main data source is the Foreign Trade Statistics (FTS) of Portugal for 2005. This is the country's official information source on international trade statistics, gathering the shipments of virtually all exporting firms to each destination market. The FTS data are collected in two different ways. Data on trade with countries outside the EU (external trade) are collected via the customs clearance system, which covers the universe of external trade transactions. Data on the transactions with other EU member states (internal trade) are obtained via the Intrastat system, where the information providers are companies engaged in internal trade and registered in the VAT system whose value of annual shipments exceeds a legally binding threshold (85,000 Euros in 2005). Export values in these data are "free on board", thus excluding any duties or shipping charges. The 2005 FTS data set comprises information on 16,541 exporting firms and 220 destination markets. Despite the above-mentioned constraint, the export transactions included in these data aggregate to 97 percent of the total value of merchandise exports reported in the official national accounts.[6]

Firm characteristics. Data on additional characteristics of exporting firms, namely labor productivity (gross value added per worker), employment, age and geographical location, come from 2005 Enterprise Integrated Accounts System (EIAS). This is a census of firms operating in Portugal run by the National Statistics Institute.[7] These data are

[6] In the FTS data, Serbia, Montenegro, and Serbia and Montenegro are considered as three different destinations. We treat them as such in the analysis, but none of our results is influenced by this decision.

[7] In both the FTS and the EIAS, firms are uniquely identified by their tax identification number (NPC). Hence the mapping of the two data sets was straightforward. After merging the two datasets, the Statistics Institute applied a transformation of the NPC to the data that were made available to researchers in order

unavailable for a small subset of exporting firms, which are therefore excluded from the final sample used in the empirical analysis.

Importing countries. We have supplemented the firm data with information on each importing country, namely its real GDP (measured at PPP), GDP per worker, and the distance between its most populated city and Lisbon (measured in Kms). The source of the information on distance is CEPII. The remaining variables come from the World Development Indicators (WDI) of the World Bank. Whenever WDI data were reported missing, we have used instead information from the CIA factbook. These data are available for 199 destination markets, including the Portuguese-speaking countries listed in Table 1.

Portuguese emigrants. We have further added information on the number of Portuguese emigrants in each importing country. These data come from the Global Migrant Origin Database (GMOD) from the the University of Sussex's Development Research Centre on Migration, Globalization and Poverty. The stocks refer to the year 2000, and are available for 193 of the 199 countries mentioned above. The full GMOD data set consists of a 226x226 matrix of origin-destination stocks. The data are obtained by disaggregating the information on migrant stocks in each destination country as given in the 2000 round of its population census.

The final data set used in the estimation gathers information on 14,782 exporting firms and 193 destination markets. Table A1 provides summary statistics on these data.[8]

5 Networks and trade at the country level

Table 2 reports descriptive statistics on the distribution of exporters across destinations. As can be seen, on average each firm exported to 3.4 countries. However, the mean hides significant firm heterogeneity. More than one-half of all exporters sell to only one destination (54.2%), but they tend to be relatively small exporters, accounting for only 6.8% of the total export value. By contrast, only 7% of firms export to more than 10 countries, but they account for 60.2% of the total export value.

We proceed by presenting preliminary evidence based on aggregate measures of the extensive and intensive margins of bilateral exports. To do so we decompose the shipments of Portugal to each importing country into two different terms:

$$exports_c = \sum_j firms_{jc} \frac{exports_c}{\sum_j firms_{jc}} \tag{9}$$

to preserve confidentiality.

[8] The final data set used in this paper is an extended version of that described in Bastos and Silva (2010), supplemented with information on Portuguese emigrants and a wider set of firm characteristics.

where the first term denotes the number of firms exporting to country c, and the second the average exports per firm. Figure 2 plots each of these components against the share of each trading partner in total exports. A clear pattern emerges from the data: the number of firms exporting to Portuguese-speaking countries (identified by a triangle) is relatively high when compared with the share of those countries in Portugal's total exports. These simple descriptive statistics point, therefore, to an important role of the extensive margin in shaping the association between colonial ties/common language and exports.

To investigate the relationship between migrant networks and exports, we estimate a gravity equation of the form:

$$\ln exports_c = \alpha \mathbf{X}_c + \beta \ln emigrants_c + \mu_c \tag{10}$$

where the dependent variable is the log of the exports value to country c and $\mathbf{X}_c$ is a vector of standard gravity regressors, namely country c's real GDP and GDP per worker, the geographic distance between Lisbon and the most populated city of the importing country, and binary variables indicating whether the country is a member of the European Union, uses the euro as its currency, and is landlocked.[9] Our main interest lies in the coefficients associated with $emigrants_c$, the number of Portuguese emigrants in country c.[10] We proceed by regressing the number of exporting firms and the average exports per firm against the same set of explanatory variables. Since OLS is a linear operator, these regressions additively decompose the margins whereby each regressor impacts on bilateral exports (Hummels and Klenow, 2005).

Table 3 reports the results. Not surprisingly, the estimates reported in column (1) indicate that bilateral exports are significantly higher in the presence of a common language and sizable emigrant stocks. Columns (2) and (3) report the relative contributions of the number of exporters and average exports per firm. The point estimates suggest that the increase in the number of exporters accounts for most of the positive effect of social networks on aggregate exports: in column (2) the coefficients of interest are significant at the 1% level and its magnitude is just slightly below the estimate presented in column (1), while in column (3) the coefficient is much smaller and insignificant.

[9] Bernard et al. (2007) adopt a similar specification to analyse US bilateral exports, but do not focus on the role of social networks.

[10] For 7 countries in our data, the number of Portuguese emigrants is zero. Since the log of zero is undefined, this issue was dealt with by transforming all zero values to 0.00001, then taking the log. We have verified that all results in the paper prevail when excluding these countries from the estimation sample.

6 Networks and trade at the firm level

While their simplicity is attractive, the aggregated measures we employed in the previous section suffer from important limitations for examining the effect of migrant networks on export participation and intensity. In fact, a key insight of the model presented in section 2 is that the effects on export participation of trade costs and demand factors depend on firm attributes. We are unable to examine the role of firm heterogeneity in determining export participation if we measure the extensive margin as the number of exporters. Another concern about this measure stems from the existence of a minimum statistical threshold for the collection of data on internal trade, which implies that the number of exporters is measured with error.

On the other hand, the use of average shipments per exporter for measuring the effects of migrant networks on export intensity is also problematic. In the context of a Melitz-type framework, Lawless (2010) shows that the effect of variable trade costs on average sales per exporter is ambiguous. This is because a fall in variable costs increases the sales of every firm serving a country, but may also lead to entry of lower-productivity firms (and thus lower-sales firms) in that market. A similar reasoning applies to the effects of firm-destination networks, $a_c(j)$. In this section, we therefore exploit the firm-destination detail of the data to estimate the effect of migrant networks on export participation and intensity at the firm-level.

