Immigrants, occupations and firm export performance

Léa Marchal, Clément Nedoncelle

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Abstract

This paper investigates the export-enhancing effect of immigrant workers and how this effect varies across occupations. We use a dataset made of French manufacturing firms from 1997 to 2009 and address the problem of endogenous employment choice using an IV-2SLS strategy and a doubly robust estimator. Our results show that immigrants in both low- and high-skilled occupations foster exports at both the intensive and the extensive margins. In addition, we show that this effect is spread across all export destinations.

Keywords: Export, Firm, Heterogeneity, Immigrant, Occupation

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1 Introduction

This paper investigates whether French manufacturing firms employing immigrant workers exhibit higher export performance. We revisit two strands of literature. On the one hand, empirical evidence shows that the export-enhancing effect of immigrants is related to the information they convey on foreign countries (Andrews et al., 2017; Hatzigeorgiou and Lodefalk, 2016; Parrotta et al., 2016; Hiller, 2013; Peri and Requena-Silvente, 2010). Existing firm-level studies show that immigrants possess valuable knowledge on foreign markets that decreases variable and fixed costs faced by exporters. Consequently, they foster exports at both extensive and intensive margins, especially toward their origin countries. This pro-trade effect is found to be larger for high-skilled than for low-skilled immigrants, which is in line with the idea that high-skilled individuals are more likely to possess and gainfully apply information that is relevant to exporters. On the other hand, Mitaritonna et al. (2017) suggest that the complementarity between natives and immigrants can lead to task reallocation and to more efficient technological choices. Hence, immigration increases the total factor productivity of firms and, in turn, increase exports at both margins. In contrast with previous evidence, this export-enhancing effect of immigrants channelled through productivity should not be restricted to high-skilled immigrants and should be not destination-specific.

In this paper, we revisit the two aforementioned results of the literature. First, we investigate to what extent the effect holds across immigrants' occupations. Second, we test whether the effect is destination-specific or not. If a productivity channel is at play, as suggested by Mitaritonna et al. (2017), the export-enhancing effect of immigrants should be neither occupation- nor destination-specific.

To do so, we combine three datasets on French manufacturing firms from 1997 to 2009. We identify immigrant workers in a comprehensive dataset containing information on French employees, that we combine with trade data at the firm-destination-product level and balance sheet data at the firm level[1]. Our sample is made of 803,603 observations.

Our estimation strategy allows us to address one main endogeneity concern related to a reverse causality bias: immigrant employment could be driven by the firm's export performance. We implement an IV-2SLS strategy in which we instrument the number of immigrant workers in the firm by the imputed stock of immigrants in the region of the firm based on the 1990 census. We find that both the intensive and the extensive margins positively react to the employment of immigrant workers. A 1% increase in the (instrumented) number of immigrant workers induces a 0.42% increase in the firm's subsequent exports. In addition, we combine our IV strategy with a doubly robust estimator to assess the impact of immigrant employment by occupation groups. We find that the effect is positive and significant for immigrants in both low- and high-skilled occupations.

[1]We define an immigrant as a foreign citizen. Note that we do not have information on the exact citizenship of the workers. Our dataset allows us to distinguish French from foreign citizens only.

In line with existing studies, we argue that the pro-trade effect of immigrants in low-skilled occupations cannot be rationalized by the informational channel which is generally emphasized for high-skilled immigrants, as these workers are less likely to occupy decision-making jobs or to be in a position to transfer operative information about foreign markets to their employer. It could nonetheless be explained by a productivity-enhancing effect of immigrants put forward by the literature on complementarity in tasks (Peri and Sparber, 2009) and in the spirit of Mitaritonna et al. (2017).

We provide a short theoretical model of heterogeneous firms to rationalize the export-enhancing effect of immigrant workers. We allow immigrant workers to impact firm-level exports through two different channels documented in the literature so far: (i) immigrant workers in high-skilled occupations convey valuable information on foreign markets which lowers trade costs and (ii) all immigrant workers have a positive impact on total factor productivity through their complementarity with natives. The export-enhancing effect of immigrants that takes place through productivity is compatible with immigrants in both low- and high-skilled occupations. This model predicts that immigrant workers foster exports to *any* destination. To test this prediction, we exploit variations in exports across destinations to provide empirical evidence for the existence of a *multi-destination* effect of immigrant workers. In line with the theory, our results show that immigrants in both low- and high-skilled occupations reduce the concentration of exports across destinations.

The contribution of this paper is twofold. First, we put forward that immigrants in both low- and high-skilled occupations enhance exports at both intensive and extensive margins. We rationalise this result with a theoretical model of heterogeneous firms in which we describe a simple relationship between immigrant workers, productivity and exports. Available theoretical models have so far focused exclusively on the cost-decreasing effect of immigrants and these models leave no room to rationalise the empirical finding of a pro-trade effect of immigrants in low-skilled occupations. Second, we provide a novel estimation strategy that consists in combining an IV-2SLS method with a doubly robust estimator. This strategy allows us to overcome multi-collinearity issues arising from the inclusion of immigrant employment in both low- and high-skilled occupations in the same estimation. In other words, this method allows us to assess the effect of employing immigrants in a given occupation group while controlling for the remaining stock of immigrant workers employed by the firm.

The paper most closely related to ours is the study of Mitaritonna et al. (2017). As mentioned above, the authors explain their results on the productivity-enhancing effect of immigrants by appealing to the literature on complementarity in tasks. We follow this line of thought but depart from Mitaritonna et al. (2017) in two respects. First, their study deals with the consequences of a local immigration shocks on firms' productivity, while we study the impact of immigrant employment on exports at the firm level. Second, their paper focuses on local immigration shocks pooling together heterogeneous immigrants. In this paper, we only focus on immigrant workers and distinguish between low- and high-skilled occupations.

The remainder of the paper is organized as follows. In the next section, we present the progress and shortcomings of the related literature. In Section 3, we present the French firm-level data used to estimate the pro-trade effect of immigrants and our empirical strategy. In Section 4, we present results in support of the export-enhancing effect of immigrant workers in both low- and high-skilled occupations. In Section 5, we develop a theoretical framework rationalising the effect of immigrants on exports. We then present a number of complementary results aimed at testing the effect across export destinations. Section 6 concludes.

2 How immigrants foster exports

2.1 Immigrants and export know-how

A substantial body of literature provides aggregate evidence on the pro-trade effect of immigrants and link this effect directly to the information and knowledge that immigrants posses. The seminal paper of Gould (1994) and subsequent work surveyed by Rauch (2001) and Parsons and Winters (2014) highlight that immigrants convey information and promote trust between their home and host countries. Their social capital reduces transaction costs and fosters bilateral trade. Most studies suggest that immigrants exert a greatest pro-trade effect on differentiated goods for which the price fails to transmit relevant information. The literature also suggests a larger pro-trade effect of high-skilled and voluntary migrants as compared to low-skilled and forced migrants.

More recent studies use firm-level data to analyse whether immigrant workers impact the export performance of their employing firms. Hiller (2013) shows that in order to access the knowledge embedded in immigrants, firms should indeed employ them. Using Danish data on the manufacturing sector, the author finds that immigrant employment increases the exported volumes and shifts the composition of exports toward immigrants' origin countries. The local presence of immigrants, however, has only a limited impact on exports. To highlight causality, the author instruments the employment of immigrants by the average number of immigrants employed in other firms of the industry, or in other firms of the region. Similarly, Hatzigeorgiou and Lodefalk (2016) use Swedish data and find that immigrant workers – in particular high-skilled and recently arrived individuals – increase exports at both margins to their origin countries, especially for small firms. They also find that low-skilled immigrants have no impact on exports (or even a negative one in some specifications). To overcome endogeneity issues, they use a GMM estimator and instrument the employment of immigrants by the average immigrant employment in other firms of the industry.

