How Migrant Workers Foster French Exports*

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Abstract

This paper analyses to what extent immigrant workers favour the export performance of their firm at both margins of trade. We develop a theoretical framework resting upon the model of Mrázová and Neary (2013). We assume that foreign workers allow their firms to be more efficient and convey valuable information to their employer on their origin countries. The model predicts that immigrants should foster exports at both margins (the probability of being an exporter and the exported quantities) towards their origin countries. The effect may be at play through a productivity channel and/or a trade-cost channel. We also find that immigrants should foster exports at both margins towards other foreign countries, but the effect is only at play through the productivity channel. We test this theoretical predictions using a French firm-level dataset over the 1995-2008 period. We find that foreign-born workers, and especially skilled individuals, foster exports at both margins through a productivity and a trade-cost channel. Our results are robust to potential endogeneity concerns which we overcome using a propensity score matching method.

Keywords: Foreign Workers, Exports, Firms, Heterogeneity

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1 Introduction

In this paper, we test whether employing migrant workers generates a pro-trade effect at the firm-level. We use a comprehensive matched employer-employee dataset of french firms to identify foreign-born workers, and we estimate the pro-trade effect of these workers at the firm level.

An extensive litterature has investigated the determinants of trade performance of firms on foreign markets. Empirical regularities suggests that among other explanations, firm-level trade outcomes are determined by (i) the idiosyncratic firm characteristics and (ii) the capacity of firms to overcome large country-specific trade costs. We investigate whether employing migrant workers affects both dimensions and as byproduct trade outcomes. A recent and emerging empirical literature documents that employing immigrant workers generates a productivity-enhancing task specialization within their firm (Peri and Sparber, 2009; Ottaviano and Peri, 2012; Mitaritonna et al., 2014). This literature echoes another strand of results supporting the pro-productivity effect of cultural and ethnic diversity (Goldin et al., 2011; Parrotta et al., 2014a). On the other hand, a number of macro-level studies provide evidence that immigrants convey valuable information on their origin countries which decreases *ad valorem* and fixed export-costs faced by firms, thus fostering trade between their origin and host countries at the intensive margin (Felbermayr and Toubal, 2012) and at the extensive margin (Gould, 1994; Rauch, 2001).

The present paper aims at investigating the channels through which foreign employment impacts firm-level exports at both margins of trade and their relative strength. To this purpose, we develop a theoretical framework with heterogeneous firms in monopolistic competition resting upon the model of Melitz (2003). We assume that foreign workers allow for efficiency gains within their firm and convey valuable information to their employer on their origin countries. Our model predicts that immigrants should foster exports at both margins toward their origin countries. The effect may be at play through a *productivity channel* and a *trade-cost channel*. We also find that immigrants should foster exports at both margins toward other foreign countries, but the effect should only be at play through the *productivity channel*.

We test these predictions using a dataset on French manufacturing firms over the period 1995-2008. We identify foreign-born workers in a comprehensive matched employer-employee dataset (DADS) that we combine with trade data at the firm(-product)-destination level using French Customs data and with firm-level balance-sheet BRN data from the French tax authority.

Our main results are twofold. First, we estimate that hiring foreign-born workers has a positive effect on exports at both margins, and the effect is all the more present that migrant workers are skilled. Our results are robust to potential endogeneity concerns which we overcome using a propensity score matching method.

Second, we are able to disentangle the two channels through which foreign-born workers impact the export performance of their firm. The effect occurring through the *trade-cost channel* is larger than the effect going through the *productivity channel*. In other words, foreign-born workers significantly reduce *ad valorem* and fixed export-costs towards their origin regions. That being said, the *productivity channel* effect is significantly positive, suggesting that foreign-born workers also foster exports towards other foreign countries.

The contributions of the paper are threefold. First, we propose an original theoretical model rationalizing the pro-trade effect of migrants. Our theoretical models predicts that immigrant workers foster

exports at both margins, toward their origin countries but also toward other export destinations. We build a model of heterogeneous firms that allows us to identify, in this single framework, the different channels through which foreign employment may impact exports, the *trade-cost channel* and the *productivity channel*. To the best of our knowledge, the only attempt to provide a theoretical framework to show how immigrants foster exports has been made by Felbermayr and Toubal (2012). The authors use a partial equilibrium gravity equation to show that immigrants foster exports by reducing *ad valorem* export-costs. We depart from this article by providing a micro-founded approach to the pro-trade effect of migrants.

Second, the trade-migration nexus has been mainly explored with macro-level data. To the best of our knowledge, Hiller (2013) is the only article invetsigting the pro-trade effect of migrants at the firm-level. The present article depart from this work by using firm-level variables to instrument firm-level migrant workers employement, while it is common wisdom in the literature to use regional-level data of immigrants, probably because of data limitation.

Third, we contribute to the trade literature by providing additional insights within the black-box of export success and failures. Despite recent contributions, what makes an exporter succesfull is still unexplained. Our results offer one explanation to the uncomplete connection between export success and firm-level observable caracteristics.

The rest of the paper is organised as follows. In the next section we present the related literature on the exports-migration nexus. In Section 3, we present the French firm-level dataset we use. In Section 4, we develop a theoretical framework in order to better understand the mechanisms at play between foreign workers and the export behaviour of their firm. We detail our empirical specification and present our results in Section 5. In Section 6, we intend to disentangle the productivity from the trade-cost channels. In Section 7, we propose an alternative empirical strategy that enables us to deal with a number of endogeneity concerns. Section 8 concludes.

2 The trade-migration nexus

In the next sub-sections, we present the literature related to our study. We distinguish the literature emphasising the impact of immigrants on trade costs form the literature focusing on their impact on productivity.

2.1 The trade-cost channel

Immigrants, and especially skilled immigrants, foster exports towards their origin countries by lowering variable and fixed export-costs. Migrants convey valuable information between their origin and host countries on trade opportunities, on local commercial customs and on local preferences. Their knowledge of international markets allows them to advise their firms on their foreign activities. Moreover, immigrants reduce cultural and linguistic barriers, promote trust and reduce risk. This, in turn, reduces transaction costs and allows for better contracts' enforcement.

In their theoretical model, Felbermayr and Toubal (2012) assume that trade-costs depend on the share of foreign individuals born in the export destination country. Empirically, they find that immigrants do reduce trade-costs, this effect accounting for 37% of the total effect of immigration on bilateral trade. This effect tends to be higher for high skilled individuals. In the same line, Hatzigeorgiou (2010) and

Hiller (2013) empirically evidence that immigrants may reduce both variable and fixed export-costs by relaxing informational barriers thanks to their superior knowledge of foreign-markets.

Overall, a large set of papers corroborates these findings; see the pioneering work of Gould (1994), Head and Ries (1998) and Rauch (2001) and the work of Peri and Requena-Silvente (2010) and Aleksynska and Peri (2014).

2.2 The productivity channel

Immigrant workers may also foster exports by increasing the productivity of their firms. Two strands of the literature can be related to this productivity channel.

First, in the continuation of Peri and Sparber (2009) and Ottaviano and Peri (2012), Mitaritonna et al. (2014) show that natives and immigrants are imperfect substitutes, and that immigrants push towards a task specialisation (foreign workers specialise in manual tasks while natives specialise in communication intensive tasks) which allows for productivity gains. With French firm-level data over 1995-2005, they find that an exogenous increase in the local supply of immigrants fosters the firm's productivity.

Second, immigrants may (either positively or negatively) impact the production performance of their employer by increasing the cultural diversity among workers. On the one hand, skilled immigrants reinforce the overall efficiency of their firm, because a higher cultural diversity stimulates innovation and problem solving which leads, for instance, to more patent filings. Their entrepreneurship capacities and potential to innovate is attested by a number of success stories: the creators of Google, Yahoo, Intel, eBay, Paypal were all immigrants (Goldin et al., 2011). In addition, immigrants increase the global ability of their firm to compete in global markets. They have an export know-how that can be adapted to any foreign market (Parrotta et al., 2014a). On the other hand, ethnic diversity may create linguistic and cultural frictions which may lead to communication problems, and weaken trust and social ties between workers. Parrotta et al. (2014b) present evidence that cultural diversity impacts negatively the firm's productivity. A number of papers in the management literature also presents mixed evidence regarding the advantages of multiculturalism. See Loth (2009) who discusses how cultural diversity may impact production processes, and Goodall and Roberts (2003) who discuss the potential gains for culturally diverse multinational firms which efficiently manage their multicultural teams.

3 Data and stylised facts

We merge three datasets providing us information on French firms over the period 1995-2008, by means of the French firm identifier (SIREN number).

First, we use the firms' annual employee declarations (Déclarations Annuelles des Données Sociales, DADS) containing almost exhaustive information on the employment of firms settled on the French metropolitan territory from 1995 to 2008. This employer-employee dataset allows us to know whether an employee was born in France, born in the European Union (EU) or outside the EU. The dataset does not contain information about the exact country of birth of foreign workers. Here, a foreigner is a person who was born abroad, thus, naturalised individuals are considered as foreigners in our study.

We also have information on the socio-professional category of each worker, from which we deduct his level of qualification[1]. To do so, we associate to each socio-professional category the corresponding

[1]The socio-professional category is only available over the period 1997-2008.

cognitive, communication and manual indexes proposed by Mitaritonna et al. (2014). The authors derive this indexes from the O*NET database (Bureau of Labor Statistics) and the ISCO88 definition of occupations. We consider a worker as skilled when his cognitive/manual ratio is higher than (or equal to) the 75th percentile of the distribution of ratios across workers.[2]. This definition of skills is occupational, contrarily to most existing studies which define the skill level of a worker using his educational background. We aggregate these employee-level data at the firm level and obtain, for each firm, the number of native, EU-born and non-EU-born workers employed, and for each category the share of skilled and unskilled workers.

Then, we use firm-level trade data from the French customs over the period 1995-2009. This database reports the volume (in tons) and the value (in Euros) of exports for each CN8 product (European Union Combined Nomenclature at 8 digits) and destination, for each firm located on the French metropolitan territory. Some shipments are excluded from this data collection. Inside the EU, firms are required to report their shipments by product and destination country only if their annual trade value exceeds the threshold of 150,000 Euros. For exports outside the EU, all flows are recorded unless their value is smaller than 1,000 Euros or one ton. Yet, these thresholds eliminate a very small proportion of total exports. From this dataset, we only keep merchandise shipments.