6.1 Networks and export participation

We begin by focusing on the effects of migrant networks on export participation. Based on (7), we estimate a specification of the form:

$$\mathbf{P}(E_{jc} = 1) = \mathbf{P}(\alpha \ln \varphi_j + \beta \mathbf{X}_c + \gamma \ln \mathit{emigrants}_c + \eta_{jc}) \tag{11}$$

where: $E_{jc} = 1$ if firm j exports to country c and $\mathbf{P}$ is a probability distribution function; φ_j is a proxy for firm efficiency; and η_{jc} is the firm-destination error term. The country-level regressors have the meaning defined above.

Table 4 reports the estimates yielded by a linear probability model (LPM). The estimated coefficients give the marginal effects of each regressor on the probability of a firm exporting to a given market. In line with the model, the estimates in column (1) reveal that, conditional on the attributes of the export destination, more productive firms are more likely to sell there. The coefficients associated with the customary gravity variables also present the expected sign: firms are more likely to export to larger and geographically closer nations, that are non-landlocked, and have the euro as the official currency.

Of most interest to our analysis, the results in column (1) suggest that migrant networks have a positive and significant effect on the probability of exporting to a given destination. Doubling the number of Portuguese emigrants in a potential destination increases the probability of export participation by about 0.14 of a percentage point. This effect is certainly non-negligible, taking into account that the distribution of emigrant stocks across export destinations is very wide (see Table A2 in the Appendix). The estimates further suggest that the probability of exporting is 8.4 percentage points higher if Portuguese is an official language of the importing country.

While our measure of firm labor productivity is closely linked to the concept of firm efficiency highlighted in the theory, it may not be the ideal proxy for efficiency in the more complex real world where firms employ multiple factors of production. To address this concern, we conduct a similar exercise using the log of firm size (total employment) as a measure of firm heterogeneity.[11] In heterogeneous-firm models with multiple factors of production, firm size tends to be positively correlated with measures of total factor productivity (Verhoogen, 2008; Bartelsman et al. 2008; Hsieh and Klenow, 2009). Reassuringly the estimates reported in column (2) show that the coefficients of interest remain unchanged when this alternative proxy is used.

For robustness, we re-estimate (11) using country-specific dummy variables for each of the seven Portuguese-speaking countries in our estimation sample. Columns (3) and (4) present the results. The magnitude of the coefficients varies somewhat across countries, but the estimated coefficients are positive and significant for all countries. More importantly, the coefficient capturing the effects of migrant networks on export participation remains little changed when country-specific slopes for these destinations are allowed for.

In columns (5) and (6), we use a linear probability model with firm fixed-effects (LPM-FE) to estimate (11). Rather than relying on a proxy to account for φ_j, the LPM-FE estimator exploits solely the within-firm variation in export participation across destinations, thereby accounting for both observed and unobserved firm heterogeneity. As noted by Baldwin and Harrigan (2011) and Bustos (2011) the LPM-FE estimator is more appropriate than the fixed-effects Probit and Logit estimators, as the latter are inconsistent when the number of effects is large (incidental parameters problem). This is clearly the case here. In addition, they note that the LPM-FE is also preferable to random-effects Logit models as the latter embody the (unsuitable) assumption that firm-effects are orthogonal to country characteristics. Reassuringly, the LMP-FE estimator yields very similar coefficients for the effects of emigrant stocks and common language on export participation.

As a further robustness check, Table 5 reports marginal effects yielded from a number

[11] As a robustness check, we have also used the log of firm total sales and obtained similar results (available upon request).

of alternative estimators: Probit with proxies for firm efficiency, Probit with firm random-effects, and Conditional Logit with firm fixed-effects. Inspecting this table we see that, while the magnitude of the marginal effect of interest varies somewhat across estimators, the key findings remains qualitatively unchanged.

6.1.1 Networks and firm age

The motives and timing of Portuguese emigration flows provide an interesting setting for testing for the presence of firm-destination networks. In particular, firms that were already born when the historical bulge in Portuguese emigration flows occurred would be expected to have a greater number of contacts among the emigrants, and hence be more responsive to their presence in potential export destinations. To investigate this hypothesis, we exploit information on firm age and examine the extent to which the effects of migrant networks on export participation vary across firms from three different cohorts: born before 1976; in 1976-1990; and after 1990.

Table 6 displays the results. Column (1) reports the coefficients on the interaction between the regressors capturing the presence of social networks and binary variables for each cohort. Column (2) reports F-tests on the equality of these coefficients using the 1976-1990 cohort as reference group. The estimates suggest that the effects of migrant networks on export participation are significantly larger for the older cohort. Notice also that a similar conclusion can be drawn from the coefficient on common language/colonial ties, and recall that most Portuguese-speaking countries declared independence around 1975.

An important concern about these results is that the differential effects of migrant networks across cohorts might be driven by confounding factors, notably the well-known association between firm age and productivity (and size) (Cabral and Mata, 2003; Angelini and Generale, 2008). To verify the extent to which underlying differences in firm efficiency might be driving our estimates, we compare the distribution of firm labor productivity (FPD) across the three cohorts, using an empirical strategy analogous to Cabral and Mata (2003). Figure 3 shows that the FPD of firms born after 1990 is more skewed to the right than that of their older counterparts, with the null hypothesis of equality of FPDs being rejected at the 5% level. This pattern is in line with Cabral and Mata (2003) who show that the distribution of firm size of Portuguese firms is very skewed to the right at the time of birth, and evolves gradually toward a log normal distribution. We also see, however, that the FPDs of the two older cohorts are visually and statistically indistinguishable from each other. This finding is also in accordance with the observation by Cabral and Mata (2003) that firm size distributions tend to evolve gradually to a more symmetric distribution, notably a log-normal distribution. Hence differences in FPD appear unable

to explain the differential effects of migrant networks and common language/colonial ties on the export participation of firms born in 1976-1990 relative to firms born before 1976.

As a further robustness check, we examine the differential effect of social networks across the three cohorts, for each tercile of the firm productivity distribution.[12] Reassuringly, the results reported in columns (3) to (8) of Table 7 show that in each productivity tercile the effect of emigrant stocks on export participation is stronger among firms born before 1976. Overall, the empirical results are therefore suggestive of the presence of firm-destination social networks.

6.1.2 Networks and firm location

As noted in section 3, the bulk of emigration flows came from the North of Portugal, where agriculture and traditional labor-intensive industries ceased to be among the priorities of the regime's industrial policy, and the excess of labour supply that emerged from this policy shift created strong pressures for emigration. This regional heterogeneity in firm exposure to migrant networks allows us to provide further evidence on the importance of firm-destination networks in shaping export participation. Column (1) in Table 7 reports the results for the full estimation sample. They suggest that the effects of migrant networks on export participation are indeed more pronounced among firms currently located in the North of the country; the coefficient of interest is clearly larger, and this difference is statistically significant at the 5% level.