Other papers focus on the transmission channels. Using data on Danish manufacturing firms, Parrotta et al. (2016) investigate the causal effect of an increase in ethnic diversity on export outcomes at both margins. The authors measure diversity using differences in spoken languages across workers. They find that more diverse firms perform better on foreign markets along all extensive margin measures. These firms have a higher relational capital which translates

into an increased ability to initiate, manage and expand international business. To control for endogeneity, they use a shift-share instrument and identify supply-driven diversity from exogenous changes in the local labour supply in the 1990's. Then, Andrews et al. (2017) provide evidence on the cost-decreasing effect of high-skilled immigrants at the firm level in Germany. They find that senior immigrants have a stronger export-enhancing effect as they are more likely to hold managerial positions and to influence export decisions. The effect is stronger for exports toward the origin countries of the immigrant workers. In line with the literature, the authors instrument the immigrant employment by the local stock of immigrant workers excluding those employed by the firm.

Theoretically, the effect of immigration on exports has been demonstrated in a study by Peri and Requena-Silvente (2010) using the model of Chaney (2008). The authors assume that immigrants lower both variable and fixed export costs. Thus, less productive firms, that were below the productivity threshold to export, become able to enter the export market when they start employing immigrants. They conclude that the trade-enhancing effect of immigrants should take place at both margins and corroborate this prediction using Spanish data. Their theoretical model, however, hardly accommodate the possibility that low-skilled immigrants foster exports.

2.2 Immigrants, productivity and technology

A recent strand of the literature investigates how immigrants affect technology and the consequent allocation of jobs within and between firms. This literature, pioneered by Peri and Sparber (2009), highlights that natives and immigrants are imperfect substitutes, and that immigrants generate dynamics of task specialization. This re-allocation of tasks, in turn, generates productivity gains and prevents natives' wages to decrease due the presence of immigrants.

In particular, Mitaritonna et al. (2017) explicitly analyse the link between immigration and productivity gains. Using French firm-level data, they find that an increase in the local supply of immigrants increases the productivity of firms located in that area. This productivity upgrade is associated with larger exports. The authors rationalize their results thanks to the literature on complementarity in tasks (Peri and Sparber, 2009). They instrument the local supply of immigrants by a shift-share instrument based on the spatial distribution of immigrants in 1990.

Other papers suggest that industries absorb immigration by adapting their technologies. Lewis (2011) looks at the impact of immigration on the use of new technologies in US manufactures. The author shows that the supply of low-skilled labour is positively related to the use of labour-intensive technologies by firms. Similarly, Gandal et al. (2004) study the impact of Russian immigration on Israeli wages. The authors suggest that a switch in production technology, such as a skill-biased technological change, could have absorbed labour-supply shocks caused by Russian immigration.

Finally, the discussion would be incomplete without mentioning that immigration could have a negative impact on productivity. For instance, ethnic diversity can create linguistic and cul-

tural frictions. Using Danish employer-employee data, Parrotta et al. (2014) find evidence that workforce diversity in term of ethnicity has a negative impact on firms' total factor productivity. They address endogeneity issues by constructing a shift-share instrument where the firm diversity is instrumented using the local diversity of the labour supply.

3 Data and empirical strategy

3.1 Data

We combine three datasets containing information on French firms from 1997 to 2009 by using a single firm administrative identifier (the SIREN number). Below, we present details on each dataset.

Administrative data on employees. We use annual employee declarations of firms (*Déclarations Annuelles des Données Sociales*, DADS) containing exhaustive information on the employment of firms settled on the French mainland territory from 1997 to 2009. This administrative database is made of compulsory reports provided by each employing establishment on the gross earning of its employees. All wage-paying legal entities established in France are required to fill payroll declarations; only establishments employing civil servants are excluded from filling such declarations. Note that this dataset allows us to follow establishments over time, but not to follow employees.

For each year, this dataset allows us to observe the citizenship of each worker (French *versus* foreign). We thus define an immigrant worker as a foreign citizen. In addition, the dataset contains information on worker's place of birth (French- *versus* foreign-born). This allows us to identify foreign-born workers, independently of their citizenship. We use this alternative definition in a robustness test. The dataset, however, does not contain information about the exact citizenship or country of birth of foreign individuals.

Then, the data contains information on workers' occupations. The French classification of occupations (*Nomenclatures des professions et catégories socioprofessionnelles*) classifies workers according to their occupation, hierarchical position and status (salaried employees *versus* others). We use this classification to identify workers in low- and high-skilled occupations. Table A.1 in the online appendix provides more information about these occupation codes. We aggregate this dataset at the firm level and count, for each firm, the number of native and immigrant workers in low- and high-skilled occupations.

After removing obvious outliers and extreme values, the mean characteristics of the DADS dataset are in line with aggregate evidence. For instance, in 2006 in the *Ile-de-France* region, 13.6% of workers are immigrants, while the partial 2006 census estimates that immigrants represent 12.9% of the working-age population. At the national level, immigrant workers represent 7.49% of all workers, which is close to the estimates proposed by Brücker et al. (2013). The

DADS data is made of 20,215,900 firm-year observations that corresponds to an average of 1,555,000 firms per year.

Using firm-level data allows us to focus on immigrant *workers*. In contrast to census data, the DADS data exhaustively covers the employment of immigrants in France. This dataset is thus appropriate for a consistent identification of the pro-trade effect of immigrants on exports *at the firm level*. Using this dataset also allows us to depart from existing studies which use regional immigration data to estimate the effect of local immigration on firms' performance.

Balance-sheet data. We then use balance-sheet data from the annual reports of French firms to the tax administration from 1997 to 2009 (*Bénéfices Réels Normaux*, BRN). This dataset contains information on the value added, capital stock, debt structure and other variables of firms. Importantly, it contains the self-reported sector of the firm which is identified by a NAF code (revision 2). This dataset excludes the agricultural and financial sectors. Importantly, it contains both small and large firms since no threshold applies on the number of employees for reporting to the tax administration.

The sample is made of 6,364,012 firm-year observations that represents between 550,000 and 650,000 firms per year (around 50% of the total number of French firms). After keeping manufacturing firms only, we obtain a sample of 833,571 firm-year observations that can be merged with the DADS sample.

Customs data. We finally use trade data from the French customs from 1997 to 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 mainland 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 export value exceeds 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 share of the total French exports.

We use this dataset to measure four export outcomes. The intensive margin is measured by the total export value, the number of destinations and the number of HS6 products, while the extensive margin is measured by the export participation of the firm.

The dataset contains 28,481,951 observations at the firm-year-destination-product level, which we aggregate into 1,322,384 observations at the firm-year level over which 294,545 can be merged with the DADS-BRN sample.

3.2 Descriptive statistics

The final sample is made of manufacturing firms that appear in both the administrative data on employees (DADS) and the tax records (BRN). After cleaning the dataset, our final sample

contains 127,861 French manufacturers, 13 years and 827,607 firm-year observations. These observations are spread across 24 manufacturing sectors. The main sector is made of manufactures of machinery, equipment and other products in metal. The capital-city region named "*Île de France*" contains the largest concentration of firms. Our sample of firms accounts for 11% of the French employment observed in the DADS data and represents 98% of the profit value and 97% of the value added produced by manufacturing firms included in the BRN data. We then use the trade data to identify exporters. Our sample contains 36% of exporters which represents 53% of the export value contained in the customs data. As a matter of comparison, the manufacturing sector of the BRN data contains 34% of exporters which represents 54% of the export value contained in the customs data[2].

We report a number of firm characteristics in Table 1. The sample includes small and large firms in terms of profit, financial resources and productivity. In terms of employment, our sample contains 96.3% of small and medium size enterprises (with less than 250 employees). This feature comes from the fact that the French administrative data are presumably exhaustive. It includes both non-exporters (64%) and exporters (36%). These exporters ship about of 6.8 million Euros and about 10 different HS6 products to an average of 10 destinations. We also report the export concentration across destinations measured as an Herfindahl index of export values for a given firm-year observation[3]. This concentration amounts to 58%. Although not reported in this table, note that approximately 65% of firms do not employ any immigrant worker. The share of immigrant workers in an average firm is about 5%. Finally, the share of immigrant workers within high-skilled occupations is about 3.6% and about 6% within low-skilled occupations.