Finally, we use balance-sheet data (Bénéfices Réels Normaux, BRN) over the period 1995-2009, constructed from reports of French firms to the tax administration. This dataset provides us with information on the value added, total sales, the capital stock and other variables at the firm-level. Unfortunately, it does not contain information on the share of foreign-owned capital. The BRN dataset contains between 650,000 and 750,000 firms per year (around 60% of the total number of French firms). Importantly, this dataset is composed of both small and large firms, since no threshold applies on the number of employees for reporting to the tax administration. Depending on the year, these firms represent between 90% and 95% of French exports contained in the customs data.

Once these data combined, we obtain a dataset of 3.5 million firm-destination observations over the period 1995-2008[3]. It contains French firms exporting manufactured goods during at least one year over the studied period[4].

A number of descriptive statistics on exporting firms[5] are presented in Table 1. From this table, we infer that firms export in average 2.67 thousands of Euros (average per year over the studied period). Although not reported in the table, note that 76.29% of firms do not employ any foreign worker. Looking at firms' employment per region of birth, we observe that exporters employ about 95.5% of natives over their total workforce. They employ much less EU foreign workers (about 0.3% of their total workforce) than non-EU foreign workers (about 4.1% of their total workforce). Then, looking at firms' employment per region of birth and skill level, we see that most immigrant workers are low-skilled workers.

4 Theoretical framework

In this section, we first build a model of heterogeneous firms in monopolistic competition resting upon the model of Melitz (2003). We consider two sources of heterogeneity: firms are not only heterogeneous

[2]For further robustness tests, we also consider a stricter definition, that is we consider a worker as skilled when his cognitive/manual ratio is higher than (or equal to) the 95th percentile of the distribution of ratios across workers.

[3]Note that these data could have allowed us to construct an employer-employee panel dataset. Yet, because of computational constraints, we build a firm-level panel data by aggregating information on employees at the firm-level.

[4]French firms which only produce for the domestic market over the studied period are excluded from the dataset.

[5]Over the 3.5 million observations, we observe 1.24 million of observations that have non-zero export values.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ECONOMIC CHARACTERISTICS					
Profit (in thousands of €)	1,240,989	.85	49.55	0	11,610.52
Revenue (in thousands of €)	1,240,989	32.11	1,579.82	0	839,872.8
Total assets (in thousands of €)	1,240,989	59.07	3,168.91	0	1,266,499
Size (total employment)	1,141,835	25.70	214.39	1	63,836
Capital intensity (fixed assets/employee)	1,073,040	2,840.86	44,108.58	0	1.41e+07
Total exports (in thousands of €)	1,240,984	2.67	56.32	1e-06	12,284.63
Age	919,266	19.04	13.79	1	80
Nr. of products exported	1,198,991	34.04	134.12	1	10,194
EMPLOYMENT PER REGION OF BIRTH					
Share of French workers	1,141,835	.955	.143	0	1
Share of European foreign workers	1,141,835	.003	.036	0	1
Share of non-European foreign workers	1,141,835	.041	.138	0	1
EMPLOYMENT PER REGION OF BIRTH AND SKILL LEVEL (cognitive skills – 25% threshold)					
Share of French skilled workers (over total workforce)	502,389	.373	.394	0	1
Share of European foreign skilled workers	502,389	.002	.036	0	1
Share of non-European foreign skilled workers	502,389	.015	.099	0	1
Share of French unskilled workers	502,389	.565	.395	0	1
Share of European foreign unskilled workers	502,389	.005	.040	0	1
Share of non-European foreign unskilled workers	502,389	.038	.136	0	1

in their productivity level but also in their employment of foreign workers. We then rest upon the model of Mrázová and Neary (2013) to analyse what the authors call first-order selection effects. More precisely, we look at the choice of a firm to supply or not a foreign market. We analyse whether employing foreign skilled workers (i) determines the choice of the firm to supply a foreign market, and whether (ii) it allows that firm to produce larger quantities for each foreign market it supplies.

4.1 Model set-up

Let us consider a world with $n+1$ symmetric countries open to trade: a domestic country denoted d and n foreign countries indexed by x.

The domestic country is endowed with a stock of composite labour denoted L. Following the literature initiated by Borjas (2003), we assume this composite labour is a CES aggregate made of native and foreign-born workers. Let the subscript o denotes the origin of a worker such that $o = \{d, m\}$ where d refers to *domestic-born* and m refers to *foreign-born*. Native and foreign workers are assumed to be imperfect substitutes, such that:

$$L = \left[\sum_{o} \theta^{o} \left(L^{o} \right)^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} \; ; \; \forall o = \{d, m\} \tag{1}$$

where θ^o denotes the origin-specific productivity level of the workers, and δ is a positive constant denoting the elasticity of substitution between the two types of workers.

Foreign workers may come from different countries. We assume foreign workers with different origin countries are perfect substitutes such that:

$$L^{m} = \sum_{x=1}^{n} L^{x} \tag{2}$$

where L^x denotes the stock of foreign workers who were born in foreign country x.

Workers are paid at their marginal productivities, and the wage of one unit of labour composite factor equals unity which ensures the factor price equalisation among countries.

A continuum of firms operating under monopolistic competition and indexed by i produce using the labour composite factor. Thus, the number of firms also equals the number of varieties available in the country.

4.2 Demand

The preferences of a representative consumer are given by a CES utility function:

$$U = \left[\int_{i\in\Omega} (q_i)^{\frac{\sigma-1}{\sigma}} \, \mathrm{d}i\right]^{\frac{\sigma}{\sigma-1}} \tag{3}$$

where Ω denotes the set of available varieties, q_i is the demand for variety i and σ denotes the elasticity of substitution between any two goods. The consumer's budget constraint is given by:

$$\int_{i\in\Omega} q_i p_i \mathrm{d}i \leq R \tag{4}$$

where p_i is the price of variety i and R denotes the aggregate revenue spent in the country.

The aggregate set of varieties is consumed as an aggregate good ($Q \equiv U$). The associated aggregate price is given by:

$$P = \left[\int_{i\in\Omega} (p_i)^{1-\sigma} \, \mathrm{d}i\right]^{\frac{1}{1-\sigma}} \tag{5}$$

Solving the consumer maximisation program gives the demand for variety i: $q_i = Q\left(\frac{p_i}{P}\right)^{-\sigma}$, and the expenditure on variety i: $r_i = R\left(\frac{p_i}{P}\right)^{1-\sigma}$, where $R = PQ$.

4.3 Supply

4.3.1 Firm's characteristics

Any firm i is characterised by an *exogenous* productivity level drawn from a random distribution and denoted ϕ_i, and by an *endogenous* productivity level denoted α_i. Together, ϕ_i and α_i determine the *global productivity* of the firm: $g_i = \phi_i \alpha_i$.

The endogenous productivity level depends on the workforce composition of the firm in term of foreign employment and is given by:

$$\alpha_i = \alpha(\lambda_i^1, ..., \lambda_i^n) \tag{6}$$

where λ_i^x denotes the share of workers born in the foreign country $x\,(\forall x = 1...n)$ and employed by firm i.[6] The function α is defined over $[0,1]^n$. It is symmetric and concave in its arguments such that there exists an optimum of the workforce composition that maximises the endogenous productivity of the firm.

[6] We consider that $\lambda_i^d + \sum_{x=1}^{n} \lambda_i^x = 1$ where λ_i^d denotes the share of native workers employed by firm i.

Let the *productivity channel* denotes the effect through which the workforce composition impacts the productivity of the firm.

Firm i selects the composition of its workforce in order to maximise its global productivity. However, its choice is constrained by the scarcity of foreign workers on the French labour market. Thus, its employment of foreign workers is always sub-optimal such that firm i's endogenous productivity increases or remains unchanged when its share of workers born in country x increases:

$$\frac{\partial \alpha_i}{\partial \lambda_i^x} \geq 0 \, \forall \, x = 1...n \tag{7}$$

Note that different firms may be constrained differently in their choices of foreign employment.

Condition (7) makes sense for two reasons. First, if foreign workers had a negative impact on the productivity of their firms, no firm would employ foreign workers and there would be no solution to the model. Second, the share of immigrants in France is not very large over the studied period (7% according to Brücker et al., 2013) so we can consider foreign labour as a scarce resource.

Finally, firm i has no intrinsic preference regarding the origin of its foreign workers. The set of foreign workers the firm hires depends on a stochastic process, therefore firms are heterogeneous in their employment of foreign workers born in specific country.

4.3.2 Domestic production

Firm i produces under increasing returns to scale. Its technology to produce q_i^d units of goods for the domestic market is given by:

$$c_i^d = w\frac{1}{g_i}q_i^d + f^d \tag{8}$$

where w denotes the remuneration of one unit of labour composite factor in the country, $\frac{1}{g_i}$ represents its marginal cost, and f^d is a positive constant greater than unity denoting a domestic market entry cost. Hereafter, the wage is normalised to unity.[7]

Firm i's ex-ante profit on the domestic market is given by:

$$\pi_i^d = R\left(\frac{p_i^d}{P}\right)^{1-\sigma} - \frac{1}{g_i}q_i^d - f^d \tag{9}$$

After maximisation, we obtain the price of variety i when sold on the domestic market: $p_i^d = \left(\frac{\sigma}{\sigma-1}\right)\frac{1}{g_i}$. Introducing the price in the demanded quantity, we obtain the quantity produced by firm i for the domestic market: $q_i^d = Q\left[P\left(\frac{\sigma-1}{\sigma}\right)g_i\right]^{\sigma}$. Finally, introducing these last two equations in equation (9), we find the ex-post profit of firm i realised on the domestic market:

$$\pi_i^d = \frac{R}{\sigma}\left[P\left(\frac{\sigma-1}{\sigma}\right)g_i\right]^{\sigma-1} - f^d \tag{10}$$

[7]Note that because we consider a one time-period model, we make no distinction between fixed and sunk costs.