Like in the previous sub-section, we worry that the differential effect of migrant networks across regions might be driven by regional heterogeneity in firm efficiency. Comparing the FPDs across the two groups of firms, we see that the distribution of labor productivity of firms located in the North of Portugal is relatively more skewed to the right, particularly in the middle of the distribution (Figure 4). For robustness, we therefore verify if the regional heterogeneity of the effect of networks on export participation is also present in each productivity tercile. The results are reported in columns (3) to (8) of Table 7 and suggest that this is indeed the case: in each productivity tercile, the effect of migrant networks on export participation tends to be significantly larger among Northern firms.[13] Interestingly, the estimates also indicate that the effect of colonial ties/common language on export participation is significantly less pronounced among Northern firms. This may reflect the fact that Lisbon, the capital city and former center of the Portuguese

[12] We use the log of firm productivity relative to the industry to which the firm belongs, where the latter is defined using data on the main product exported by the firm (at the 5-digit level). This procedure is analogous to that adopted by Bustos (2011).

[13] As a further robustness check, we have conducted a similar analysis excluding the firms born before 1976. The results, not shown but available upon request, are qualitatively similar.

colonial empire, is located in the South of the country. Overall, therefore, our estimates suggest that the effects of migrant networks on export participation tend to be more pronounced among the firms located in the region where such networks are likely to be stronger, in line with the model presented in section 2.

6.2 Networks and export intensity

We now turn to the effect of migrant networks on the export intensity of each firm, conditional on exporting to that market. From (8), we specify the revenue estimating-equation as:

$$\ln x_{jc}^{\text{fob}} = \alpha \ln \varphi_j + \beta \mathbf{X}_c + \gamma \ln \textit{emigrants}_c + \eta_{jc} \tag{12}$$

where x_{jc}^{fob} is the revenue obtained by firm j in country c, and the remaining regressors have the meaning defined above.

The theory we adopt and the empirical analysis of the previous section suggest that firms self-select into export markets. An important difficulty in estimating (12) is therefore that non-zero export revenues are only observed for the subset of destinations that firm j serves. Due to sample selection, OLS estimation on non-zero export revenues may deliver biased estimates on the effect of migrant networks on export intensity.

We will employ two alternative methods to account for potential selection bias in the estimation of (12). First, we will adopt the Tobit procedure proposed by Crozet et al. (2011). In the context of a similar theoretical framework, Crozet et al. (2011) show that the minimum value of positive firm-level exports observed in country c can be used as a theory-grounded censoring point for x_{jc}^{fob} in Tobit estimation. Replacing $x_c(j)$ with $x_c^{\text{fob}}(j)\tau_c$ in (6), we see that firm j finds it profitable to serve country c if $x_c^{\text{fob}}(j) > \sigma F_c/\tau_c$. For each destination, there is therefore a minimum value of $x_c^{\text{fob}}(j)$ that is consistent which non-negative profits. Under the assumption of a log-normal distribution for $a_c(j)$, this yields a Tobit structure where the minimum value of $x_c^{\text{fob}}(j)$ in country c serves as a theoretically-consistent censoring point.

The main advantage of the Tobit estimator is that the correction procedure relies solely on the link between theory and observed trade flow data. For robustness, we will also use a Heckman correction approach similar to Helpman et al. (2008). To avoid identification based on functional form, the Heckman selection model requires identifying at least one variable that affects export participation but not export intensity. From (7) and (8), we see that this requirement is fulfilled by a variable that influences solely fixed costs of exporting. In line with Helpman et al. (2008), we will use measures of entry costs based on World Bank data that may plausibly satisfy this requirement. As a benchmark, we will also present the results of OLS estimates of (12) on non-zero export revenues.

Table 8 reports the OLS and Tobit estimates. The OLS estimates are solely based on non-zero export flows and are reported in columns (1) to (3). The specifications in columns (1) and (2) use firm labor productivity and employment, respectively, as proxy for firm efficiency, while that in column (3) uses a firm fixed-effects estimator to account for firm heterogeneity. In all cases, the estimates point to a positive and statistically significant relationship between export volumes and migrant networks.

Columns (4) and (5) report the Tobit estimates. In this case, the estimation sample includes both zero and positive firm-level bilateral trade flows and the dependent variable is left-censored by the minimum value of $\ln x_{jc}^{\text{fob}}$ to account for sample selection. The corresponding marginal effects confirm the theoretical prediction that, conditional on selection into export markets, more efficient firms obtain larger revenues. Of most interest to the present analysis, the marginal effects of migrant networks on export intensity are positive and statistically significant at the 1% level, but are now larger in magnitude. Therefore, conditional on a firm serving a market, the presence of emigration stocks appears to be an important determinant of how much it sells there.

A potential concern with the Tobit estimation is that the censoring point might be measured with error. To assess if the estimates are sensitive to the proxy for the entry threshold, in columns (6) and (7) we report marginal effects from Tobit estimation, but with the dependent variable left-censored at zero. Reassuringly, the estimates remain very similar.

For robustness, Table 9 reports the results of a Heckman sample selection model. In line with Helpman et al. (2008), we use World Bank data on country-specific regulation costs of firm entry to proxy for fixed costs of exporting. These indicators consist of the number of procedures and the number of days for an entrepreneur to legally start operating a business.[14] Columns (1) to (3) report the marginal effects of the Probit selection equation. The results in column (1) show that export participation is significantly less likely in markets characterized by a larger number of procedures to form a business, as would be expected. Column (2) shows that the number of days required to form a business also enters negatively the selection equation, but this effect is not statistically significant. In column (3), we specify a binary indicator for both of these costs, which takes the value of one when the sum of the number of days and procedures is above the median. Once again, the effect of this indicator on the probability of exporting is negative, although statistically insignificant.

Columns (4) to (6) report the corresponding estimates of the Heckman selection model for the export revenue equation. The estimation can be conducted using full maximum

[14] Data refer to 2005, come from the WDI of the World Bank, and are available for 159 countries of our sample.

likelihood or the two-step method proposed by Heckman (1979). We report results from the former method only, but have verified that the latter yields very similar estimates. As before, the results point to a positive and statistically significant relationship between export revenue and migrant networks. Results from additional estimations (not reported but available upon request) confirm that these estimates remain very similar when log employment is used as a proxy of firm efficiency.

Overall, thus, these results suggest that, conditional on a firm serving a market, the presence of emigration stocks appears to be an important determinant of how much it sells there. This finding is in line with the theory presented in section 2, which suggests that migrant networks are a source of firm-destination demand shocks.

7 Concluding remarks

We have used detailed firm-level data from Portugal to examine the effect of migrant networks on export participation and intensity. In doing so, we have exploited unique features from Portugal – notably stable, historically-determined stocks of emigrants with whom some firms are more likely to have close ties.

While accounting for the role of firm productivity heterogeneity and the customary gravity-type regressors, we have found that larger stocks of Portuguese migrants in a given destination increase the likelihood of export participation. This effect tends to be significantly larger for firms that are more likely to have a larger number of contacts among the emigrants – i.e., firms currently located in the North of the country; and firms that were already born when the bulk of emigration flows took place. Conditional on a firm serving a market, the presence of migrant networks appears to be an important determinant of how much it sells there. Taken together, these findings suggest that migrant networks are an important source of market and firm-specific heterogeneity in entry costs and demand, thereby complementing and extending recent work by Eaton et al. (2011).