– Insert Table 1 here –

We focus on firms' export outcomes in Table 2. We report a number of statistics for firms employing no immigrant worker ($\text{Mig}_{it} = 0$) and those employing at least one immigrant worker ($\text{Mig}_{it} > 0$) at time t. We also report whether the means across the two groups differ from zero in the last column of the table. The export performance measures are significantly higher for firms with a positive immigrant employment. 53% of these firms are exporters, while this is only the case for 26% of firms with no immigrant employment. This trend holds for all extensive and intensive margin measures.

– Insert Table 2 here –

Finally, we compare firms' export outcomes along their employment of immigrant workers in Figures 1 and 2. We use a quadratic fit to plot the employment of immigrant workers

[2]Also note that the DADS data contains 5% of exporters which represents 84% of the export value contained in the customs data. This data however contains all sectors of the economy, while this paper focuses on the manufacturing sector only, which is identified thanks to the NAF codes reported in the BRN data.

[3]More precisely, this measure is given by $H_{it} = \sum_j (X_{ijt}/X_{it})^2$ where X_{ijt} denotes the exports of firm i to destination j at time t and X_{it} denotes the total exports of firms i at time t.

against the export performance of the firm. These figures show that immigrant employment in both low- and high-skilled occupations is positively correlated with firms' export value and negatively correlated with their export concentration across markets. The correlation between the employment of immigrants and the export performance is smaller for low- than for high-skilled occupations, but follows a very similar trend than that of immigrants in high-skilled occupations.

– Include Figure 1 here –

– Include Figure 2 here –

3.3 Empirical strategy

In this section, we first explain why our empirical strategy must account for endogeneity concerns and then introduce our instrumentation strategy and the doubly robust estimator.

Endogeneity concerns. We investigate the link between firms' export outcomes and their employment of immigrant workers using the following relationship:

$$y_{it} = \beta \ln \text{Mig}_{it-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \quad (1)$$

where y_{it} is the export performance of a firm i at time t, Mig_{it-1} represents the number (increased by one) of immigrant workers employed by the firm at time $t-1$, C_{it-1} denotes firm-year controls at time $t-1$, and γ_i and γ_{st} respectively denote firm and sector-year fixed effects. Firm-year controls include size dummies (less than 20 employees, between 20 and 250 employees, and more than 250 employees), the share of high-skilled occupations and the concentration of occupations (Herfindahl index). Firm fixed effects account for time-invariant firm characteristics and sector-year fixed effects control for time-variant sector characteristics such as the labour demand. These set of fixed effects prevents us from omitting variables which could downwardly or upwardly bias the estimates. Note that in all estimations, standard errors are robust to heteroscedasticity and clustered at the sector-year level.

The main source of endogeneity that could bias the estimation of equation (1) is due to reverse causality issues. On the one hand, the export performance of the firm may affect its ability to attract a certain type of workers and thus bias the estimation. For instance, immigrant workers may self-select into exporting firms because they offer higher performance, higher wages, better locations, etc. On the other hand, firms' export performance may affect their preference for immigrant workers. For instance, we cannot exclude that firms may favour the employment of individuals coming from the destinations with which they already have a trading experience. Hence, both immigrants' and firms' decisions are likely to generate a potential upward bias in the estimation of the export-enhancing effect of immigrant workers.

Instrumental variable. Consistently with existing empirical studies mentioned earlier, we control for endogeneity by using an instrumental variable (IV) approach in a two-stage least square estimation (2SLS). So far, studies tackling endogeneity due to reverse causality with an IV-2SLS strategy have instrumented the employment of immigrants either by the lagged variable, the immigration stock in the region and/or sector of the firm, or the immigration stock in a neighbouring country. Some other studies instrument the regional share of immigrants with an imputed share (or shift-share instrument) *à la* Card (2001).

We follow this last piece of literature and instrument the number of immigrant workers in the firm by the imputed stock of immigrant workers in the region of the firm built on the spatial distribution of immigrants by occupations observed in 1990:

$$\text{Mig\_stock}_{rt} = \sum_{o} \frac{\text{Immigrants}_{o,r,1990}}{\text{Immigrants}_{o,\text{FR},1990}} \text{Immigrants}_{o,\text{FR},t} \tag{2}$$

where r denotes the region of the firm (French "*département*") and o denotes an occupation group. This instrument consists in weighting the stock of immigrants in occupation o in France at time t (from the DADS data) by the share of immigrants in occupation o in region r in 1990. To measure this share, we use the 1990 population census to get information on stocks of native and immigrant populations by regions and by occupations (only 1-digit occupation codes are available in the census data). Note that we consider immigrants in all sectors of the economy and not only those working in the manufacturing sector.

Our instrument presents two advantages. First, using the distribution of immigrant *workers* allows us to focus on the working population *i.e.* to reduce – as much as possible – the effect of spillovers on firms that could arise from the non-working immigrant population located in the region of the firm. Second, our instrument relies on the spatial and occupational distribution of immigrants in 1990. We therefore assume that this distribution is not correlated with firms' contemporaneous outcomes. Doing so is presumably better than using a simple lagged variable because past and contemporaneous immigration stocks are highly correlated due to network effects.

IV specification. In a first step, our IV-2SLS strategy consists in predicting the number of immigrant workers in firm i at time $t-1$ using the following specification:

$$\ln \text{Mig}_{it-1} = \alpha \ln \text{Mig\_stock}_{rt-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \tag{3}$$

In a second step, we estimate the effect of an exogenous change in firm i's employment of immigrants at time $t-1$ on its export performance at time t as follows:

$$y_{it} = \beta \widehat{\ln \text{Mig}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{4}$$

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where $\widehat{\ln \text{Mig}_{it-1}}$ is the predicted number of immigrant workers in firm i at time $t-1$ obtained from the estimation of equation (3).

IV-2SLS and the doubly robust estimator. Ideally, to identify the export-enhancing effect of immigrant workers by occupation groups, we would like to estimate the following first-stage equations for immigrants in low-skilled (ls) and high-skilled (hs) occupations:

$$\ln \text{Mig}^{\text{hs}}_{it-1} = \alpha_1 \ln \text{Mig\_stock}^{\text{hs}}_{rt-1} + \alpha_2 \ln \text{Mig\_stock}^{\text{ls}}_{it-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \quad (5)$$

$$\ln \text{Mig}^{\text{ls}}_{it-1} = \alpha_1 \ln \text{Mig\_stock}^{\text{hs}}_{rt-1} + \alpha_2 \ln \text{Mig\_stock}^{\text{ls}}_{it-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \zeta_{it} \quad (6)$$

where:

$$\text{Mig\_stock}^{g}_{rt} = \sum_{o \in g} \frac{\text{Immigrants}_{o,r,1990}}{\text{Immigrants}_{o,\text{FR},1990}} \text{Immigrants}_{o,\text{FR},t} \ \forall g = \{\text{hs}, \text{ls}\} \quad (7)$$

and the following second-stage equation:

$$y_{it} = \beta_1 \widehat{\ln \text{Mig}^{\text{hs}}_{it-1}} + \beta_2 \widehat{\ln \text{Mig}^{\text{ls}}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \quad (8)$$

This strategy, implemented by Andrews et al. (2017), is however not appropriate in our case as our instruments ($\text{Mig\_stock}^{\text{ls}}_{rt}$ and $\text{Mig\_stock}^{\text{hs}}_{rt}$) are highly correlated (87% correlation). The results of this model would therefore suffer from multi-collinearity issues.