4.3.3 Export

The technology of firm i to produce q_i^x units of goods for a foreign market x is given by:

$$c_i^x = \frac{\tau_i^x}{g_i} q_i^x + f_i^x \ ; \ \forall x \tag{11}$$

where τ_i^x denotes a variable cost to export the merchandise from the domestic country towards a foreign country x and f_i^x denotes a positive foreign market-entry cost.

The variable cost is firm-specific and greater than unity such that: $\tau_i^x = T^x + \tau\left(\lambda_i^x\right) \mapsto \mathbb{R}^{+*}$ where T^x is a constant greater than unity and where τ represents the firm-specific component of the cost. We assume that foreign workers provide their firms with information on their origin countries. This decreases the variable export-cost of their firms towards their origin countries. Thereby, we can write:

$$\frac{\partial \tau\left(\lambda_i^x\right)}{\partial \lambda_i^x} \leq 0 \tag{12}$$

The fixed cost is firm-specific and depends on the firm's employment of foreign workers born in the export destination country such that: $f_i^x = F^x + f\left(\lambda_i^x\right) \mapsto \mathbb{R}^{+*}$ where F^x denotes a positive cost to enter the foreign market x and where the function f represents the firm-specific component of the cost. Here again, we assume that foreign workers decrease export-cost towards their origin countries such that:

$$\frac{\partial f\left(\lambda_i^x\right)}{\partial \lambda_i^x} \leq 0 \tag{13}$$

We further assume that it is more costly to enter a foreign market than to enter the domestic market, so that: $f^d \leq f_i^x \ ; \ \forall i \, \forall x \neq d$.

Since we allow export-costs to differ across countries, firm i may not export towards all foreign destinations. Let the *trade-cost channel* denotes the effect through which foreign workers impact the export-costs of their firms.

Firm i's ex-ante profit on market x is given by:

$$\pi_i^x = R\left(\frac{p_i^x}{P}\right)^{1-\sigma} - \frac{\tau_i^x}{g_i} q_i^x - f_i^x \tag{14}$$

After maximisation, we find the price charged by firm i on market x: $p_i^x = \left(\frac{\sigma}{\sigma-1}\right)\frac{\tau_i^x}{g_i}$. Introducing the price in the demanded quantity, we obtain the quantity sold on market x: $q_i^x = Q\left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{g_i}{\tau_i^x}\right]^{\sigma}$. Then, introducing these last two equations (price and quantity) in equation (14), we find the ex-post profit of firm i on market x:

$$\pi_i^x = \frac{R}{\sigma}\left[P\left(\frac{\sigma-1}{\sigma}\right)\frac{g_i}{\tau_i^x}\right]^{\sigma-1} - f_i^x \tag{15}$$

Finally, since $\pi_i^d \geq \pi_i^x \, \forall x \neq d$, when firm i is able to supply market x, it is also able to supply the domestic market. Thus, there is no export-only firm.

4.4 First-order selection effects

Following Mrázová and Neary (2013), we assume that a general equilibrium exists.[8] The firm's profit is continuous and decreasing in the marginal cost, we can thus study the emergence of first-order selection effects (Mrázová and Neary, 2013). In other words, assuming that firms are small so their actions have no impact on the general equilibrium, we realise a comparison to understand whether differences in foreign employment induce differences in export behaviours.

4.4.1 Export performance at the extensive margin

Proposition 1. *The profit of any firm i realised on any foreign market x is given by $\pi_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$. Due to the existence of a positive entry cost on market x (f_i^x), the zero-profit condition ($\pi_i^x = 0$) implicitly defines a firm-specific threshold function for market x given by: $\psi_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$.*

Corollary 1.1. *ψ_i^x denotes the lowest ability firm i should get to supply market x.*

Proposition 2. *The higher firm i's exogenous productivity, ϕ_i, the higher its probability to match market x's entry threshold such that: $\dfrac{\partial \psi_i^x}{\partial \phi_i} < 0$.*

Proof. To enter market x, firm i should get a positive profit on that market: $\pi_i^x \geq 0$. Its probability to serve market x can be written: $\Pr\left(\pi_i^x \geq 0\right)$. Let first see what happens to the profit on market x when firm i's exogenous productivity increases:

$$\frac{\partial \pi_i^x}{\partial \phi_i} = \frac{\sigma - 1}{\sigma} R \left[P \left(\frac{\sigma - 1}{\sigma} \right) \frac{\alpha_i}{\tau_i^x} \right]^{\sigma - 1} \phi_i^{\sigma - 2} > 0 \tag{16}$$

Hence, the higher firm i's exogenous productivity, the higher its profit on market x and the higher its probability to serve that market. □

Proposition 3. *The higher firm i's foreign employment, the higher its probability to match market x's entry threshold such that: $\dfrac{\partial \psi_i^x}{\partial \lambda_i^x} < 0 \, \forall x$.*

Proof. Let us look at what happens to the profit on market x, when firm i increases its employment of foreign workers coming from country x:

$$\frac{\partial \pi_i^x}{\partial \lambda_i^x} = \frac{\sigma - 1}{\sigma} R \left[P \left(\frac{\sigma - 1}{\sigma} \right) \right]^{\sigma - 1} \left(\frac{g_i}{\tau_i^x} \right)^{\sigma - 2} \left(\frac{\partial g_i}{\partial \lambda_i^x} \tau_i^x - g_i \frac{\partial \tau_i^x}{\partial \lambda_i^x} \right) \frac{1}{\left(\tau_i^x\right)^2} - \frac{\partial f_i^x}{\partial \lambda_i^x} > 0 \tag{17}$$

On the one hand, for a given exogenous productivity (ϕ_i), a marginal increase in the share of foreign workers coming from country x induces an increase in the firm's global productivity:

$$\frac{\partial g_i}{\partial \lambda_i^x} = \phi_i \frac{\partial \alpha\left(\lambda_i^1, ..., \lambda_i^n\right)}{\partial \lambda_i^x} \geq 0 \, \forall x \tag{18}$$

On the other hand, a marginal increase in the share of foreign workers coming from country x induces a reduction of firm i's variable and fixed export-costs towards market x. Hence, when firm i increases

[8] A number of papers show that an equilibrium exists in any general model of monopolistic competition (Negishi, 1961; Arrow and Hahn, 1971). This is likely to be the case for our model since its structure is similar to the model of Melitz (2003).

its employment of foreign workers coming from country x, its profit on market x increases, and so its probability to serve that market increases.

Let us now look at what happens when firm i increases its employment of foreign workers coming from another foreign country denoted x':

$$\frac{\partial \pi_i^x}{\partial \lambda_i^{x'}} = \frac{\sigma-1}{\sigma} R \left[P \left(\frac{\sigma-1}{\sigma} \right) \frac{1}{\tau_i^x} \right]^{\sigma-1} (g_i)^{\sigma-2} \frac{\partial g_i}{\partial \lambda_i^{x'}} > 0 \, \forall x' \neq x \tag{19}$$

From equation (18), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. However, it does not impact its variable and fixed export-costs towards market x. Hence, firm i's probability to serve market x increases with its employment of foreign workers coming from country $x'(\forall x' \neq x)$. □

Corollary 3.1. *For any two firms i and i' only differing in their employment of foreign workers born in country x such that: $\lambda_i^x < \lambda_{i'}^x$, then:* $\Pr(\pi_i^x \geq 0) < \Pr(\pi_{i'}^x \geq 0)$.

Empirically, we should observe that the probability to enter a foreign market depends positively on the firm's employment of foreign workers born in that country. We could then conclude that foreign workers foster exports towards their origin countries at the extensive margin. However, this positive effect could corroborate the existence of both (or either one of) the studied channels: foreign workers can increase the productivity of their firms, but they can also decrease the export-costs of their firms towards their origin countries.

Corollary 3.2. *For any two firms i and i' only differing in their employment of foreign workers born in country x' such that: $\lambda_i^{x'} < \lambda_{i'}^{x'}$, then:* $\Pr(\pi_i^x \geq 0) < \Pr(\pi_{i'}^x \geq 0)$.

Empirically, we should also observe that the probability to enter a foreign market depends positively on the firm's employment of foreign workers born in any other country than this destination. We could then conclude that foreign workers affect foreign activities by increasing their firm's productivities, and corroborate the existence of the productivity channel.

4.4.2 Export performance at the intensive margin

Proposition 4. *The higher firm i's foreign employment, the higher its exported quantities towards market x.*

Proof. Firm i's exported quantities towards market x are given by: $q_i^x\left(\phi_i, \lambda_i^1, ..., \lambda_i^n\right)$. Let us look at what happens to the exports of firm i towards market x, when it increases its employment of foreign workers coming from country x:

$$\frac{\partial q_i^x}{\partial \lambda_i^x} = \sigma Q \left[P \left(\frac{\sigma-1}{\sigma} \right) \right]^{\sigma} \left(\frac{g_i}{\tau_i^x} \right)^{\sigma-1} \left(\frac{\partial g_i}{\partial \lambda_i^x} \tau_i^x - g_i \frac{\partial \tau_i^x}{\partial \lambda_i^x} \right) \frac{1}{\left(\tau_i^x\right)^2} > 0 \tag{20}$$

From equation (18), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. In addition, this a marginal increase impacts its variable export-costs towards market x. Hence, firm i's exported quantities towards market x increase with its employment of foreign workers coming from country x.

Let us now look at what happens when firm i increases its employment of foreign workers coming from another foreign country, x':

$$\frac{\partial q_i^x}{\partial \lambda_i^{x'}} = \sigma Q \left[P \left(\frac{\sigma - 1}{\sigma} \right) \frac{1}{\tau_i^x} \right]^{\sigma} (g_i)^{\sigma - 1} \frac{\partial g_i}{\partial \lambda_i^{x'}} > 0 \, \forall x' \neq x \tag{21}$$

From equation (18), we know that a marginal increase in the share of foreign workers coming from country x' induces an increase in the firm's global productivity. However, it does not impact its variable export-costs towards market x. Hence, firm i's exported quantities towards market x increase with its employment of foreign workers coming from country x'. □

Corollary 4.1. *For any two firms i and i' only differing in their employment of foreign workers from country x such that $\lambda_i^x < \lambda_{i'}^x$, then $q_i^x < q_{i'}^x$.*

Empirically, we should observe that foreign workers born in the export destination foster exports at the intensive margin. However, this could corroborate the existence of both studied channels.