By way of conclusion, we would like to note that although our empirical findings are consistent with a relatively parsimonious static model, a framework highlighting dynamic interactions between the formation of social networks, entry in export markets and firm growth would likely provide important additional insights. We regard the development of such a framework as an interesting avenue for future research.

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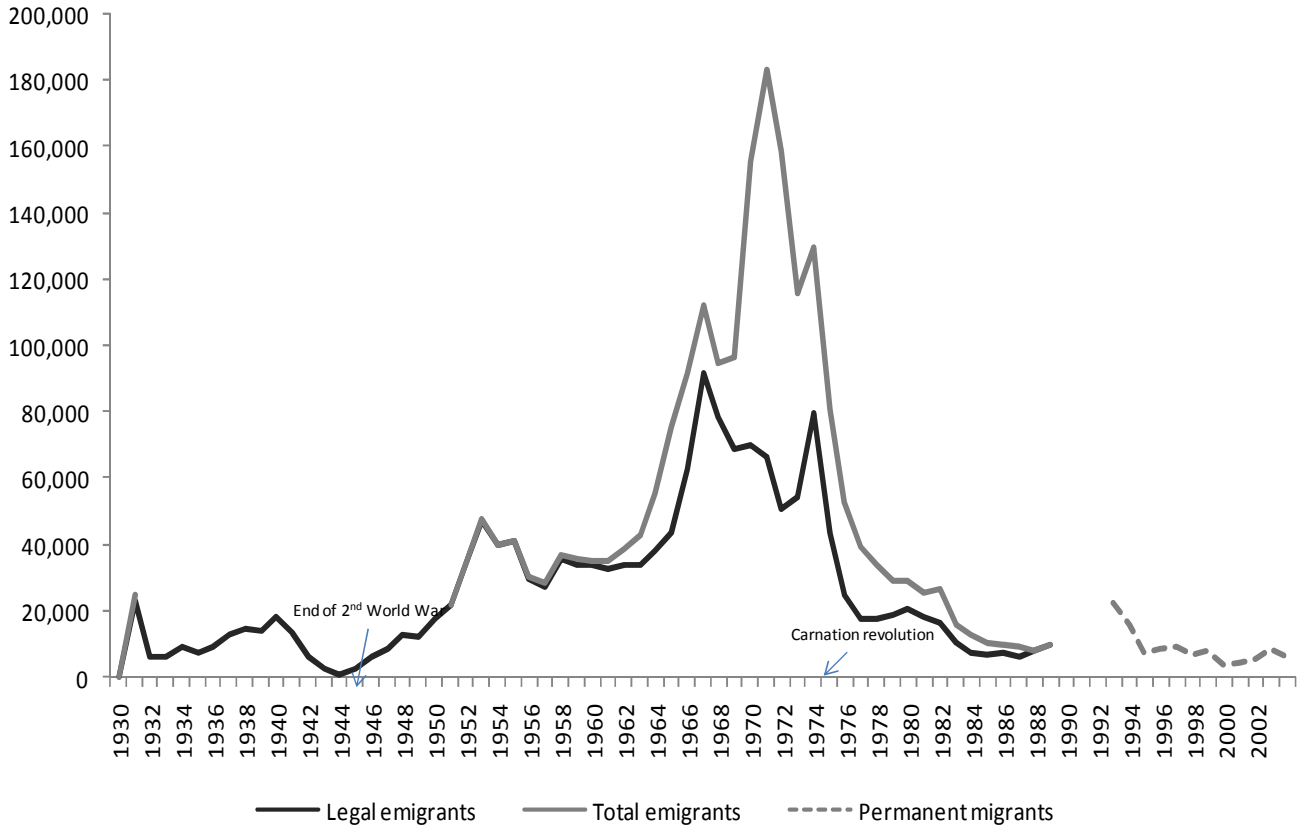
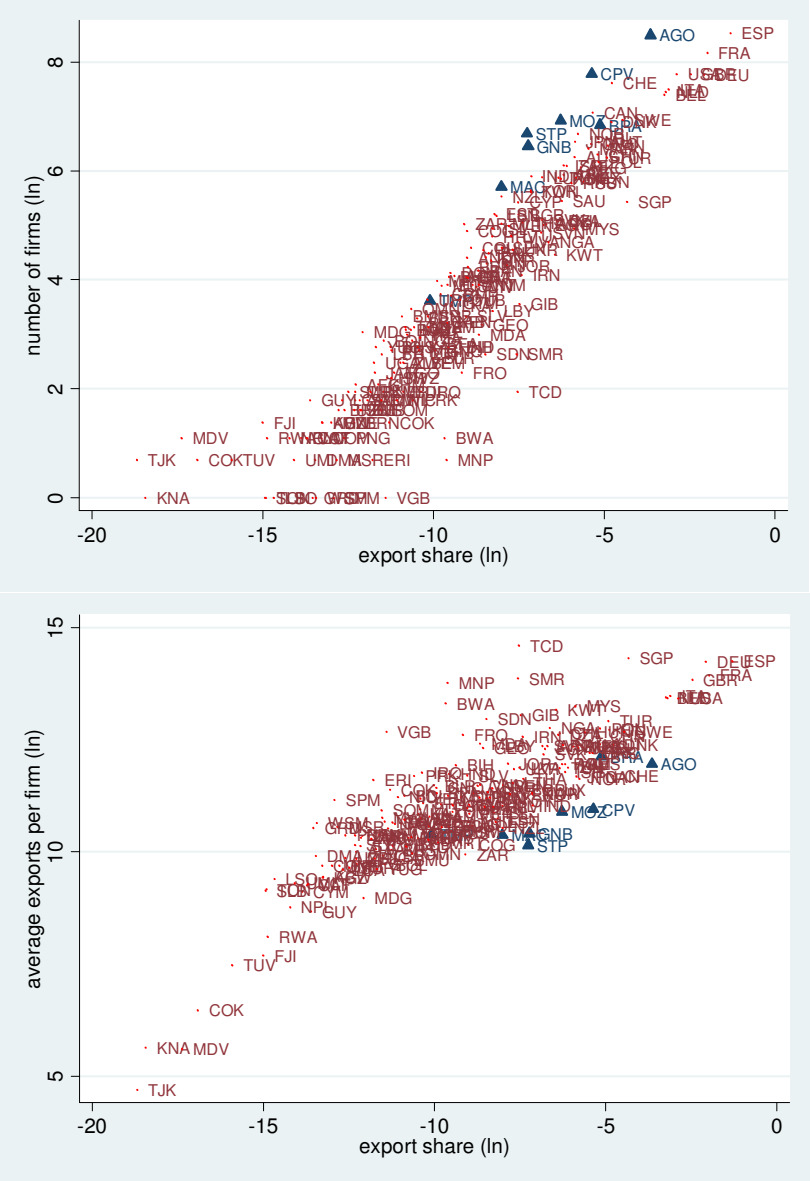
Figure 1: Portuguese emigration flows, 1930-2003