Another strategy suggested by Hatzigeorgiou and Lodefalk (2016) consists in estimating two distinct models, one for immigrants in high-skilled occupations (omitting those in low-skilled occupations) and another one for immigrants in low-skilled occupations (omitting those in high-skilled occupations). We however exclude such an empirical strategy because, in our data, the firm-level presence of immigrants in high-skilled occupations is correlated to the presence of immigrants in low-skilled occupations (56% correlation). For instance, it is possible that the presence of immigrant managers determines the employment of immigrants in low-skilled jobs. Therefore, the estimates of the two models would suffer from an omitted variable bias.

To overcome this difficulty, our strategy consists in combining an IV-2SLS estimator with a doubly robust estimator (DRE). The use of propensity score based methods to infer causal relationships (such as propensity scores, re-weighting and doubly robust analyses) is not new to the applied international economics literature (Arnold and Javorcik, 2009; Girma and Goerg, 2007; Girma et al., 2015). In particular, the DRE dates back to Bang and Robins (2005) and is described with care in the paper of Emsley et al. (2008).

This method allows us to estimate the effect of employing immigrants in high-skilled occupations on the export performance of the firm, controlling for its employment of immigrants workers in low-skilled occupations, and vice versa. Consider two groups of observations: treated firms that employ immigrants in high-skilled occupations at time $t-1$ ($\text{Mig}^{\text{hs}}_{it-1} > 0$) and control

firms which do not ($\text{Mig}^{\text{hs}}_{it-1} = 0$). For these two groups, we estimate the following IV equations:

$$y_{it} | \left(\text{Mig}^{\text{hs}}_{it-1} = 0\right) = \beta \widehat{\ln \text{Mig}^{\text{ls}}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{9}$$

$$y_{it} | \left(\text{Mig}^{\text{hs}}_{it-1} > 0\right) = \beta \widehat{\ln \text{Mig}^{\text{ls}}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{10}$$

where $\widehat{\ln \text{Mig}^{\text{ls}}_{it-1}}$ is the predicted number of immigrant workers in low-skilled occupations obtained for the following first-stage equation:

$$\ln \text{Mig}^{\text{ls}}_{it-1} = \alpha \ln \text{Mig\_stock}^{\text{ls}}_{rt-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \tag{11}$$

The estimation of equations (9), (10) and (11) allows us to control for the employment of immigrants in low-skilled occupations for each group of firms. Thus, we can assess whether the export performance of treated and control firms differ due to their employment of immigrants in high-skilled occupations *all things being equal*.

To do so, we calculate firms' propensity to employ immigrants in high-skilled occupations by regressing the following logit model for each year of the sample:

$$d_i = \delta \text{Mig\_stock}^{\text{hs}}_{r} + \mu C_i + \gamma_s + \xi_i \tag{12}$$

where d_i equals one if $\text{Mig}^{\text{hs}}_{i} > 0$ and zero otherwise. We obtain time-varying scores (d_{it}) by polling observations across years. Note that we impose a common support condition to ensure that firm-year observations with identical characteristics are observed in both groups of treated and untreated firms, and rule out the phenomenon of perfect predictability of the treatment. To determine the region of common support, we keep observations from the treated group which scores are lower than the maximum or more than the minimum score of the control group. For all the specifications presented hereafter in this paper, the observations outside this support represent less than 0.01% of the sample.

We are then able to compute a weighted difference between the predicted export outcome obtained from either equation (9) or (10) and the observed outcome such that:

$$\text{DR}^{(0)}_{it} = \frac{1}{1 - \widehat{d_{it-1}}} \left[\widehat{d_{it-1}} \widehat{y_{it}}^{(0)} - y_{it}\right] \tag{13}$$

$$\text{DR}^{(1)}_{it} = \frac{1}{\widehat{d_{it-1}}} \left[y_{it} - \left(1 - \widehat{d_{it-1}}\right) \widehat{y_{it}}^{(1)}\right] \tag{14}$$

We finally compute the average treatment effect (ATE) of employing immigrants in high-skilled occupations by comparing these weighted differences across the two groups of firms:

$$\text{ATE}(\text{Mig}^{\text{hs}}_{it-1}) = \frac{1}{N} \sum^{N} \left[\text{DR}^{(1)}_{it} - \text{DR}^{(0)}_{it}\right] \tag{15}$$

Our empirical strategy presents two important features. First, it allows us to estimate the impact of employing immigrants in a given occupation group thanks to a DRE, while controlling for the remaining immigrant workers thanks to an IV-2SLS method. Although imperfect, this strategy allows us to reduce as much as possible the bias induced by the inclusion of both endogenous variables in the same estimation (the employment of immigrants in both low- and high-skilled occupations). Second, this strategy ensures that there is no longer a systematic association between the firm characteristics and the treatment received, making treated and untreated firms comparable. As explained by Emsley et al. (2008), one advantage of the DRE (as compared to the simple inverse probability of treatment-weighted estimator) is to offer protection against misspecification of either the outcome model (equations 9, 10 and 11) or the exposure model (equation 12).

4 Empirical results

In this section, we estimate the effect of immigrant workers on several export outcomes at the firm level. We provide evidence that the pro-trade effect of immigrant workers occurs at both trade margins and for immigrants in both low- and high-skilled occupations.

4.1 The pro-trade effect of immigrant workers

Baseline results. First-stage results obtained from the estimation of equation (3) are presented in Table 3. The results show a positive and significant coefficient of our instrument (Mig_stock_{rt-1}) on the number of immigrant workers employed by the firm (Mig_{it-1}). We report the F-stat form of the Kleibergen-Paap statistic that provides a test for weak instruments. For both intensive and extensive margin samples, the statistic is well above the critical value which confirms that the imputed regional stock of immigrants is a strong predictor of firms' employment of immigrants.

– Insert Table 3 here –

Second-stage results obtained from the estimation of equation (4) are reported in Table 4, columns (2), (4), (6) and (8). At the intensive margin, an increase in the employment of immigrant workers is associated with higher export outcomes. The coefficient in column (2) suggests that on average, a 1% increase in immigrant employment increases total exports by 0.42% which is close to existing results in the literature[4]. We also estimate that an increase in immigrant employment leads to a larger set of exported products, toward a larger set of destinations (columns 4 and 6). Note that these two export measures exclude zeros and are therefore estimated on the intensive margin sample. At the extensive margin, the participation dummy is positively

[4]Using Danish firm-level data, Hiller (2013) finds that an increase in the number of immigrant employees from a given destination induces a 0.43% increase in the export of the firm toward this destination.

affected by immigrant workers. We find that a 1% increase in the employment of immigrants induces a 0.09% increase in the probability to be an exporter.

For each export outcome, we provide the OLS coefficient as a reference point that allows us to estimate the direction of the endogeneity bias (columns 1, 3, 5 and 7). We find that the OLS coefficients are downwardly biased. Omitting to control for endogeneity would therefore lead to under-estimate the export-enhancing effect of immigrant workers.

– Insert Table 4 here –

Validity of the instrument. To further check the validity of our instrument, we modify our baseline estimations as follows. First, we lag the imputed regional immigration stock by one more year (denoted Mig_stock$_{rt-2}$) in the estimation of equation (3). First-stage results are presented in columns (1) and (2) of Table 5. Here again, the weak identification test confirms our choice of instruments. Second-stage results are displayed in columns (1), (3), (5) and (7) of Table 6. Including two instruments allows to test for over-identification. We thus report the Hansen J-stat which is higher than the critical value of 0.01 for all specifications. We are therefore unable to reject our set of instruments. The estimates presented in this table are very close to our baseline estimates in both magnitude and significance level.

Second, we use census data from 1982 instead of 1990 to build an alternative instrument that could presumably be more exogenous. For instance, the year 1990 could be to close from the first year of our sample (1997) to guaranty the exogeneity of the instrument to firms' decisions and outcomes. In other words, using the 1982 census data, we further ensure that variations in the instrument only come from an increase in the total number of immigrants over time. First-stage results are displayed in columns (3) and (4) of Table 5 and the corresponding second-stage results are reported in columns (2), (4), (6) and (8) of Table 6. Here again, our baseline results are confirmed for both stages.