Corollary 4.2. *For any two firms i and i' only differing in their employment of foreign workers from country x' such that $\lambda_i^{x'} < \lambda_{i'}^{x'}$ $\forall x' \neq x$, then $q_i^x < q_{i'}^x$.*

Empirically, we should also observe that employing foreign workers from any other country than the export destination, fosters exports at the intensive margin. This would corroborate the existence of a productivity channel.

Table 2 summaries the theoretical predictions of the model regarding the impact of foreign workers on their firms' export performance at both trade margins.

Table 2: Impacts of foreign workers on their firm's export performance

	PRODUCTIVITY channel	**TRADE-COST channel**	
		variable cost	fixed cost
	g_i	τ_i^x	f_i^x
Extensive margin			
$\mathrm{d}\Pr\left(\pi_i^x \geq 0\right)/\mathrm{d}\lambda_i^x$	+	+	+
$\mathrm{d}\Pr\left(\pi_i^x \geq 0\right)/\mathrm{d}\lambda_i^{x'}$	+	0	0
Intensive margin			
$\partial q_i^x/\partial \lambda_i^x$	+	+	0
$\partial q_i^x/\partial \lambda_i^{x'}$	+	0	0

5 Empirical strategy and results

In this section, we detail our empirical strategy to test our theoretical predications. One theoretical result we get is that firms can be ranked, for a given year and a given destination, according to their export performance. Thus, we investigate the effect of foreign workers on their firm's exports by comparing firms at the year-destination level.

Our dataset contains one domestic country, France, and two export zones indexed by x, the European Community (France excluded) denoted EU, and the rest of the world denoted $nonEU$, such that $x = \{EU, nonEU\}$.

We estimate the following equation:

$$\text{Perf}^x_{i,\,t} = \beta_0 + \beta_1 \text{Mig}_{i,\,t-1} + \beta_2 \ln \text{CapInt}_{i,\,t-1} + \beta_3 \ln \text{Employ}_{i,\,t-1} + \beta_4 \ln \text{Age}_{i,\,t} + \theta^x_t + \rho_s + \varepsilon^x_{i,\,t} \quad (22)$$

$\text{Perf}^x_{i,\,t}$ is the dependent variable and denotes the export performance of firm i at time t on a foreign market x. We analyse exports at both the extensive and the intensive margins of trade. When studying the extensive margin, we explore the entry and the participation probabilities, as well as the number of export destinations per zone (in logarithm), that is the number of foreign countries in zone x towards which the firm exports, and the number of CN8 products exported per zone (in logarithm). When studying the intensive margin, our dependant variable is the logarithm of the value exported towards zone x, $\text{Perf}^x_{i,\,t} = \ln\left(q^x_{i,\,t}\right)$. We consider the total value exported (we do not distinguish by products).

In line with our theoretical model, we include year-destination fixed effects, θ^x_t, to investigate variations within this dimension, that is across firms at a given time and a given destination[9].

Our main variable of interest is denoted $\text{Mig}_{i,\,t-1}$ and represents the share of foreign workers (disregarding their region of birth) employed by firm i at time $t-1$. We expect foreign employment to be positively related to the firm's export performance.

We include firm-level controls that may affect firms' performances, and thus the export hierarchy across firms at a given time and for a given zone. $\text{CapInt}_{i,\,t-1}$ denotes the firm's capital intensity and is measured by the gross fixed assets per employee, $\text{Employ}_{i,\,t-1}$ denotes the size of the firm approximated by the number of employees, and $\text{Age}_{i,\,t}$ is the age of the firm since its creation. We expect the capital intensity and the size of the firm to impact positively its export performance.

We also include sectoral time-invariant dummies, ρ_s, to control for unobserved heterogeneity across sectors. We attribute to each firm the 2-digit sector of its main NC8 exported product. Finally, β_0 is a constant term, β_1, β_2, β_3 and β_4 are parameters to be estimated, and $\varepsilon^x_{i,\,t}$ is the standard error term. Standard errors are clustered at the sector-year level. We use the White correction for heteroscedasticity.

In the next sub-sections, we investigate the impact of foreign employment on exports at the extensive and at the intensive margins of trade. We then investigate foreign skilled employment.

5.1 Extensive margin of trade

We start by investigating the impact of foreign employment on exports at the extensive margin of trade. Several measures of the extensive margin can be used. First, we investigate the impact of foreign employment on the entry probability. We define the entry dummy variable as such: a firm enters a foreign market x at time t if it did not serve this market at time $t-1$, and serves it at time t. The value of this entry dummy is unconditional to the number of years the firm is serving the market. Due to the size of the sample, we estimate equation (22) using a linear probability model (LPM) [10].

Results with respect to the entry probability are presented in the first three columns of Table 3. In column 1, we regress the entry dummy variable on the share of foreign workers using the whole sample of firms (EU and non-EU exporters). Surprisingly, the estimate of the effect of immigrant workers on the entry behaviour is not significant which is not consistent with our theoretical predictions nor with

[9] Since our data is zone-specific and not country-specific, it is not straightforward to use macro-level control variables here, such as the bilateral distance or the GDP of the export destination. Thus, we include a set of year-destination fixed effects in order to control as much as possible for destination-specific unobserved heterogeneity.

[10] To check that the LMP estimates are not misleading, we performed a number of preliminary estimations using a standard conditional logit model and find results pretty close to those obtained with a LPM. We simply favour LPM estimates to logit estimates because of computational constraints.

the literature. We replicate this estimation restricting our sample to firms exporting towards non-EU countries in column 2, and to firms exporting towards EU countries in column 3. We find that the nil effect of immigrant workers holds for both sub-samples. However, this result should be considered with caution. The entry dummy variable allows us to capture firms that start exporting only, and excludes information related to the export status of the firms. In other words, we do not take into account firms that are exporters at time $t-1$ and at time t, nor firms that export at time $t-1$ but do not at time t.

We widen the picture by investigating the participation of firms to foreign markets. Using a LPM, we regress a participation dummy variable taking the value of 1 if the firm exports towards a foreign market x at time t, 0 otherwise. Doing so, we only look at the export status of the firm with respect to market x.

Results are presented in the last three columns of Table 3. We find that the share of foreign workers has a significantly positive impact on the probability of exporting. The effect is at play when looking at the whole sample of exporting firms (column 4), and when looking at firms exporting either towards non-EU or towards EU countries (columns 5 and 6). The results are now as we expected, but the magnitude of the coefficients is rather low.

Such mixed results regarding the effect of immigrants on the extensive margin of trade may be explained by the structure of the data. Since we are working at the zone level, and not at the country level, the within-zone variance of entry and participation probabilities across firms are very low. A large set of firms are exporting to both EU and non-EU zones every year, which makes more difficult the identification of the effect of foreign employment on exports at the extensive margin.

Table 3: Extensive margin: entry and participation

Dep. variable:	Entry dummy			Participation dummy		
Sample (x)	whole	nonEU	EU	whole	nonEU	EU
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{Mig}_{i,\,t-1}$	-0.002	-0.002	-0.001	0.059^a	0.074^a	0.043^a
	(0.010)	(0.012)	(0.013)	(0.009)	(0.017)	(0.009)
$\text{CapInt}_{i,\,t-1}$	-0.002^a	0.004^a	-0.017^a	0.008^c	0.029^a	-0.012^a
	(0.002)	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)
$\text{Employ}_{i,\,t-1}$	0.018^a	0.017^a	0.022^a	0.047^a	0.077^a	0.017^a
	(0.001)	(0.002)	(0.002)	(0.006)	(0.001)	(0.001)
$\text{Age}_{i,\,t}$	-0.012^a	-0.011^a	-0.015^a	-0.001	-0.000	-0.001
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)
Observations	254,071	187,059	67,012	1,315,948	657,974	657,974
R^2	0.004	0.005	0.006	0.026	0.058	0.005
Zone-year fixed effects	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Cluster - sector level	yes	yes	yes	yes	yes	yes

Standard errors in parentheses. Intercept not reported.

^{a} and ^{c} respectively denote significance at the 1% and 10% level.

We follow our analysis by studying the effect of immigrant workers on an alternative dependant variable. We use the number (in logarithm) of foreign countries towards which a firm exports within a given zone. Here, we only look at exporting firms, thus the dependant variable is non-negative. Using

this measure allows us to gain some variance across firms. In addition, this approach is justified by the fact that exporting firms are heterogeneous in many dimensions, including the number of destinations served (Bernard et al., 2012).

Results obtained with a standard OLS procedure are reported in the first three columns of Table 4. We find that immigrant workers have a positive and significant impact on the number of destinations served by their firm. A 10% increase in the share of foreign workers employed by a firm, generates a 2.8% increase in the number of foreign destinations served by that firm. This result is stronger when looking at firms exporting towards EU countries (column 3). Thus, the estimate obtained with the whole sample is particularly driven by firms exporting towards the EU, that is to destinations relatively close from France.

Then, we use the number of exported products per zone as an alternative dependant variable. This measure of the extensive margin of trade is used by Hiller (2013) and is in the spirit of the work of Mayer et al. (2014). With respect to our theoretical model, this last dependant variable is the closest definition of the extensive margin of trade we may found. In our theoretical model, each firm produces a single good in monopolistic competition. Thus, it makes sense to include the product dimension in our empirical analysis. Crucially, using this variable allows us to take into account that a large number of firms are multi-product firms.

Results are reported in the last three columns of Table 4. Here again, we find that foreign-born workers impact positively and significantly the number of products exported by their firms, the effect being slightly stronger for firms exporting towards the EU zone.