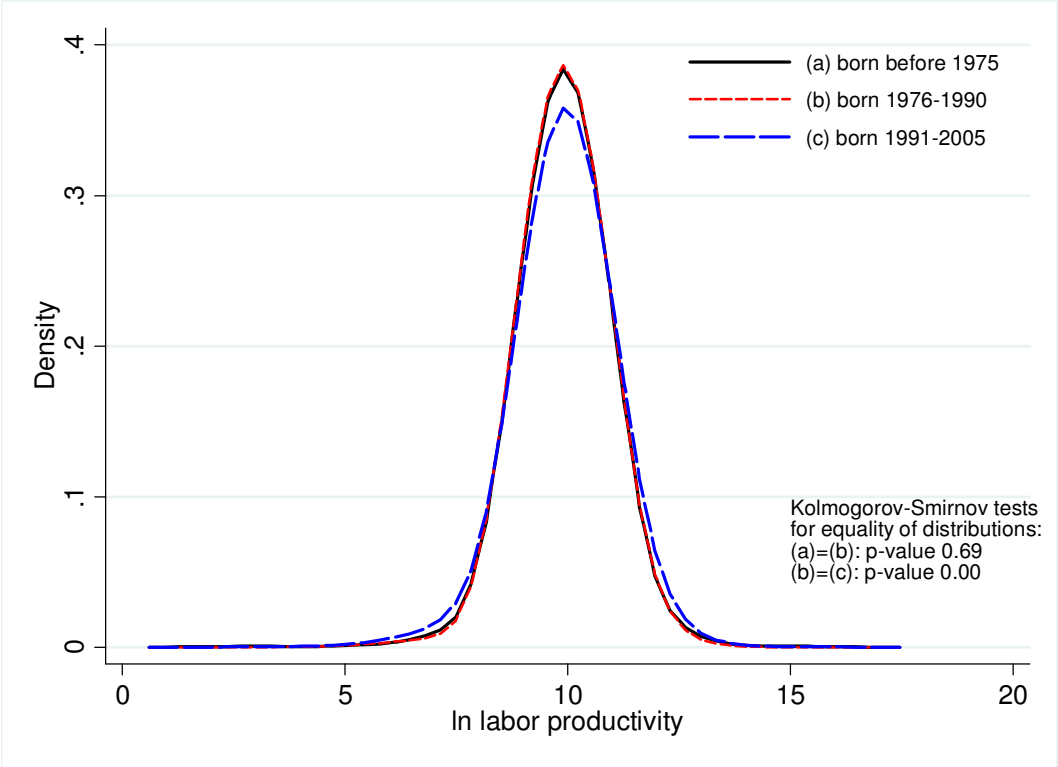
Notes: Data on legal emigrants and total emigrants until 1988 come from the Portuguese Ministry of Foreign Affairs. Data on permanent emigration from 1992 onwards come from the National Statistics Institute. Data on Portuguese emigration for the period 1989-1991 are not available.

Figure 2: Decomposing bilateral exports



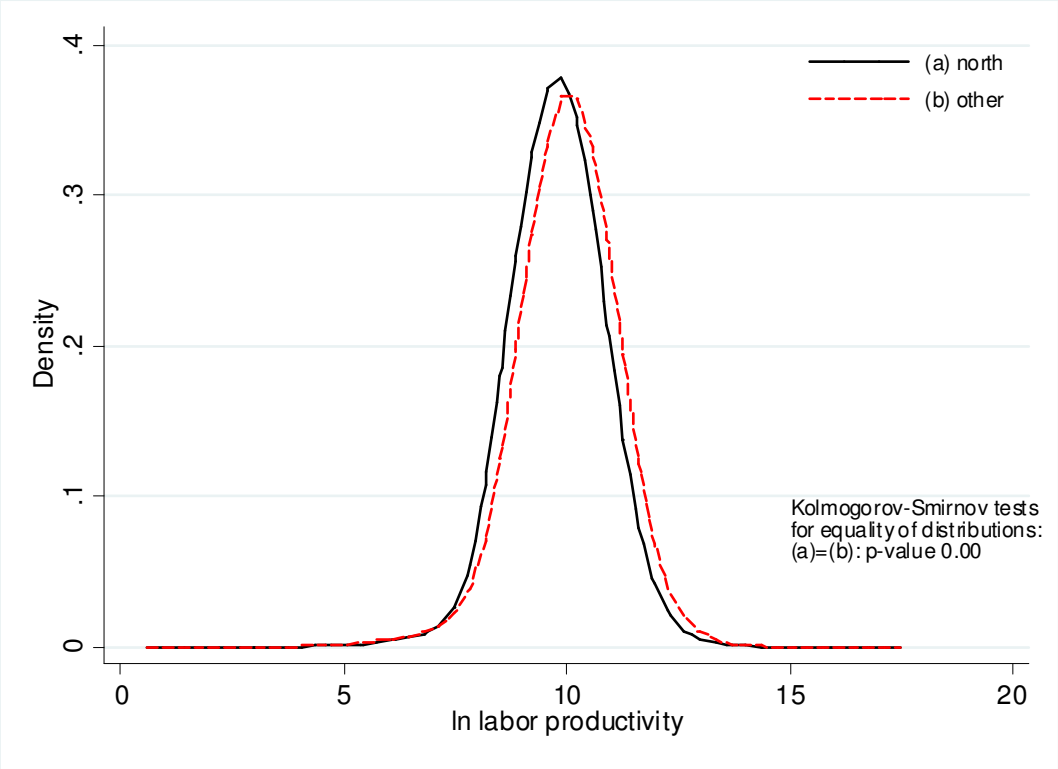
Notes: Portuguese-speaking countries are identified by a triangle.

Figure 3: Distribution of log firm labor productivity by age



Notes: The curves are based on a normal kernel density smoother with a bandwidth of 0.7.

Figure 4: Distribution of log firm labor productivity by region



Notes: The curves are based on a normal kernel density smoother with a bandwidth of 0.7.