– Insert Table 5 here –

– Insert Table 6 here –

Robustness tests. We present a set of robustness tests in the online appendix. We start by checking whether our results are robust to alternative specification choices. First, to investigate whether the export-enhancing effect of immigrants is time resistant, we use the two-year lagged number of immigrant workers instead of the one-year lag. It allows us to further test the hypothesis that immigrant workers *subsequently* cause an increase in exports. Results are reported in Table A.2 and Table A.3 and corroborate our baseline estimates. Second, we capture the immigrant employment of the firm using a binary instead of a continuous variable. Results are

presented in Table A.4 and Table A.5. We find that the probability of employing immigrants positively depends upon the imputed stock of immigrant workers in the region of the firm. This probability, in turn, increases exports at all trade margins. Third, our specification includes firm fixed effects which capture a large part of the variance in firms' immigrant employment. This specification choice implies that our estimates relies on variations within firms and across years. We thus provide first and second-stage results of our baseline model without firm fixed effects. Results are reported in Table A.6 and Table A.7. We find that the first-stage coefficients are larger than our baseline estimates, while second-stage results are lower than our baseline estimates. Contrarily to our baseline results, the IV estimates are lower than the OLS estimates (Table A.7). The direction of the bias hence relies on the specification choice[5].

We then attempt to assess whether our results are in line with the study of Mitaritonna et al. (2017). In Table A.8 and Table A.9, we use the share of immigrant workers instead of the number. It allows us to consider that employing one immigrant worker may matter more for small than for large firms. We thereby obtain a log-level model to estimate which we can better compare to the specification proposed by Mitaritonna et al. (2017). We find that a 1% point increase in the share of immigrant workers increases exports by 3.107%. Depending on their instrument, Mitaritonna et al. (2017) find that a 1% point increase in the regional share of immigrants increases exports between 1.275% and 2.721% (Table 10 in their paper). The remaining gap between our results may either come from the fact that we investigate immigration at the firm-level and not at the regional level, or from the fact that our sample include a larger number of small firms (their sample excludes firms with less than 20 employees). We investigate the latter hypothesis in Table A.10 and Table A.11 in which we compare small and medium enterprises (SME) that have less than 250 employees, to large firms that have 250 or more employees. We estimate separately our baseline regression on each group of firms and find that the average effect is driven by small and medium firms. We estimate no significant effect for large firms.

We then explore two alternative definitions for immigrant workers. We start by defining a worker as an immigrant if she is either a foreign citizen or a foreign-born French citizen. Doing so, we enlarge the group of immigrant workers used in the baseline specification in which we only considered foreign citizens. Second, we define an individual as immigrant if she is foreign-born. First- and second-stage results are reported in Table A.12 and Table A.13 respectively. In both tests, the first-stage results are confirmed. However, the second-stage results do not show a clear impact of the number of immigrant workers on the export value, which is either positive and significant at the 5% level (column 1) or nil (column 2). The coefficients reported in these two columns are nonetheless very close in magnitude which indicates that the estimates using the "foreign-born" definition are only less precise. Baseline estimates are nonetheless confirmed for the other export measures (columns 3 to 8). This exercise suggests that French citizens born abroad are different from foreign citizens, and that defining immigrants based on their country

[5]This is because firm fixed effects allow us to control for omitted variables. Yet, if these omitted variables increase exports but are positively correlated with the employment of immigrant workers, they can induce an upward bias of the OLS estimates. On the contrary, if these variables are negatively correlated with the employment of immigrants, they can downwardly bias the OLS estimates.

of birth might generate a group of individuals too heterogeneous for the purpose of this study. This test also allows us show that immigrants' skill transferability is imperfect[6].

We then test whether our results are robust to the use of alternative samples. First, we replicate our baseline estimations of the intensive margin on a sample of continuous exporters. Results are presented in Table A.14 and Table A.15. For this exercise, we keep only firms that export each year of the sample period. Doing so, we homogenize the sample and focus on firms that already have an export experience to test if the effect of immigrant workers is solely driven by their systemic association with exporting firms. The results are confirmed for both stages which indicates that immigrant employment matters for the intensive margin of trade. Second, we investigate to what extent the two reporting thresholds for the EU and the non-EU zones imposed by the French customs could bias our results. We replicate our baseline estimations on a sample including only export flows that are above 150,000 euros for both the EU and the non-EU zones. Doing so, we modify the distribution of exports for the EU zone by excluding about 0.264% of the exported value for each year of the sample. Results are presented in Table A.16 and Table A.17 and are in line with our baseline estimates.

Finally, we check that the results obtained for the intensive margin are robust to the inclusion of zero trade flows. Results are reported in Table A.18 and Table A.19. We start by running two regressions in which the dependent variable is the logarithm of the export value and in which we only include firm, sector and year fixed effects (as including sector-year fixed effects would be too intensive in the next specifications). OLS results are presented in column (1) and IV-2SLS results in column (2) of Table A.19. We then compare these results to an alternative specification, in which we use the logarithm of the export value plus one (columns 3 and 4). Doing so, we include firm-year observations with nil exports. Although imperfect, this strategy allows us to show that our results remain positive and significant for both OLS and IV-2SLS estimates although the magnitude of the coefficients is larger as compared to columns (1) and (2) (Head and Mayer, 2015). In columns (5) and (6), we use a Poisson model (Poisson GMM in column 6) in which we estimate the export value instead of the logarithm of the export value. It allows us to keep all zero flows and to reduce the bias induced by the omission of these flows (Santos Silva and Tenreyro, 2006). As it is computationally too intensive to include firm fixed effects in a Poisson model, we have demeaned and centered our variables. Here again, our results remain positive and significant.

4.2 The pro-trade effect of immigrant workers across occupation groups

Baseline results. Table 7 presents the estimated ATE of employing immigrants in a given occupation group (high- or low-skilled occupations) on each export outcome, controlling for the employment of immigrant workers in other occupations. The results show that immigrants employed in both occupation groups generate an export-enhancing effect at both intensive and extensive margins. Firms employing immigrants in high-skilled occupations export on average

[6]Among others, see Bleakley and Chin (2004) and Mattoo et al. (2008).

2.25 times more than control firms (column 1). Similarly, firms employing immigrants in low-skilled occupations export on average 2.68 times more than control firms (column 1). The pro-trade effect of immigrant workers is therefore not restricted to immigrants holding high-skilled occupations.

Although the DRE provides protection against misspecification of either the exposure or the outcome model (Emsley et al., 2008), we assess the quality of the exposure model (equation 12) by verifying that, on average, treated and control firms have similar characteristics. In other words, we check that the inverse probability weighing scheme is successful in controlling for firm differences. More precisely, we check that the mean bias between the characteristics of treated and untreated firms (C_i) is lower than 10% (as recommended by the literature).

– Insert Table 7 here –

Robustness tests. We provide a set of robustness tests in the online appendix. First, we want to ensure that our empirical strategy allows us to estimate the *unbiased* effect of employing immigrants in a given occupation group on the export performance of the firm. To do so, we perform a robustness test that consists in modifying the outcome model (equations 9 and 10) as follows:

$$y_{it} | \left(\text{Mig}^{\text{hs}}_{it-1} = 0 \right) = \beta_1 \widehat{\ln \text{Mig}^{\text{ls}}_{it-1}} + \beta_2 \ln \text{Mig}^{\text{hs}}_{it-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{16}$$

$$y_{it} | \left(\text{Mig}^{\text{hs}}_{it-1} > 0 \right) = \beta_1 \widehat{\ln \text{Mig}^{\text{ls}}_{it-1}} + \beta_2 \ln \text{Mig}^{\text{hs}}_{it-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{17}$$

Introducing the endogenous treatment variable in the IV-2SLS stage should not modify the ATE of employing immigrants in high-skilled occupations provided by equation (15). Otherwise, it would indicate that using a DRE poorly controls for the endogeneity bias induced by this variable. We provide the results of this test in Table A.20. The results are close to the baseline ATEs presented in Table 7 in terms of sign, magnitude and significance level. The results hence confirm the that our strategy adequately controls for endogeneity. Note that we perform this robustness test for all estimations using the IV-2SLS/DRE method presented in this paper. Although not reported in the paper, results are always as expected.