Table 4: Extensive margin: nr. of destinations and nr. of products

Dep. variable:	ln(nr. of destinations)			ln(nr. of products)		
Sample (x)	whole	nonEU	EU	whole	nonEU	EU
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{Mig}_{i,\,t-1}$	0.286^a	0.274^a	0.294^a	0.374^a	0.355^a	0.385^a
	(0.022)	(0.025)	(0.033)	(0.031)	(0.040)	(0.043)
$\text{CapInt}_{i,\,t-1}$	0.044^a	0.039^a	0.048^a	0.068^a	0.042^a	0.084^a
	(0.002)	(0.004)	(0.002)	(0.005)	(0.003)	(0.004)
$\text{Employ}_{i,\,t-1}$	0.300^a	0.304^a	0.299^a	0.434^a	0.447^a	0.424^a
	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
$\text{Age}_{i,\,t}$	-0.004	-0.004	-0.004	-0.006	0.001	-0.009
	(0.004)	(0.006)	(0.006)	(0.005)	(0.007)	(0.007)
Observations	879,727	326,586	553,141	895,390	335,894	559,496
R^2	0.177	0.184	0.179	0.256	0.284	0.248
Zone-year fixed effects	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Cluster - sector level	yes	yes	yes	yes	yes	yes

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Overall, this set of results on the effect of immigrant workers on exports at the extensive margin points towards the following conclusion. Foreign workers seem to provide a *trade premium* to their employing firm. If the entry probability does not seem to be favoured, immigrant workers increase the participation

of their employer to foreign markets, the number of destinations served and the number of exported products. We interpret these results as favourable evidence of the positive impact of immigrants on exports at the extensive margin of trade. These results corroborate, among other studies, the paper of Koenig (2009) which provides evidence of the positive impact of regional immigration on the probability of local firms to start exporting.

5.2 Intensive margin of trade

We now investigate if variations in the employment of foreign-born workers impact exported quantities. We estimate equation (22) with a standard OLS procedure, using the log-value of exports as a dependant variable. Results are presented in Table 5. We report our baseline estimation for the whole sample of firms in column 1. As we expected, the coefficient associated to the share of foreign workers is positive and highly significant. A 10% increase in the firm's share of immigrant workers increases the quantity exported by around 7%. This result is in line with previous macro and micro-level studies on the topic (Hatzigeorgiou and Lodefalk, 2014). Additionally, our estimate is larger than existing studies which find an average elasticity between 1% and 2%; see the meta-analysis of Genc et al. (2012).

Table 5: Intensive margin: baseline results

Dep. variable: $\ln\left(q^x_{i,t}\right)$			
Sample (x)	whole	nonEU	EU
	(1)	(2)	(3)
$\text{Mig}_{i,t-1}$	0.727^a	0.802^a	0.672^a
	(0.062)	(0.057)	(0.082)
$\text{CapInt}_{i,t-1}$	0.232^a	0.310^a	0.184^a
	(0.014)	(0.013)	(0.008)
$\text{Employ}_{i,t-1}$	0.714^a	0.820^a	0.650^a
	(0.020)	(0.009)	(0.015)
$\text{Age}_{i,t}$	-0.193^a	-0.284^a	-0.133^a
	(0.018)	(0.015)	(0.012)
Observations	895,386	335,893	559,493
R^2	0.227	0.267	0.215
Zone-year fixed effects	yes	yes	yes
Sector dummies	yes	yes	yes
Cluster - sector level	yes	yes	yes

Standard errors in parentheses. Intercept not reported.
^{a} denotes significance at the 1% level.

Columns 2 and 3 present results of the estimations performed on the two sub-samples respectively restricted to non-EU and to EU exporters. With both sub-samples, we find that employing foreign-born workers has a positive effect on exports at the intensive margin. The estimated coefficients associated to foreign employment appear significantly positive, yet slightly lower for the sample of firms exporting towards the EU. EU exports react relatively less to a change in foreign employment than non-EU exports. If foreign workers provide information about their origin countries' to their firm, this information advantage could be less valuable if immigrants are EU citizens than if they come from a more distant country. In other words, destination-specific information may be more valuable for trading activities with

non-EU countries than with EU countries. This would be consistent with the fact that EU countries are close to France in many dimensions such that firms would not require much information to export towards the EU.

We then test whether our results are driven by our measure of immigration at the firm-level. As suggested by Hatzigeorgiou and Lodefalk (2011), we use the total number of immigrant workers as an independent variable, instead of using the share of immigrant workers. To illustrate the difference, let us take an example with two identical firms only differing in their foreign employment. The first one employs one foreign worker over ten workers, the second one employs ten foreign workers over one hundred workers. Looking at the share of foreign workers, these two firms are perfectly similar and should retrieve the same benefits from employing foreign workers. Nonetheless, doing so, we neglect the fact that each foreign worker may bring some additional benefits to his employing firm, in terms of both productivity and information on foreign markets. Using the number of foreign workers allows us to capture this effect. Results are presented in Table 15, in Appendix section A. We find similar results as those obtained in Table 5, which confirms the pro-trade effect of foreign-born workers on exports at the intensive margin. As we expected, the magnitude of the estimate is lower when we use the number instead of the share of foreign workers.

5.3 Foreign skilled workers and exports

We now investigate the effect of foreign skilled workers on export behaviours. Following the literature, these workers are supposed to have more abilities than low-skilled foreign workers to transform their knowledge on foreign markets into real trade opportunities for their firm (Hiller, 2013). Up to now, we have provided evidence of the pro-trade effect of immigrant workers, unconditionally to their skill level. We expect the effect of foreign skilled workers on their firm's exports to be larger than the effect of foreign workers as a whole (disregarding their qualifications).

We now use as an independent variable the share of foreign skilled workers in the firm's skilled workforce, denoted $\text{SkilledMig}_{i,t-1}$, instead of using the share of foreign workers within the firm. This variable is derived from an index presented in section 3, which allows us to rank all workers employed by French firms according to their skill intensity (cognitive intensity), and to designate as *skilled* workers the 25% of workers composing the right tail of the distribution.

Extensive margin of trade

First, let us analyse the extensive margin of trade by using the number of export destinations per zone as our dependent variable. In the first five columns of Table 6, we report the results when we use the cognitive intensity definition of skilled workers.

In column 1, we replicate the baseline specification presented in Table 4 column 1, but we restrict our sample to firms on which we have information on the skill composition of their workforce, in order to get a benchmark coefficient. We find a significantly positive impact of foreign employment on the number of destinations served by the firm.

In column 2, we analyse the share of foreign skilled workers. As we expected, we find that foreign skilled workers have a significantly positive impact on exports at the extensive margin. The elasticity obtained is much larger than the benchmark elasticity obtained in column 1. A 10% increase in the share

of foreign skilled employment generates a 2.2% increase in the number of destinations served, while a 10% increase in the total foreign employment generates a 1.3% increase.

In column 3, we add the share of skilled workers (disregarding their birth countries) within the firm in our specification ($\text{Skilled}_{i,t-1}$). We find that the effect of foreign skilled workers on exports is resistant to the introduction of this variable. Both coefficients associated to foreign skilled workers and skilled workers are significantly positive. In addition, the coefficient associated to foreign skilled workers is still larger that the benchmark coefficient (column 1). This results is in line with the literature showing that skilled foreign workers have an influence on the strategic decisions of their firms.

In columns 4 and 5, we replicate the same estimations as in columns 2 and 3, but using a more restrictive measure of skilled workers. We now define as skilled workers the 5% of workers composing the right tail of the distribution of skills across workers. These workers are likely to be executives and top-managers, that is to occupy decisional positions within their firm. We nevertheless find no effect of high skilled immigrants on exports at the extensive margin. We believe that this measure may be too restrictive since it reduces drastically the number of firms employing foreign skilled workers. For instance, EU-born and non-EU-born workers both represent in average less than 0.001% of the total skilled workforce.

Then, we look at the number of products exported per zone. Results are presented in the last five columns of Table 6. Here again, we find a significantly positive effect of foreign skilled workers on the number of products exported by their firm. A 10% increase in the share of foreign skilled workers generates a 2.9% increase in the number of products exported by the firm (column 7), while a 10% increase in the total foreign employment generates a 1.7% increase (column 6). The introduction of the share of skilled workers in the specification (column 8) does not alter the sign nor the significance level of the coefficient associated to the employment of skilled immigrants. Looking at columns 9 and 10, we still find no effect of foreign top-skilled workers on exports at the extensive margin.

Intensive margin of trade

We follow our analysis by looking at exports at the intensive margin. In Table 7, we report the results when we use the cognitive intensity definition of skilled workers.

In column 1, we replicate the baseline specification presented in Table 5 column 1, but here again we restrict our sample to firms on which we have information on the skill composition of their workforce. We find a significantly positive impact of foreign employment on the number of destinations served by the firm.

In column 2, we use as an independent variable the share of foreign skilled workers. We find a positive and significant coefficient associated to this variable. As we expected, this elasticity is higher than the elasticity obtained when looking at the share of foreign workers disregarding their skill level (column 1). A 10% increase in the share of foreign skilled workers generates a 5.2% increase in the number of destinations served by the firm, while a 10% increase in the total foreign workforce generates a 4.7% increase. Thus, if immigrant workers have a positive effect on the quantities exported, a large part of this effect comes from skilled immigrants. In column 3, we find that the effect of foreign skilled workers on exports is resistant to the introduction of the share of skilled workers in the specification.

In columns 4 and 5, we replicate the same estimations but using a more restrictive measure of skilled workers (5% threshold). Similarly to the results found for the extensive margin of trade, we find no effect of high skilled immigrants on exports at the intensive margin.

Table 6: Extensive margin and cognitive skills

Dep. variable:	ln(nr. of destinations)					ln(nr. of products)				
Sample (x)	whole (1)	whole (2)	whole (3)	whole (4)	whole (5)	whole (6)	whole (7)	whole (8)	whole (9)	whole (10)
$\text{Mig}_{i,t-1}$	0.132^a					0.174^a				
	(0.017)					(0.025)				
$\text{SkilledMig}_{i,t-1}$ (25%)		0.222^a	0.197^a				0.294^a	0.258^a		
		(0.025)	(0.024)				(0.031)	(0.029)		
$\text{SkilledMig}_{i,t-1}$ (5%)				0.011	0.042				0.247	0.204
				(0.271)	(0.272)				(0.508)	(0.512)
$\text{Skilled}_{i,t-1}$ (25%)			0.182^a					0.274^a		
			(0.018)					(0.035)		
$\text{Skilled}_{i,t-1}$ (5%)					-0.215					-0.443^a
					(0.146)					(0.131)
$\text{CapInt}_{i,\,t-1}$	0.059^a	0.056^a	0.055^a	0.057^a	0.057^a	0.087^a	0.082^a	0.081^a	0.083^a	0.083^a
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.009)	(0.009)	(0.009)	(0.009)
$\text{Employ}_{i,\,t-1}$	0.309^a	0.304^a	0.317^a	0.305^a	0.305^a	0.452^a	0.449^a	0.467^a	0.449^a	0.449^a
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)
$\text{Age}_{i,\,t}$	0.010	0.004	0.006	0.002	0.002	0.013	0.008	0.011	0.006	0.006
	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Observations	237,029	237,029	237,029	237,029	237,029	244,989	244,989	244,989	244,989	244,989
R^2	0.180	0.178	0.180	0.178	0.178	0.269	0.274	0.276	0.273	0.273
Zone-year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Cluster - sector level	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Standard errors in parentheses. Intercept not reported.
^{a} denotes significance at the 1% level.