Table 1: Portuguese-speaking countries

Country	Continent	Official languages	Independence from Portugal	Portuguese migrants
Angola	Africa	Portuguese	1975	1555
Brazil	South America	Portuguese	1822	170210
Cape Verde	Africa	Portuguese	1975	1656
East Timor	Asia	Tetum, Portuguese	1975	n.a.
Guinea Bissau	Africa	Portuguese	1973	766
Macau-China	Asia	Chinese, Portuguese	1999	445
Mozambique	Africa	Portuguese	1975	55520
Sao Tome and Principe	Africa	Portuguese	1975	814

Table 2: Export destinations per firm

Number of destinations served	% of firms	% of revenue
1	54.2	6.8
2	15.0	6.2
3	7.7	4.7
4	5.0	3.2
5	3.3	3.7
6	2.4	3.9
7	1.8	2.5
8	1.5	3.6
9	1.1	2.6
10	1.0	2.6
More than 10	7.0	60.2
Average number of destinations per firm	3.4	
Maximum number of destinations per firm	84	

Table 3: Networks and the extensive and intensive margins of exports

Dependent variable:	ln exports	ln number of firms	ln exports per firm
	(1)	(2)	(3)
ln GDP	0.7185***	0.4661***	0.2524***
	(0.0666)	(0.0366)	(0.0479)
ln GDP per capita	0.2369*	0.1932**	0.0437
	(0.1344)	(0.0765)	(0.0792)
ln distance	-1.5067***	-0.8026***	-0.7042***
	(0.1910)	(0.1204)	(0.1441)
EU member	1.2831***	1.0289***	0.2542
	(0.3033)	(0.1983)	(0.2281)
common currency	0.0954	-0.0575	0.1529
	(0.2883)	(0.2215)	(0.2228)
landlocked	-1.4478***	-0.9793***	-0.4685*
	(0.3497)	(0.1718)	(0.2726)
common language	3.7571***	3.6676***	0.0895
	(0.6136)	(0.5326)	(0.1996)
ln emigrants	0.0736**	0.0609**	0.0127
	(0.0308)	(0.0235)	(0.0213)
Observations	193	193	193
R2	0.76	0.82	0.41

Notes: The estimation method is OLS. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Networks and export participation

Dependent variable:	export participation					
	(1)	(2)	(3)	(4)	(5)	(6)
ln firm labor productivity	0.0031***		0.0031***			
	(0.0003)		(0.0003)			
ln firm employment		0.0083***		0.0083***		
		(0.0012)		(0.0012)		
ln GDP	0.0038***	0.0038***	0.0036***	0.0036***	0.0038***	0.0036***
	(0.0009)	(0.0009)	(0.0008)	(0.0008)	(0.0009)	(0.0008)
ln GDP per capita	0.0016	0.0016	0.0021*	0.0021*	0.0016	0.0021*
	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0013)	(0.0012)
ln distance	-0.0117**	-0.0117**	-0.0106**	-0.0106**	-0.0117**	-0.0106**
	(0.0047)	(0.0047)	(0.0046)	(0.0046)	(0.0047)	(0.0046)
EU member	0.0091	0.0091	0.0099	0.0099	0.0091	0.0099
	(0.0096)	(0.0096)	(0.0096)	(0.0096)	(0.0096)	(0.0096)
common currency	0.0571**	0.0571**	0.0567**	0.0567**	0.0571**	0.0567**
	(0.0227)	(0.0227)	(0.0228)	(0.0228)	(0.0228)	(0.0229)
landlocked	-0.0095**	-0.0095**	-0.0090*	-0.0090*	-0.0095*	-0.0090*
	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0049)
common language	0.0835**	0.0835**			0.0835**	
	(0.0348)	(0.0348)			(0.0349)	
ln emigrants	0.0014**	0.0014**	0.0016***	0.0016***	0.0014**	0.0016***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Angola			0.2850***	0.2850***		0.2850***
			(0.0026)	(0.0026)		(0.0026)
Brazil			0.0189***	0.0189***		0.0189***
			(0.0063)	(0.0063)		(0.0063)
Cape Verde			0.1328***	0.1328***		0.1328***
			(0.0043)	(0.0043)		(0.0043)
Guinea Bissau			0.0334***	0.0334***		0.0334***
			(0.0042)	(0.0042)		(0.0042)
Macau			0.0100***	0.0100***		0.0100***
			(0.0034)	(0.0034)		(0.0034)
Mozambique			0.0511***	0.0511***		0.0511***
			(0.0039)	(0.0039)		(0.0039)
Sao Tome and Principe			0.0512***	0.0512***		0.0512***
			(0.0034)	(0.0034)		(0.0034)
Firm fixed-effects	No	No	No	No	Yes	Yes
Observations	2852926	2852926	2852926	2852926	2852926	2852926
Firms	14782	14782	14782	14782	14782	14782
Destinations	193	193	193	193	193	193
R2	0.06	0.07	0.08	0.08	0.11	0.12

Notes: The estimation method is OLS. Robust standard errors clustered by importing country are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Networks and export participation, alternative estimators

Dependent variable:	export participation			
	(1)	(2)	(3)	(4)
ln firm labor productivity	0.0014***			
	(0.0002)			
ln firm employment		0.0022***		
		(0.0003)		
ln GDP	0.0020***	0.0015***	0.0007***	0.0203***
	(0.0003)	(0.0003)	(0.0000)	(0.0023)
ln GDP per capita	0.0011**	0.0008**	0.0004***	0.0124***
	(0.0004)	(0.0003)	(0.0000)	(0.0015)
ln distance	-0.0049***	-0.0037***	-0.0020***	-0.0566***
	(0.0010)	(0.0008)	(0.0000)	(0.0074)
EU member	0.0036**	0.0025*	0.0011***	0.0274***
	(0.0018)	(0.0014)	(0.0000)	(0.0035)
common currency	0.0009	0.0007	0.0004	0.0066***
	(0.0011)	(0.0009)	(0.0000)	(0.0013)
landlocked	-0.0024*	-0.0018*	-0.0009***	-0.0353***
	(0.0014)	(0.0010)	(0.0000)	(0.0048)
common language	0.0853*	0.0793*	0.0699***	0.0682***
	(0.0464)	(0.0462)	(0.0016)	(0.0091)
ln emigrants	0.0006***	0.0005***	0.0002***	0.0067***
	(0.0002)	(0.0001)	(0.0000)	(0.0009)
Estimator	Probit	Probit	RE Probit	Cond. Logit
Firm effects	No	No	Random	Fixed
Observations	2852926	2852926	2852926	2852926
Firms	14782	14782	14782	14782
Destinations	193	193	193	193

Notes: Marginal effects reported. In columns (1) and (2), robust standard errors clustered by importing country are in parentheses. In columns (3) and (4), robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Networks, firm age and export participation

Dependent variable:	export participation							
	full sample		low productivity		medium productivity		high productivity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coeff.	F-stat (P-value)	Coeff.	F-stat (P-value)	Coeff.	F-stat (P-value)	Coeff.	F-stat (P-value)
common language * born before 1976	0.1129***	51.42	0.0893***	17.68	0.1231***	44.46	0.1361***	26.87
	(0.0376)	(0.00)	(0.0328)	(0.00)	(0.0406)	(0.00)	(0.0415)	(0.00)
common language * born in 1976-1990	0.0841**		0.0772**		0.0807**		0.0981**	
	(0.0357)		(0.0328)		(0.0352)		(0.0405)	
common language * born after 1990	0.0738**	8.60	0.0744**	0.50	0.0735**	3.65	0.0734**	8.69
	(0.0337)	(0.00)	(0.0340)	(0.48)	(0.0347)	(0.06)	(0.0323)	(0.00)
ln emigrants * born before 1976	0.0023***	8.29	0.0018**	6.29	0.0024**	6.79	0.0031***	9.41
	(0.0009)	(0.00)	(0.0007)	(0.01)	(0.0010)	(0.01)	(0.0011)	(0.00)
ln emigrants * born in 1976-1990	0.0016**		0.0013**		0.0017**		0.0018**	
	(0.0007)		(0.0006)		(0.0007)		(0.0007)	
ln emigrants * born after 1990	0.0011**	6.13	0.0008**	5.77	0.0011**	5.93	0.0014**	4.94
	(0.0005)	(0.01)	(0.0004)	(0.02)	(0.0005)	(0.02)	(0.0006)	(0.02)
Firm fixed-effects	Yes		Yes		Yes		Yes	
Observations	2852926		1107627		929874		815425	
Firms	14782		5739		4818		4225	
Destinations	193		193		193		193	
R2	0.11		0.09		0.11		0.13	