Second, we compare the ATE coefficients reported in Table 7 to the estimates provided in Table A.5. In the latter table, we report that firms employing immigrant workers (disregarding their occupations) export on average 1.27 times more than firms employing none. This average effect is smaller than the ATEs we find for immigrants in low- and high-skilled occupations. We can therefore not exclude that our method could generate an upward bias in our results.

Third, we want to investigate the fact that the ATE of employing immigrants in low-skilled occupations is slightly higher than the ATE of employing immigrants in high-skilled occupations for all export outcomes (Table 7). Following the literature, one could expect the opposite. However, the two coefficients are not directly comparable as treated and control firms are not

the same depending on the occupation group studied. In one case, we compare firms that employ immigrants in high-skilled occupations to firms that do not, while in the other case, we compare firms that employ immigrants in low-skilled occupations to firms that do not. In Table A.21, we provide the mean value of the export outcomes for firms that do not employ any immigrant workers, firms that only employ immigrants in either high- or low-skilled occupations, and firms that employ immigrants in both occupation groups. We find that these four groups of firms are poorly comparable in terms of export outcomes. We homogenize our sample by keeping firms that employ no immigrant workers and firms that employ immigrants in both occupation groups. We then recompute the ATE of employing immigrants in high- and low-skilled occupations. Results are presented in Table A.22. Firms employing immigrants in high-skilled occupations export on average 10 times more than control firms (column 1). This effect is positive and significant for all measures of the intensive margin. It is however not significant for the participation dummy. On the contrary, firms employing immigrants in low-skilled occupations export on average 24.25 times less than control firms (column 1). The coefficient is significant at the 5% level in columns (1) and (2), at the 10% level in column (3) and not significant in the last column. Our baseline results are therefore driven by firms that employ immigrants in one occupation group only.

Complementary results. To further explore how the effect of immigrant workers on exports varies across occupation groups, we estimate an IV-2SLS model in which we include the interaction between the number of immigrant workers in the firm (disregarding their occupations) and the share of workers in high-skilled occupations. The first-stage equations are the following:

$$\begin{aligned}\ln \text{Mig}_{it-1} =& \alpha_1 \ln \text{Mig\_stock}_{rt-1} + \alpha_2 \ln \text{Mig\_stock}_{rt-1} \times \text{Sh\_hs}_{it-1} \\ &+ \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \qquad (18)\\ \ln \text{Mig}_{it-1} \times \text{Sh\_hs}_{it-1} =& \alpha_1 \ln \text{Mig\_stock}_{rt-1} + \alpha_2 \ln \text{Mig\_stock}_{rt-1} \times \text{Sh\_hs}_{it-1} \\ &+ \mu C_{it-1} + \gamma_i + \gamma_{st} + \zeta_{it} \qquad (19)\end{aligned}$$

and the second-stage equation reads:

$$y_{it} = \beta_1 \widehat{\ln \text{Mig}_{it-1}} + \beta_2 \widehat{\ln \text{Mig}_{it-1} \times \text{Sh\_hs}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \qquad (20)$$

where Sh_hs_{it-1} denotes the share of total employment in high-skilled occupations at time $t-1$. Due to the presence of the interaction term, β_1 captures the unconditional impact of immigrant workers on exports for firms hiring no high-skilled worker. First- and second-stage results are reported in Table A.23 and Table A.24 in the online appendix. In Table A.24, the unconditional effect is positive and significant for all export measures, showing that even if the firm had no worker in high-skilled occupations, its employment of immigrants (who would necessarily occupy low-skilled jobs) would still have a positive impact on its export performance. The interaction term is negative which indicates that the effect of hiring immigrant workers on exports is decreasing with the employment of high-skilled workers. This is not surprising as immigrant workers are over-represented in low-skilled occupations as compared to native workers. Note that

the effect of immigrant employment remains positive up to 0.62% of high-skilled jobs within the firm (while the average firm only use 18.1% of high-skilled jobs)[7]. A negative export-effect of immigrants is therefore possible, but for outlying firms in term of high-skilled employment.

5 Theoretical implications and results across destinations

In this section, we investigate the implications of our empirical results. We rationalize our results with a model of heterogeneous firms *à la* Melitz (2003). It illustrates that if immigrants in low-skilled occupations (i) do not transmit relevant information on foreign markets to their employers but (ii) do enhance firms' productivity (as emphasized in the literature), then their effect on exports should *not* be destination-specific. We then investigate if immigrants foster exports toward all destinations or not using export flows at the firm-destination-year level from the French customs data.

5.1 Insights from a model of heterogeneous firms

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 j. In each country, a continuum of firms operate under monopolistic competition and produce using a single input factor denoted L. Each firm faces the following demand function on each market: $q = Q\left(\frac{p}{P}\right)^{-\sigma}$ where σ denotes the elasticity of substitution between any two varieties, p is the price of the variety, Q is the aggregate set of varieties consumed as an aggregate good and P is the associated aggregate price.

Each country is endowed with a stock of input factor given by $L = \lambda\left(L^{ls,d}, L^{hs,d}, L^{ls,m}, L^{hs,m}\right)$. This factor is made of low- (ls) and high-skilled (hs) workers who can be natives (d) or immigrants (m). The input factor is paid at its marginal productivity which is equal to unity to ensure factor price equalization across countries.

The firm size is given by $l = \lambda\left(l^{ls,d}, l^{hs,d}, l^{ls,m}, l^{hs,m}\right)$ where $l^{ls,d}$ and $l^{hs,d}$ respectively denote the number of low- and high-skilled native workers, and $l^{ls,m}$ and $l^{hs,m}$ respectively denote the number of low- and high-skilled immigrant workers. These numbers are randomly drawn from independent distribution functions. In addition, let φ denote the firm productivity and be an increasing function of its size such that $\partial\varphi/\partial l \geq 0$. Firms are thus heterogeneous in size, which generates heterogeneity in productivity.

Following available evidence, we specify function λ as a nested CES aggregate made of low- and high-skilled workers who are imperfect substitutes, and made of native and immigrant workers who are imperfect substitutes within skill groups. Consequently, the marginal product of each type of worker is always positive ($\partial l/\partial l^{ls,d} \geq 0$, $\partial l/\partial l^{hs,d} \geq 0$, $\partial l/\partial l^{ls,m} \geq 0$, $\partial l/\partial l^{hs,m} \geq 0$). This is in line with the literature showing that immigrant workers increase productivity due to

[7] Sh_skilled_{it} ranges from 0 to 1 with a mean equal to 0.181.

their imperfect complementary in tasks with native workers (Peri and Sparber, 2009). This effect is at play whether these immigrants are low- or high-skilled.

The firm's technology to serve a foreign market j is given by $c_j = \frac{\tau_j}{\varphi} q_j + f_j$ where τ_j denotes an iceberg cost and f_j is a positive fixed cost. Both export costs are firm- and destination-specific, thus the firm may not export toward all foreign destinations.

We assume that immigrants in decisional and operative jobs (such as high-skilled occupations) decrease export costs toward destination j, so that $\partial \tau_j / \partial l^{hs,m} \leq 0$ and $\partial f_j / \partial l^{hs,m} \leq 0$. In line with empirical evidence, we assume that these workers provide operational information about their origin country which eventually allows their firm to overcome trade barriers for that particular destination; we also consider that these immigrant workers have a general knowledge of foreign markets that allows them to lower export costs toward other destinations (Andrews et al., 2017; Hatzigeorgiou and Lodefalk, 2016; Parsons and Winters, 2014). Finally, we account for non-linearities in the effect of immigrant employment by allowing these derivatives to equal zero. This implies that the information brought by the first-hired immigrant worker may be more important than the information brought by the second one.