At this stage, our main results are the following: The pro-trade effect of immigrants is clearly at play at both trade margins. The number of destinations served, the number of exported products and the exported value, all positively react to foreign-born employment. We have also presented evidence supporting a larger pro-trade effect of skilled workers. The next section aims at better identifying the channels by which immigrants favour trade at the firm-level.

6 Disentangling the *productivity* from the *trade-cost* channel

We follow our analysis by identifying the two effects of immigrant workers emphasised in our theoretical model, namely the productivity and the trade-cost channels. More precisely, we intend to disentangle the effect of foreign workers on the productivity of their firm, from their effect on variable and fixed export-costs.

To this end, we distinguish foreign workers by region of birth. It allows us to estimate separately the effect of foreign workers born in zone x on the exports of their firm towards zone x, and the effect of foreign workers born in another zone x' on the exports of their firm towards zone x. We expect workers born in the export zone to impact both the productivity of their firm *and* to provide valuable information on their home countries that reduces export-costs. We expect foreign workers not born in the export destination to only impact the productivity of their firm and have no informational effect. In our specification (equation 22), we replace the main variable of interest by the two following variables: $\text{Mig}^{EU}_{i,\,t-1}$ which denotes the share of foreign workers born in the European Union employed by firm i at time $t-1$, and $\text{Mig}^{nonEU}_{i,\,t-1}$ which denotes the share of foreign workers born outside the EU employed by firm i at time $t-1$.

Table 7: Intensive margin and cognitive skills

Dep. variable: $\ln\left(q^x_{i,t}\right)$					
Sample (x)	whole	whole	whole	whole	whole
	(1)	(2)	(3)	(4)	(5)
$\text{Mig}_{i,t-1}$	0.473^a				
	(0.051)				
$\text{SkilledMig}_{i,t-1}$ (25%)		0.519^a	0.468^a		
		(0.070)	(0.068)		
$\text{SkilledMig}_{i,t-1}$ (5%)				-0.349	-0.346
				(0.612)	(0.617)
$\text{Skilled}_{i,t-1}$ (25%)			0.393^a		
			(0.029)		
$\text{Skilled}_{i,t-1}$ (5%)					-0.025
					(0.357)
$\text{CapInt}_{i,\,t-1}$	0.287^a	0.314^a	0.313^a	0.316^a	0.316^a
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
$\text{Employ}_{i,\,t-1}$	0.743^a	0.743^a	0.769^a	0.743^a	0.743^a
	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)
$\text{Age}_{i,\,t}$	-0.180^a	-0.202^a	-0.198^a	-0.205^a	-0.205^a
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Observations	244,989	244,989	244,989	244,989	244,989
R^2	0.268	0.269	0.270	0.268	0.268
Zone-year fixed effects	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Cluster - sector level	yes	yes	yes	yes	yes

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

However, following the literature, foreign workers may help their firm to export towards other countries than their origin countries, because they have a *general* knowledge about foreign markets. As we look at export zones, and not at countries, this effect of knowledge transferability, that is likely to be higher for foreign markets closed to the worker's origin country, is partially taken into account in our estimations.

We first estimate the impact of immigrant workers by region of birth on the extensive margin of trade. We report the results in Table 8. In columns 1 and 2, we regress the number of export destinations per zone on different firm-level controls and on the zone-dependent measures of foreign employment. We estimate the effect of both types of immigrants on two sub-samples respectively composed of EU and non-EU exporters. We find that the number of destinations served by the firm outside of the EU are relatively more affected by immigrants from outside the EU than by immigrants born in the EU (column 1). Similarly, immigrants born in the EU have a larger impact on the number of destinations served by their firm within the EU zone, than immigrants born outside the EU (column 2).

Then, in columns 3 and 4, we look at the number of products exported per zone. We find similar evidence as when we focus on the number of export destinations per zone.

Finally, we estimate the impact of immigrant workers by region of birth on the exports value per zone. We report the results in Table 9. As we expected, we find that immigrant workers increase more the exported quantities towards countries of their origin zone than towards other countries.

This set of results is in line with our theoretical predictions. On the one hand, we underline that immigrants, disregarding their origin country, have a positive impact the their firm's exports. This could be a first evidence that immigrants impact the *productivity* of their firm, and it corroborates papers studying the migration-productivity nexus. On the other hand, we show that immigrants convey market-specific information that is likely to reduce variable and fixed export-costs. This evidences the existence of a trade-cost channel largely documented in the literature.

7 Endogeneity concerns and alternative empirical strategy

An important endogeneity concern when estimating the impact of immigration on trade is the existence of the reverse causality. As documented in the paper of Hatzigeorgiou and Lodefalk (2014), existing studies adopting instrumental variable techniques show that the causal relation runs from migration to trade. However, the authors underline that this result may not be generalised. It may well be the case that migration depends on the conditions of the host country's labour market, which in turn depend on the importance of trade in that country's economy.

At the micro-level, firms may favour the employment of foreign workers coming from the destinations with which they already have a commercial experience, or where they intend to export. In other words, firms' export performance may determine their decisions to employ immigrant workers. To the best of our knowledge, only one paper evidences this reverse causality at the firm-level. Molina and Muendler (2013) show that firms planning to export prepare their workforce by hiring workers from other exporters, in order to get a better access to the foreign market targeted.

The estimations presented previously might thus present an endogeneity bias. Ideally, we would need an instrumental variable at the firm-level that affects the firm's foreign employment but not its exports. We could use an instrument at the regional-level, for instance lagged regional immigration stocks as done by Koenig (2009) or the average number of immigrants who are employed in other firms in the same industry as done by Hiller (2013). However, using a regional- or an industry-level instrument does not allow us to keep the firm-level dimension of our analysis.

We therefore propose an alternative empirical strategy that allows us to keep information on foreign employment at the firm-level. We estimate the average treatment effect of employing immigrant workers on export behaviours. To do so, we use the propensity score matching (PSM) method which is now widely used in the estimation of treatment effects (Rosenbaum and Rubin, 1983). This method allows us to overcome the problem that firms employing immigrant workers may be different from firms employing none[11].

We consider the effect of an increase in foreign employment between time $t-2$ and time $t-1$ on export behaviours. Let T_i denotes the treatment dummy variable for firm i taking the value of 1 if $\text{Mig}_{i,\,t-1} > \text{Mig}_{i,\,t-2}$, and 0 otherwise. We are able to identify two groups of firms, the treated group formed by all firms with $T_i = 1\,\forall i$, and the non-treated group formed by all firms with $T_i = 0\,\forall i$.

[11] Of course, we bear in mind that a PSM approach allows to deal with endogeneity issues only because we assume that we can observe most of the factors driving the potential bias, that is all important variables that affect a firm's treatment. The richness of our dataset allows us to believe that selection on unobservables is negligible, and that the PSM approach allows for causal inference.

Table 8: Extensive margin and foreign employment by zone of birth

Dep. variable:	ln(nr. of destinations)		ln(nr. of products)	
Sample (x)	non-EU	EU	non-EU	EU
	(1)	(2)	(3)	(4)
$\text{Mig}^{EU}_{i,\,t-1}$	0.175^a	0.193^a	0.266^a	0.255^a
	(0.046)	(0.058)	(0.052)	(0.059)
$\text{Mig}^{nonEU}_{i,\,t-1}$	0.218^a	0.186^a	0.286^a	0.237^a
	(0.026)	(0.024)	(0.036)	(0.026)
$\text{CapInt}_{i,\,t-1}$	0.048^a	0.039^a	0.084^a	0.042^a
	(0.002)	(0.004)	(0.004)	(0.003)
$\text{Employ}_{i,\,t-1}$	0.299^a	0.304^a	0.424^a	0.447^a
	(0.006)	(0.005)	(0.006)	(0.005)
$\text{Age}_{i,\,t}$	-0.004	-0.004	-0.009	0.001
	(0.006)	(0.006)	(0.007)	(0.007)
Observations	553,141	326,586	559,496	335,894
R^2	0.179	0.184	0.248	0.341
Zone-year fixed effects	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes
Cluster - sector level	yes	yes	yes	yes

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Table 9: Intensive margin and foreign employment by zone of birth

Dep. variable: $\ln\left(q^x_{i,\,t}\right)$		
Sample (x)	nonEU	EU
	(1)	(2)
$\text{Mig}^{EU}_{i,\,t-1}$	0.458^a	1.008^a
	(0.017)	(0.060)
$\text{Mig}^{nonEU}_{i,\,t-1}$	0.497^a	0.505^a
	(0.077)	(0.073)
$\text{CapInt}_{i,\,t-1}$	0.185^a	0.310^a
	(0.008)	(0.013)
$\text{Employ}_{i,\,t-1}$	0.650^a	0.819^a
	(0.015)	(0.009)
$\text{Age}_{i,\,t}$	-0.133^a	-0.284^a
	(0.012)	(0.015)
Observations	559,493	335,893
R^2	0.216	0.267
Zone-year fixed effects	yes	yes
Sector dummies	yes	yes
Cluster - sector level	yes	yes

Standard errors in parentheses.

Intercept not reported.

^{a} denotes significance at the 1% level

The first step of this estimation technique is to check that the economic characteristics (except the export performance) of the two groups of firms are not statistically different, to ensure that our estimation will not be biased by a selection effect among the two groups. In Table 16 (Appendix, section A), we present a number of descriptive statistics for the two groups of firms. We also present the T-statistics showing whether or not the mean of each variable is equal among the two groups. The null hypothesis cannot be rejected for all variables, suggesting that treated firms are not different, on average, from firms that are not treated.