Notes: The estimation method is OLS. Columns (1), (3), (5) and (7) report estimated coefficients from regressions that additionally include interactions between the other gravity variables and the age-cohort dummies. Robust standard errors clustered by importing country are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Columns (2), (4), (6) and (8) report F-tests of equality of coefficients across the three age-cohorts, where the reference group is the 1976-1990 cohort.

Table 7: Networks, firm location and export participation

Dependent variable:	export participation							
	all firms		low productivity		medium productivity		high productivity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coeff.	F-stat. (P-value)	Coeff.	F-stat. (P-value)	Coeff.	F-stat. (P-value)	Coeff.	F-stat. (P-value)
common language * North	0.0488**		0.0463*		0.0487**		0.0524**	
	(0.0238)	8.49	(0.0236)	8.62	(0.0247)	9.22	(0.0231)	7.26
common language * Other	0.1083**	(0.00)	0.1008**	(0.00)	0.1112**	(0.00)	0.1150**	(0.01)
	(0.0431)		(0.0408)		(0.0443)		(0.0450)	
ln emigrants * North	0.0020**		0.0015**		0.0021**		0.0025***	
	(0.0008)	5.56	(0.0006)	5.55	(0.0009)	4.83	(0.0010)	6.34
ln emigrants * Other	0.0010**	(0.02)	0.0008*	(0.02)	0.0011**	(0.03)	0.0013**	(0.01)
	(0.0005)		(0.0004)		(0.0005)		(0.0005)	
Firm fixed-effects	Yes		Yes		Yes		Yes	
Observations	2852926		1107627		929874		815425	
Firms	14782		5739		4818		4225	
Destinations	193		193		193		193	
R2	0.11		0.09		0.12		0.13	

Notes: The estimation method is OLS. Columns (1), (3), (5) and (7) report estimated coefficients from regressions that additionally include interactions between the other gravity variables and region dummies. Robust standard errors clustered by importing country are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Columns (2), (4), (6) and (8) report F-tests of equality of coefficients across regions.

Table 8: Networks and export intensity, OLS and Tobit

Dependent variable:	ln export revenue						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln firm labor productivity	0.3808***			1.9873***		1.9951***	
	(0.0387)			(0.2012)		(0.2009)	
ln firm employment		0.3310***			4.1915***		4.1879***
		(0.0231)			(0.3596)		(0.3573)
ln GDP	0.1310***	0.1414***	0.1914***	2.8406***	2.7758***	2.8132***	2.7494***
	(0.0347)	(0.0377)	(0.0459)	(0.5817)	(0.5958)	(0.5733)	(0.5875)
ln GDP per capita	-0.0727*	-0.0745*	0.0046	1.5500***	1.5132***	1.5341***	1.4977***
	(0.0381)	(0.0405)	(0.0395)	(0.5922)	(0.5851)	(0.5869)	(0.5801)
ln distance	-0.5246***	-0.5943***	-0.6477***	-6.9170***	-6.9301***	-6.8611***	-6.8748***
	(0.0871)	(0.0996)	(0.0891)	(0.9276)	(0.9195)	(0.9244)	(0.9167)
EU member	0.9288***	0.769***	0.7166***	4.3223***	3.9470**	4.3025***	3.9276**
	(0.1379)	(0.1459)	(0.1445)	(1.6598)	(1.6444)	(1.6505)	(1.6357)
common currency	0.0896	0.1278	0.0171	1.1312	1.1824	1.1789	1.2301
	(0.1364)	(0.1401)	(0.1351)	(1.2395)	(1.2415)	(1.2363)	(1.2389)
landlocked	-0.8273***	-0.8543***	-0.7335***	-4.0660	-4.0295	-4.0425	-4.0078
	(0.1124)	(0.1171)	(0.1200)	(2.5010)	(2.5175)	(2.4721)	(2.4891)
common language	0.0119	0.3332	0.9917**	25.4061***	25.6086***	25.2408***	25.4474***
	(0.2204)	(0.256)	(0.3998)	(5.5898)	(5.5996)	(5.5485)	(5.5589)
ln emigrants	0.0454**	0.0517***	0.0802***	0.8546***	0.8464***	0.8512***	0.8429***
	(0.0178)	(0.0188)	(0.0205)	(0.2456)	(0.2499)	(0.2436)	(0.2478)
Estimator	OLS	OLS	OLS	Tobit	Tobit	Tobit	Tobit
Firm fixed-effects	No	No	Yes	No	No	No	No
Observations	52053	52053	52053	2852926	2852926	2852926	2852926
Firms	14782	14782	14782	14782	14782	14782	14782
R2	0.18	0.2	0.51	0.15	0.18	0.15	0.18
Destinations	193	193	193	193	193	193	193

Notes: In columns (1) to (3), the estimation method is OLS and only non-zero export flows are used in the estimation. In columns (3) and (4) the estimation method is Tobit and the dependent variable is left-censored at the minimum firm-level export value observed in each destination. In columns (6) and (7) the estimation method is Tobit and the dependent variable is left-censored at zero. Marginal effects reported. Robust standard errors clustered by importing country are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Networks and export intensity, Heckman selection model