Profit maximization gives the quantity offered by the firm on market j: $q_j = Q \left[P \left(\frac{\sigma - 1}{\sigma} \right) \frac{\varphi}{\tau_j} \right]^{\sigma}$ and its *ex-post* profit: $\pi_j = \frac{R}{\sigma} \left[P \left(\frac{\sigma - 1}{\sigma} \right) \frac{\varphi}{\tau_j} \right]^{\sigma - 1} - f_j$

Comparative statics. We now look at the emergence of first-order selection effects[8]. We consider that firms are small enough to have no impact on the general equilibrium which allows us to study whether differences in employment induce different export behaviours or not. The theoretical predictions of the model are reported in Table 8 and detailed in the online appendix.

– Insert Table 8 here –

Our theoretical framework predicts that immigrant workers favour exports at both margins. More precisely, an increase in the use of low-skilled immigrants fosters exports through a productivity-enhancing effect, while an increase in the use of high-skilled immigrants enhances exports through (i) a productivity-enhancing effect and (ii) a reduction in destination-specific export costs. Note that the productivity-enhancing effect is modelled as a naive size effect; consequently, native workers also foster exports at both margins.

Finally, the model establishes that, in addition to the destination-specific informational effect generated by high-skilled immigrant workers, a non-destination-specific effect is at play. The latter effect takes place for all immigrant workers disregarding their skills. The employment of immigrants should therefore impact exports not only to their origin countries, as broadly

[8]We are able to study first-order selection effects because (i) we assume that a general equilibrium exists and (ii) the profit is continuous and decreasing in the marginal cost. Mrázová and Neary (2018) explain that an equilibrium exists in any general model of monopolistic competition. This is likely to be the case for our framework since its structure is similar to the seminal model of Melitz (2003).

documented in the literature (Hiller, 2013; Parsons and Winters, 2014), but to any export destination.

5.2 The multi-destination effect of immigrant workers

To test the implications of the above theoretical framework, we investigate whether immigrants foster exports toward all destinations or if they rather skew exports toward a smaller set of destinations. To do so, we use export flows at the firm-destination-year level from the French customs data and exploit variations in exports across destinations for a given firm-year observation. The customs data contains 28,481,951 observations at the firm-year-destination-product level which we aggregate into 6,835,274 observations at the firm-year-destination level over which 2,920,687 can be merged with the DADS-BRN sample.

Average effect across destinations. We consider two measures of firm-level export dispersion. We start by studying whether immigrant workers impact the concentration of exports at the firm level. This measure consists in a Herfindahl index based on firms' export destinations observed in the customs data. This index ranges from zero to one, where larger values indicate a concentration of exports toward a smaller number of destinations. Following our theoretical framework, we expect the employment of immigrant workers to decrease firms' export concentration across markets.

First-stage results are reported in the online appendix in Table A.25 and second-stage results are reported in Table 9. In column (1) of Table 9, we find that the employment of immigrant workers has a negative and significant impact on firms' export concentration. We present the results by occupation groups in Table 10. The ATE estimates reported in column (1) indicate that firms employing immigrants in both high- and low-skilled occupations exhibit a significantly lower export concentration.

The main drawback of this exercise lies in the fact that we do not observe the origin countries of immigrant workers. Hence, we cannot exclude that a firm could hire many immigrant workers from various origin countries while it could also hire many immigrant workers from the same origin country. If firms were hiring immigrants from the same origin country, we could expect these workers to have a positive impact on the export concentration, especially for immigrants in high-skilled occupations who are more likely to detain export know-how. Nonetheless, we find a negative and significant coefficient which we therefore interpret as a lower bound estimate.

We further investigate our theoretical prediction by recovering export variations that are common across destinations for a given firm-year observation thanks to the following model:

$$y_{ijt} = \gamma_{it} + \gamma_{ij} + \gamma_{jt} + \epsilon_{ijt} \tag{21}$$

where y_{ijt} is the exported value by firm i to a destination j at time t, and γ_{it}, γ_{ij} and γ_{jt} respectively denote firm-year, firm-destination and destination-year fixed effects. Doing so,

we control for all variations that are destination-specific and that could be due to the origin countries of the immigrant workers. We recover the predicted firm-year fixed effect ($\hat{\gamma_{it}}$) that captures the remaining variations that are common across destinations. We then estimate the impact of immigrant workers on this predicted firm-year fixed effect. If the pro-trade effect of immigrant workers were to be solely driven by a destination-specific effect, variations at the intensive margin would be absorbed by the firm-destination or destination-year fixed effects. Hence, the employment of immigrants would have no impact on $\hat{\gamma_{it}}$. On the contrary, a positive effect of immigrants on $\hat{\gamma_{it}}$ would imply that variations are driven by changes in export flows in all destinations simultaneously. We would then infer that immigrant workers generate an export-enhancing effect common to all destinations, whatever their origin countries.

First-stage results are reported in the online appendix in Table A.25 and second-stage results are reported in Table 9. We find no significant impact of immigrant workers on $\hat{\gamma_{it}}$. Nonetheless, we find a positive and significant impact when we look at occupation groups separately in column (2) of Table 10. Overall, this set of results corroborates the hypothesis that immigrant workers have a positive impact on exports which is spread across all destinations and is therefore not only destination-specific. Importantly, this multi-destination effect is at play for immigrant workers in both occupation groups.

– Insert Table 9 here –

– Insert Table 10 here –

Robustness tests. We provide three robustness tests in the online appendix. First, to ensure that our empirical strategy allows us to estimate the unbiased effect of employing immigrants in a given occupation group on the export performance of the firm, we perform the same robustness test as before which consists in introducing the endogenous treatment variable in the IV-2SLS stage. We report the results in Table A.26. Here again, the ATEs are close to the baseline ATEs presented in Table 10 in terms of sign, magnitude and significance level.

Second, we investigate the fact that the magnitude of the ATE of employing immigrants in low-skilled occupations is larger than the ATE of employing immigrants in high-skilled occupations (Table 10). To provide a clean comparison of the two ATE coefficients, we homogenize our sample by keeping firms that employ no immigrant workers and firms that employ immigrants in both occupation groups. We then recompute the ATE of employing immigrants in high- and low-skilled occupations. Results are presented in Table A.27. The magnitude of the ATE coefficients is now larger for the employment of immigrants in high-skilled occupations than in low-skilled ones.

Third, we further investigate the main limitation of our first strategy that consists in estimating the impact of immigrant workers on the export concentration of firms measured by

a Herfindahl index. To exclude the possibility that some firms could hire several immigrant workers from various origin countries, we reduce our sample and keep firms that employ either no immigrant workers or one single immigrant worker at time $t-1$. Results are displayed in Table A.28, Table A.29 and Table A.30. In Table A.29, we find that the effect of employing one immigrant on the export concentration remains negative and significant, while its effect on $\hat{\gamma_{it}}$ is now positive and highly significant. Looking at the results across occupation groups in Table A.30, we find that the employment of one immigrant on the export diversification of the firm depends on whether this worker holds a low- or a high-skilled occupation. The effect of employing an immigrant in a low-skilled occupation is close to the baseline result in terms of sign. However, employing an immigrant in a high-skilled occupation leads to the opposite effect *i.e.* in a higher concentration of exports. This finding is in line with existing studies and can reflect the fact that the export knowledge detained by this high-skilled worker (which is presumably destination-specific) overweights its productivity effect (which is multi-destination), hence resulting in a higher concentration of exports.