Then, using a standard logit model, we regress the treatment dummy variable (T_i) on various firm-level observables[12]. We consider here variables that are well-know to be compatible with gravity firm-level equations. Estimation results are presented in Appendix, section A, Table 17.

We are able to assign to each firm an estimated probability – a score – to be treated by using the predicted values derived from the logit estimation. This score allows us to match a treated firm i ($T_i = 1$) with one non-treated firm i' ($T_{i'} = 0$) that exhibits a score close to the score of firm i. We can then investigate differences in export outcomes between treated and non-treated firms, that is between firms having very close probabilities to employ immigrant workers, but which are actually different in their foreign employment.

For both margins, the estimated average treatment effect on treated firms is presented in Table 10, column 1. The three coefficients are positive and highly significant, which confirm our previous findings obtained using a standard regression analysis. Being treated leads, *ceteris paribus*, to an increase in export outcomes, that is in the number of export destinations, the number of products exported and the exported quantities. Thus, both margins of trade react positively to foreign employment.

In the next columns of the table, we study different treatment effects[13]. In column 2, we look at an increase in the number of foreign workers between time $t-2$ and time $t-1$, instead of looking at an increase in the share. We still find a significantly positive impact of foreign employment on export behaviours. As we expected, the magnitude of this effect is lower when we look at the increase in the number than when we look at an increase in the share.

We then study the effect of an increase in the employment of foreign-born workers between time $t-5$ and time $t-4$ in order to control for remaining endogeneity concerns. Estimated results presented in column 3 are significantly positive confirming previous results on both margins of trade. In addition, the coefficients are higher as compared to those obtained in column 1, suggesting that immigrants need time to integrate within their firm and thus to impact the productivity and the export decisions of their firm.

To check the robustness of our results, we reproduce the same estimations using an alternative matching algorithm. We use a 5-neighbour instead of a one-to-one matching algorithm which allows us to check whether our results depend upon the matching strategy we use or not. Instead of comparing a treated firm with the closest non-treated firm, we now compare a firm with the five closest non-treated firms. Results are presented in Table 11. We find that our results do not seem to be driven by the matching algorithm, and confirm the positive effect of foreign workers on exports at both margins. Not surprisingly, the magnitude of the effects is lower when we use a 5-neighbour rather than a one-to-one matching algorithm, simply because the matching operation is less precise.

[12] We have also used a probit model, and results are qualitatively similar to the ones presented in the current version of the paper. Those results are available upon request to the authors.

[13] Although not reported here, we perform a first-stage analysis for each treatment variable and find no selection bias between the two groups of firms studied.

Then, we investigate whether our results on foreign skilled workers are robust to the estimation technique used. The treatment now consists to increase the share of foreign skilled workers. We first use the cognitive intensity dimension to define skilled workers. Results obtained with the one-to-one matching algorithm are presented in Table 12 and confirm the pro-trade effect of skilled foreign workers. We find that skilled foreign workers have a positive impact on both trade margins. This result is robust to the use of 4-year lags. The treatment effects obtained are, in most cases, higher than the effects obtained when looking at an increase in the total foreign employment of the firm (Table 10, column 1).

We check the robustness of our results using a 5-neighbour matching algorithm. Results are presented in Appendix section A, Table 18, and are consistent with previous evidence despite the lower precision of the matching procedure.

We finally investigate whether our results on foreign workers by zone of birth hold when we use a PSM method. The regression analysis allow us to control for both variations in the employment of the EU-born and non-EU born workers simultaneously, but doing so using the PSM technique is less straightforward. We instead consider the following treatment: a firm i is treated if its share of EU-born workers increases relatively more than its share of non-EU-born workers between time $t-2$ and time $t-1$. Estimates for both trade margins are presented in Table 13. In column 1, we restrict the sample of firms to non-EU exporters, and in column 2 we restrict the sample to EU exporters. We find that all estimates are positive and significant. We also find that an increase in the share of non-EU workers relatively to the share of EU-workers favour more exports towards non-EU countries than towards EU countries. This result suggests that immigrants favour trade through both a productivity and a trade-cost channel. For each dependant variable, we can interpret the difference between the two coefficient as an indirect measure of the trade-cost channel. Additionally, the largest discrepancy between the estimates of the two sub-samples is observed for the number of exported products. This suggests that exporting products to distant markets requires information about local consumers' tastes and preferences.

We check the robustness of our results using 4-year lagged variables to build our treatment variables. Results are reported in Table 14. We also reproduce our analysis using a 5-neighbour matching algorithm. These results are reported in Appendix section A, Tables 19 and 20. All those tests confirm our previous findings and thus the robust effect of immigrant workers on exports at both margin of trade.

Table 10: Exports and foreign workers – PSM: one-to-one matching algorithm

Sample (x): whole			
	(1)	(2)	(3)
Treatment	$\text{Mig}_{t-1} > \text{Mig}_{t-2}$	$\text{Mig}^{nb}_{t-1} > \text{Mig}^{nb}_{t-2}$	$\text{Mig}_{t-4} > \text{Mig}_{t-5}$
ln(nr. of destinations)	0.208^a	0.165^a	0.310^a
	(0.006)	(0.006)	(0.007)
ln(nr. of products)	0.336^a	0.289^a	0.445^a
	(0.007)	(0.007)	(0.008)
$\ln\left(q^x_{i,t}\right)$	0.316^a	0.217^a	0.534^a
	(0.012)	(0.013)	(0.015)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Table 11: Exports and foreign workers – PSM: 5-neighbour matching algorithm

Sample (x): whole			
	(1)	(2)	(3)
Treatment	$\text{Mig}_{t-1} > \text{Mig}_{t-2}$	$\text{Mig}^{nb}_{t-1} > \text{Mig}^{nb}_{t-2}$	$\text{Mig}_{t-4} > \text{Mig}_{t-5}$
ln(nr. of destinations)	0.072^a	0.036^a	0.186^a
	(0.004)	(0.004)	(0.005)
ln(nr. of products)	0.120^a	0.078^a	0.248^a
	(0.004)	(0.005)	(0.006)
$\ln\left(q^x_{i,\,t}\right)$	0.136^a	0.060^a	0.374^a
	(0.009)	(0.009)	(0.010)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Table 12: Exports and cognitive skills – PSM: one-to-one matching algorithm

Sample (x): whole		
	(1)	(2)
Treatment	$\text{SkilledMig}_{t-1} > \text{SkilledMig}_{t-2}$	$\text{SkilledMig}_{t-4} > \text{SkilledMig}_{t-5}$
ln(nr. of destinations)	0.233^a	0.344^a
	(0.010)	(0.013)
ln(nr. of products)	0.354^a	0.474^a
	(0.011)	(0.015)
$\ln\left(q^x_{i,\,t}\right)$	0.311^a	0.562^a
	(0.020)	(0.26)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Table 13: Exports and foreign employment by zone of birth (I) – PSM: one-to-one matching algorithm

Sample (x)	nonEU	EU
	(1)	(2)
Treatment	$\left(\text{Mig}^{EU}_{t-1} - \text{Mig}^{EU}_{t-2}\right) < \left(\text{Mig}^{nonEU}_{t-1} - \text{Mig}^{nonEU}_{t-2}\right)$	$\left(\text{Mig}^{EU}_{t-1} - \text{Mig}^{EU}_{t-2}\right) < \left(\text{Mig}^{nonEU}_{t-1} - \text{Mig}^{nonEU}_{t-2}\right)$
ln(nr. of destinations)	0.496^a	0.319^a
	(0.009)	(0.011)
ln(nr. of products)	0.606^a	0.324^a
	(0.011)	(0.012)
$\ln\left(q^x_{i,\,t}\right)$	0.839^a	0.623^a
	(0.017)	(0.021)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

Table 14: Exports and foreign employment by zone of birth (II) – PSM: one-to-one matching algorithm

Sample (x)	nonEU	EU
	(1)	(2)
Treatment	$\left(\text{Mig}_{t-4}^{EU} - \text{Mig}_{t-5}^{EU}\right)$ $< \left(\text{Mig}_{t-4}^{nonEU} - \text{Mig}_{t-5}^{nonEU}\right)$	$\left(\text{Mig}_{t-4}^{EU} - \text{Mig}_{t-5}^{EU}\right)$ $< \left(\text{Mig}_{t-4}^{nonEU} - \text{Mig}_{t-5}^{nonEU}\right)$
ln(nr. of destinations)	0.482^a	0.388^a
	(0.012)	(0.014)
ln(nr. of products)	0.665^a	0.363^a
	(0.014)	(0.015)
$\ln\left(q_{i,\,t}^{x}\right)$	0.846^a	0.756^a
	(0.022)	(0.027)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.

8 Conclusion

This paper investigates the pro-trade effect of immigrants at the firm-level. Theoretically, we rationalise the effect of immigrant workers on their firm's exports at both margins of trade. We show that immigrant workers convey valuable information about their home countries which reduces the variable and the fixed export-costs of their firm towards their origin countries. In addition, we evidence that immigrants increase their firm's productivity, which, in turn, increases exports towards any foreign countries. We underline that the intensive margin is determined by the productivity and the variable export-costs of the firm, while the extensive margin is also determined by the fixed export-costs. Our theoretical framework predicts that the probability to export and the exported quantities should positively react to the employment of foreign workers.

Using a French firm-level dataset over the period 1995-2008, we find a positive effect of foreign-born workers on the number of destinations served, the number of exported products and the exported quantities by their firm. Our results are robust to the use of the propensity score matching method to evaluate the effect of foreign employment on export outcomes. In line with the literature, we find that the pro-trade effect of foreign workers is driven by skilled foreign workers.

In order to disentangle the two channels emphasised in our theoretical model, we distinguish workers by regions of birth. We find that immigrant workers from the EU favour relatively more exports at both margins towards EU countries than immigrants born outside the EU. These results suggest that both productivity and trade-cost channels are at play, although the trade-cost channel effect is quantitatively larger.

Our results suggest a number of policy recommendations to favour French exports. Pro-active immigration policies could create a favourable environment for exporting activities. In that respect, a simplification of labour regulations, especially for skilled immigrants, could create employment incentives for French firms. This would, in turn, create favourable conditions within the employing firm to start exporting or to expand its export activities.