Dependent variable:	export participation			ln export revenue		
	(1)	(2)	(3)	(4)	(5)	(6)
ln firm labor productivity	0.0016***	0.0016***	0.0016***	0.4025***	0.4029***	0.4241***
	(0.0002)	(0.0002)	(0.0002)	(0.0553)	(0.0558)	(0.0294)
ln GDP	0.0023***	0.0023***	0.0019***	0.1590***	0.1594***	0.1847***
	(0.0006)	(0.0006)	(0.0006)	(0.0579)	(0.0584)	(0.0511)
ln GDP per capita	0.0026***	0.0025***	0.0037***	-0.0375	-0.0358	0.0143
	(0.0008)	(0.0008)	(0.0006)	(0.1238)	(0.1240)	(0.0916)
ln distance	-0.0062***	-0.0062***	-0.0058***	-0.6126***	-0.6132***	-0.6902***
	(0.0013)	(0.0013)	(0.0013)	(0.1502)	(0.1510)	(0.0838)
EU member	0.0004	0.0006	0.0016	1.0212***	1.0219***	1.0445***
	(0.0013)	(0.0016)	(0.0015)	(0.1390)	(0.1388)	(0.1470)
common currency	0.0025	0.0025	0.0014	0.0643	0.0645	0.0821
	(0.0017)	(0.0016)	(0.0013)	(0.1270)	(0.1276)	(0.1367)
landlocked	-0.0017	-0.0016	-0.0023	-0.8521***	-0.8538***	-0.8807***
	(0.0015)	(0.0015)	(0.0016)	(0.1177)	(0.1172)	(0.1007)
common language	0.1508*	0.1547**	0.1243*	0.3722	0.3798	0.6990
	(0.0779)	(0.0751)	(0.0717)	(0.5530)	(0.5581)	(0.4425)
ln emigrants	0.0005**	0.0005**	0.0007***	0.0645**	0.0647**	0.0736***
	(0.0002)	(0.0002)	(0.0002)	(0.0257)	(0.0255)	(0.0227)
ln number of procedures	-0.0042**	-0.0038**				
	(0.0018)	(0.0017)				
ln number of days		-0.0004				
		(0.0009)				
reg. costs (proc. & days)			-0.0005			
			(0.0014)			
Observations	2350338	2350338	2350338	2350338	2350338	2350338
Firms	14782	14782	14782	14782	14782	14782
Destinations	159	159	159	159	159	159
R2	0.25	0.25	0.25			
Log likelihood				-297017.8	-297005	-297929.5

Notes: Columns (1) to (3) report results from the Probit selection equation. Marginal effects and pseudo R2 reported. Columns (4) to (6) report the corresponding maximum likelihood estimates from a Heckman selection model. Robust standard errors clustered by importing country are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A1: Summary statistics, country and firm-level covariates

	Obs.	Mean	SD
Country-level covariates			
ln GDP	193	24.00	2.49
ln GDP per capita	193	9.63	9.63
log distance	193	8.55	0.69
EU member	193	0.12	0.12
common currency	193	0.06	0.24
landlocked	193	0.19	0.39
common language	193	0.04	0.19
ln emigrants	193	4.75	3.95
	Obs.	Mean	SD
Firm-level covariates			
ln firm labor productivity	14782	9.92	0.91
ln firm employment	14782	2.68	1.46
firm age	14782	18.49	36.11
	% of total		
Regional distribution			
North	41.62		
Center	21.06		
Lisbon	31.72		
Alentejo	3.56		
Algarve	1.18		
Azores	0.35		
Madeira	0.5		

Table A2: Portuguese emigrants, 2000

France	619,847	Philippines	1,753	Macao, China	445
Germany	234,840	Bermuda	1,750	Chile	413
United States	212,318	Cape Verde	1,656	Indonesia	404
Brazil	170,210	Angola	1,555	Morocco	399
Canada	155,984	Austria	1,473	Tanzania	382
Switzerland	104,159	Ghana	1,427	Kyrgyz Republic	373
Spain	56,359	Nigeria	1,338	Moldova	373
Mozambique	55,520	Cote d'Ivoire	1,262	Suriname	371
Venezuela, RB	54,414	Malaysia	1,251	Japan	368
Luxembourg	41,722	Guinea	1,220	Ethiopia	322
United Kingdom	37,910	Hong Kong, China	1,170	Croatia	322
Belgium	21,371	Netherlands Antilles	1,005	Cameroon	315
Pakistan	21,302	Kenya	887	San Marino	314
Zimbabwe	19,729	Sao Tome and Principe	814	Greece	302
Australia	15,441	Congo, Rep.	776	Yemen, Rep.	298
Kuwait	10,411	Norway	769	Costa Rica	297
Netherlands	10,218	Cuba	768	Mexico	270
Andorra	8,873	Guinea-Bissau	766	Turkmenistan	235
South Africa	8,037	Ecuador	759	Turkey	225
Russian Federation	6,451	Lebanon	747	Singapore	213
Italy	5,901	Algeria	713	Bahrain	212
Argentina	5,840	Denmark	686	Syrian Arab Republic	196
Uzbekistan	5,059	Uruguay	680	India	187
Jordan	4,806	China	652	Iraq	178
Israel	3,986	Ireland	601	Estonia	176
Ukraine	3,656	Colombia	589	Togo	170
Nepal	2,876	Zambia	571	Aruba	164
Sweden	2,533	Namibia	566	Faeroe Islands	157
Malawi	2,446	Romania	508	Burundi	155
Libya	1,945	New Caledonia	506	Belarus	149
Burkina Faso	1,846	Taiwan	503	New Zealand	148
United Arab Emirates	1,841	Tajikistan	450	Thailand	143

Table A2: Portuguese emigrants, 2000 (continued)

Finland	141	Lesotho	45	St. Vincent and the Grenadines	12
Panama	137	Somalia	43	Bosnia and Herzegovina	11
Kazakhstan	127	Cambodia	42	Jamaica	11
Seychelles	123	Paraguay	42	Korea, Rep.	10
Niger	122	Rwanda	40	British Virgin Islands	8
Iceland	116	Czech Republic	39	Bahamas, The	7
Madagascar	115	Grenada	39	Dominica	7
Swaziland	113	Bangladesh	32	Anguilla	6
Georgia	102	Gabon	31	Albania	6
Gambia, The	99	Benin	29	Maldives	6
Uganda	99	Bolivia	28	Solomon Islands	6
Senegal	98	Hungary	28	Northern Mariana Islands	5
Bulgaria	96	Eritrea	27	Botswana	4
Oman	92	Tonga	22	Latvia	4
Mali	91	St. Kitts and Nevis	21	Macedonia, FYR	4
Haiti	86	Korea, Dem. Rep.	21	Slovak Republic	4
Armenia	83	El Salvador	20	Samoa	4
Trinidad and Tobago	83	Tunisia	20	Antigua and Barbuda	3
Gibraltar	81	Comoros	19	Lithuania	3
Dominican Republic	75	Cyprus	19	Mauritania	3
Afghanistan	71	Mauritius	18	Cayman Islands	2
Poland	70	Brunei Darussalam	17	Equatorial Guinea	1
Iran, Islamic Rep.	67	Guyana	17	St. Lucia	1
Liberia	67	Sri Lanka	16	Monserat	1
Malta	63	Marshall Islands	16	St Hellen	1
French Polynesia	63	Barbados	15	Azerbaijan	0
Peru	57	Cook Islands	15	Central African Republic	0
Egypt, Arab Rep.	55	Fiji	15	Federal States of Micronesia	0
Djibouti	53	Guatemala	15	Qatar	0
Chad	52	Sierra Leone	14	Sudan	0
Saudi Arabia	51	Honduras	12	Slovenia	0
Papua New Guinea	48	Nicaragua	12	Tuvalu	0
Vietnam	48				

Note: This table reports the number of Portuguese emigrants in 193 countries. The data come from the Global Migrant Origin Database and refer to the year 2000.