Finally, policy makers should bear in mind that any change in the French migration policy could impact French exports. For instance, a change in the selection of immigrants by region of birth, could

lead to trade creation and/or trade diversion effects. This is due to the fact that immigrants not only impact their firm's productivity, but also their firm's export-costs towards their origin regions.

References

Aleksynska, M. and G. Peri, "Isolating the network effect of immigrants on trade," *The World Economy*, 2014, *37* (3), 434–455.

Arrow, K. J. and F. Hahn, *General Competitive Analysis*, San Francisco: Holden-Day, 1971.

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott, "The Empirics of Firm Heterogeneity and International Trade," *Annual Review of Economics*, 2012, *4* (1), 283–313.

Borjas, G. J., "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *The Quarterly Journal of Economics*, 2003, *118* (4), 1335–1374.

Brücker, H., S. Capuano, and A. Marfouk, "Education, gender and international migration: insights from a panel-dataset 1980-2010," *mimeo*, 2013.

Felbermayr, Gabriel J. and Farid Toubal, "Revisiting the Trade-Migration Nexus: Evidence from New OECD Data," *World Development*, 2012, *40* (5), 928–937.

Genc, M., M. Gheasi, P. Nijkamp, and J. Poot, "The impact of immigration on international trade: a meta-analysis," in P. Nijkamp, J. Poot, and M. Sahin, eds., *Migration impact assessment: new horizons*, Edward Elgar Publishing, 2012, p. 301.

Goldin, I., G. Cameron, and M. Balarajan, *Exceptional people: How migration shaped our world and will define our future.*, Princeton University Press, 2011.

Goodall, K. and J. Roberts, "Only connect: teamwork in the multinational," *Journal of World Business*, 2003, *38* (2), 150 – 164.

Gould, David M, "Immigrant links to the home country: empirical implications for US bilateral trade flows," *The Review of Economics and Statistics*, 1994, pp. 302–316.

Hatzigeorgiou, A, "Migration as Trade Facilitation: Assessing the Links between International Trade and Migration," *The B.E. Journal of Economic Analysis & Policy*, 2010, *10* (1).

Hatzigeorgiou, A. and M. Lodefalk, "Trade and Migration: Firm-Level Evidence," Working paper 06/2011, Örebro University 2011.

__ **and** __ , "Trade, Migration and Integration - Evidence and Policy Implications," *The World Economy*, 2014.

Head, K. and J. Ries, "Immigration and trade creation: econometric evidence from Canada," *Canadian Journal of Economics*, 1998, *31* (1), 47–62.

Hiller, S., "Does Immigrant Employment Matter for Export Sales? Evidence from Denmark," *Review of World Economics*, 2013, *149* (2), 369–394.

Koenig, P., "Immigration and the export decision to the home country," Working paper 31, Paris School of Economics 2009.

Loth, D., "Le fonctionnement des équipes interculturelles," *Management & Avenir*, 2009, (8), 326–344.

Mayer, Thierry, Marc J. Melitz, and Gianmarco I. P. Ottaviano, "Market Size, Competition, and the Product Mix of Exporters," *American Economic Review*, February 2014, *104* (2), 495–536.

Melitz, M. J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

Mitaritonna, C., G. Orefice, and G. Peri, "Immigrants and Firms' productivity: Evidence from France," *CEPII Working Paper*, March 2014, (09).

Molina, D. and M.-A. Muendler, "Preparing to export," Working Paper 18962, National Bureau of Economic Research 2013.

Mrázová, M. and J. P. Neary, "Selection effects with heterogenous firms," Discussion Paper DP9288, Centre for Economic Policy Research January 2013.

Negishi, T., "Monopolistic Competition and General Equilibrium," *Review of Economic Studies*, 1961, *28* (3), 196–201.

Ottaviano, G. I. P. and G. Peri, "Rethinking the effect of immigration on wages," *Journal of the European Economic Association*, 2012, *10* (1), 152–197.

Parrotta, P., D. Pozzoli, and D. Sala, "Ethnic Diversity and Firms' Export Behavior," *IZA Discussion Papers*, 2014, (7923).

—— , —— , and M. Pytlikova, "Labor diversity and firm productivity," *European Economic Review*, 2014, *66*, 144 – 179.

Peri, G. and C. Sparber, "Task Specialization, Immigration, and Wages," *American Economic Journal: Applied Economics*, 2009, *1* (3), 135–169.

—— and F. Requena-Silvente, "The trade creation effect of immigrants: evidence from the remarkable case of Spain," *Canadian Journal of Economics/Revue canadienne d'économique*, 2010, *43* (4), 1433–1459.

Rauch, J.E., "Business and social networks in international trade," *Journal of Economic Literature*, December 2001, *XXXIX*, 1177–1203.

Rosenbaum, Paul R. and Donald B. Rubin, "The central role of the propensity score in observational studies for causal effects," *Biometrika*, 1983, *70* (1), 41–55.

A Additional tables

Table 15: Intensive margin: complementary results

Dep. variable: $\ln\left(q^{x}_{i,\,t}\right)$			
Sample (x)	whole	nonEU	EU
	(1)	(2)	(3)
$\text{Mig}^{nb}_{i,\,t-1}$	0.058^{a}	0.094^{a}	0.034^{a}
	(0.009)	(0.006)	(0.009)
$\text{CapInt}_{i,\,t-1}$	0.232^{a}	0.310^{a}	0.185^{a}
	(0.014)	(0.013)	(0.009)
$\text{Employ}_{i,\,t-1}$	0.708^{a}	0.811^{a}	0.647^{a}
	(0.020)	(0.009)	(0.015)
$\text{Age}_{i,\,t}$	-0.193^{a}	-0.284^{a}	-0.133^{a}
	(0.018)	(0.015)	(0.012)
Observations	895,386	335,893	559,493
R^2	0.226	0.267	0.215
Zone-year fixed effects	yes	yes	yes
Sector dummies	yes	yes	yes
Cluster - sector level	yes	yes	yes

Standard errors in parentheses. Intercept not reported.
^{a} denotes significance at the 1% level.

Table 16: Groups comparison, $T_i = 1$ if $\text{Mig}_{i,\,t-1} > \text{Mig}_{i,\,t-2}$

	Mean		T-test	
Variable	Treated	Non-treated	T-value	P-value
Employment (t-1)	0.633	0.627	0.52	0.602
Labour productivity (t-1)	3.869	3.877	0.38	0.701
Profit growth (t-1)	-0.102	-0.095	-0.88	0.379
Capital Intensity (t-1)	3.517	3.527	1.35	0.176
Age (t-1)	2.771	2.768	0.62	0.538

Table 18: Exports and cognitive skills – PSM: 5-neighbour matching algorithm

Sample (x): whole		
	(1)	(2)
Treatment	$\text{SkilledMig}_{t-1} > \text{SkilledMig}_{t-2}$	$\text{SkilledMig}_{t-4} > \text{SkilledMig}_{t-5}$
ln(nr. of destinations)	0.099^{a}	0.212^{a}
	(0.007)	(0.009)
ln(nr. of products)	0.015^{a}	0.277^{a}
	(0.008)	(0.011)
$\ln\left(q^{x}_{i,\,t}\right)$	0.194^{a}	0.439^{a}
	(0.014)	(0.019)

Standard errors in parentheses. Intercept not reported.
^{a} denotes significance at the 1% level.

Table 17: Results from logit regression used to compute propensity scores

	(1)
Dep. Variable	$T_i = 1$ if $\text{Mig}_{i,\,t-1} > \text{Mig}_{i,\,t-2}$
Employment $(t-1)$	-0.077^a
	(0.006)
Labour productivity $(t-1)$	-0.063^a
	(0.003)
Profit growth $(t-1)$	-0.002^a
	(0.001)
Capital Intensity $(t-1)$	0.089^a
	(0.002)
Age $(t-1)$	-0.016^b
	(0.008)
Observations	1132880
R^2	0.0085

Standard errors in parentheses. Intercept not reported.
^{a} and ^{b} respectively denote significance at the 1% and 5% level.

Table 19: Exports and foreign employment by zone of birth (I) – PSM: 5-neighbour matching algorithm

Sample (x)	nonEU	EU
	(1)	(2)
Treatment	$\left(\text{Mig}_{t-1}^{EU} - \text{Mig}_{t-2}^{EU}\right) < \left(\text{Mig}_{t-1}^{nonEU} - \text{Mig}_{t-2}^{nonEU}\right)$	$\left(\text{Mig}_{t-1}^{EU} - \text{Mig}_{t-2}^{EU}\right) < \left(\text{Mig}_{t-1}^{nonEU} - \text{Mig}_{t-2}^{nonEU}\right)$
ln(nr. of destinations)	0.492^a	0.307^a
	(0.007)	(0.008)
ln(nr. of products)	0.605^a	0.316^a
	(0.008)	(0.009)
$\ln\left(q_{i,\,t}^{x}\right)$	0.845^a	0.587^a
	(0.012)	(0.016)

Standard errors in parentheses. Intercept not reported.
^{a} denotes significance at the 1% level.

Table 20: Exports and foreign employment by zone of birth (II) – PSM: 5-neighbour matching algorithm

Sample (x)	nonEU	EU
	(1)	(2)
Treatment	$\left(\text{Mig}_{t-4}^{EU} - \text{Mig}_{t-5}^{EU}\right)$ $< \left(\text{Mig}_{t-4}^{nonEU} - \text{Mig}_{t-5}^{nonEU}\right)$	$\left(\text{Mig}_{t-4}^{EU} - \text{Mig}_{t-5}^{EU}\right)$ $< \left(\text{Mig}_{t-4}^{nonEU} - \text{Mig}_{t-5}^{nonEU}\right)$
ln(nr. of destinations)	0.484^a	0.396^a
	(0.009)	(0.011)
ln(nr. of products)	0.661^a	0.365^a
	(0.011)	(0.011)
$\ln\left(q_{i,\,t}^{x}\right)$	0.842^a	0.746^a
	(0.017)	(0.021)

Standard errors in parentheses. Intercept not reported.

^{a} denotes significance at the 1% level.