Complementary results. We now provide complementary evidence on the multi-destination effect of immigrant workers. The main limitation of our data is that it does not contain information on the origin countries of immigrant workers. Nonetheless, the French censuses report immigrant populations by citizenships for seven large source countries: Algeria, Italy, Morocco, Portugal, Spain, Tunisia and Turkey. We therefore use the 1982 census to compute a shift-share-like instrument as follows:

$$\text{Mig\_sh}_{jrt} = \frac{\text{Immigrants}_{j,r,1982}}{\text{Immigrants}_{\text{FR},1982}} \frac{\text{Immigrants}_{\text{FR},t}}{\text{Natives}_{\text{FR},1982} + \text{Immigrants}_{\text{FR},t}} \tag{22}$$

where j denotes one of the seven aforementioned countries. Mig_sh_{jrt} is the region-specific imputed share of immigrants from country j in region r at time t.

We then modify our baseline IV-2SLS/DRE specification to estimate the impact of firms' exposure to immigrants coming from country j on their exports to j while controlling for their employment of immigrants. We modify equations (9), (10), (11) and (12) as follows:

$$y_{ijt} | \left(\text{Mig\_sh}_{jrt-1} < \overline{\text{Mig\_sh}_{jt-1}}\right) = \beta \widehat{\ln \text{Mig}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{23}$$

$$y_{ijt} | \left(\text{Mig\_sh}_{jrt-1} \geq \overline{\text{Mig\_sh}_{jt-1}}\right) = \beta \widehat{\ln \text{Mig}_{it-1}} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \epsilon_{it} \tag{24}$$

$$\ln \text{Mig}_{it-1} = \alpha \ln \text{Mig\_stock}_{rt-1} + \mu C_{it-1} + \gamma_i + \gamma_{st} + \varepsilon_{it} \tag{25}$$

$$d_i = \delta \text{Mig\_sh}_{jrt-1} + \mu C_i + \gamma_s + \xi_i \tag{26}$$

where $\overline{\text{Mig\_sh}_{jt-1}}$ denotes the national time-varying average of Mig_sh_{jrt-1} and d_i equals one if $\text{Mig\_sh}_{jrt-1} \geq \overline{\text{Mig\_sh}_{jt-1}}$ and zero otherwise. Note that about 70% of firm-year observations are located in a region in which their exposure to immigrants coming from country j is higher than the national average.

Using this model, we also estimate the impact of firms' exposure to immigrants coming from country j on their exports to all destinations but j denoted $y_{it(-j)}$.

Note that we use the 1982 census to avoid multi-collinearity between our variable of interest and the imputed regional immigration stock built with the 1990 census that we use to instrument the employment of immigrant workers. Nonetheless, the correlation between Mig_sh_{jrt-1} and Mig_stock_{it-1} amounts to 28% and therefore forbids us to implement a standard IV-2SLS model. This is why we implement the IV-2SLS/DRE method.

Results are presented in Table 11. We estimate positive ATEs of the exposure to immigrants from country j on exports to j (column 1) and to all destinations but j (column 2). If the positive ATE in column (1) is not surprising, we find that an increase in the exposure to immigrants from country j increases exports to all destinations but j. This exposure can also be interpreted as the firm's probability to employ immigrant workers from country j. Similarly, we report the results for the number of exported products in columns (3) and (4), and find similar results. This last exercise hence confirms the presence of a multi-destination effect of immigrant workers. Moreover, we provide a robustness test in Table A.31 in which we check the validity of our empirical strategy by introducing the endogenous treatment variable in the IV-2SLS stage.

Finally, note that due to multi-collinearity issues, we cannot estimate this model for immigrants in both high- and low-skilled occupations. Such a model would include four endogenous and highly correlated variables while the IV-2SLS/DRE method only allows us to control for two of them.

– Insert Table 11 here –

6 Conclusion

This paper investigates the export-enhancing effect of immigrant workers at the firm level. Using a dataset on French manufacturing firms from 1997 to 2009 and an IV-2SLS method, we evaluate the impact of immigrants on export outcomes. We find a positive effect of immigrant workers on the export value, the number of destinations served, the number of exported products and the export probability. In addition, combining an IV-2SLS method with a doubly robust estimator, we find that this export-enhancing effect is positive and significant for immigrants in both low- and high-skilled occupations. While the effect of immigrants in high-skilled jobs is compatible with the informational effect documented in the literature, this is unlikely to be the case for immigrants in low-skilled jobs.

We complement our empirical study with a simple model of heterogeneous firms in monopolistic competition. This model formalises the different channels through which an exogenous increase in the employment of immigrants impacts the choice of a firm to serve a foreign market and the quantity it supplies. In line with the literature, we assume that (i) high-skilled immigrant workers provide valuable information about foreign markets that reduces trade costs and

that (ii) all immigrants (disregarding their skills) allow their firm to be more productive. The model predicts that the probability to export and the quantity exported are positively affected by the employment of immigrant workers. As the effect takes place through both a trade-cost and a productivity channel, this effect is compatible with immigrants in both low- and high-skilled occupations. This illustrative model also predicts that immigrants foster exports to *any* destination. We support this prediction with our data and show that this result holds across occupations.

These results are quite instructive for future research on the link between immigrant employment and export outcomes. Besides looking at the relationship between immigrant employment and productivity, a promising research avenue could be to further investigate how immigrant and native workers differ in terms of occupations and job characteristics/preferences. It would help to better understand the causal link between immigration and export outcomes.

Finally, our results suggest that employing immigrants in low- and high-skilled occupations is at worst harmless and at best positive for export outcomes. In that respect, simplifications of labour regulations for immigrant workers including low-skilled immigrants could create further incentives for French firms to hire these workers. This could, in turn, create favourable conditions within the employing firm to start exporting or to expand its export activities.

In the current European context, policy makers should bear in mind that a tightening of immigration policies and labour market regulations for immigrants may impact firms' export outcomes. At the extensive margin, firms may experience a loss of opportunities to start exporting. At the intensive margin, one could expect a negative impact on exports.

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Online appendix for "Immigrants, Occupations and Firm Export Performance" by Léa Marchal and Clément Nedoncelle

A Additional material to Section 3

Table A.1 – Classification of occupations

CS code	Occupation (French)	Occupation (English)	(1)
1	**Agriculteurs exploitants**	**Farmers**	
11	Agriculteurs sur petite exploitation	Farmers on small farms	-
12	Agriculteurs sur moyenne exploitation	Farmers on medium-sized farms	-
13	Agriculteurs sur grande exploitation	Farmers on large farms	-
2	**Artisans, commerçants et chefs d'entreprise**	**Craftsmen, traders and business leaders**	
21	Artisans	Craftsmen	-
22	Commerçants et assimilés	Traders and similar persons	-
23	Chefs d'entreprise de 10 salariés ou plus	Entrepreneurs with 10 or more employees	-
3	**Cadres et professions intellectuelles supérieures**	**Executives and Higher Intellectual Professions**	
31	Professions libérales	Liberal professions	H
33	Cadres de la fonction publique	Public Service executives	H
34	Professeurs, professions scientifiques	Professors, scientific professions	H
35	Professions de l'information, des arts et des spectacles	Information, arts and entertainment occupations	H
37	Cadres administratifs et commerciaux d'entreprise	Corporate administrative and commercial executives	H
38	Ingénieurs et cadres techniques d'entreprise	Engineers and business technical executives	H
4	**Professions Intermédiaires**	**Intermediate Occupations**	
42	Professeurs des écoles, instituteurs et assimilés	Teachers of schools, teachers and assimilated	H
43	Professions intermédiaires de la santé et du travail social	Intermediate health and social work occupations	H
44	Clergé, religieux	Clergy, religious	H
45	Professions intermédiaires administratives de la fonction publique	Intermediate administrative professions in the public service	H
46	Professions intermédiaires administratives et commerciales des entreprises	Intermediate administrative and commercial professions in companies	H
47	Techniciens	Technicians	H
48	Contremaîtres, agents de maîtrise	Foremen, supervisors	H
5	**Employés**	**Clericals**	
52	Employés civils et agents de service de la fonction publique	Civilian employees and public service employees	L
53	Policiers et militaires	Police and military	L
54	Employés administratifs d'entreprise	Corporate Administrative Employees	L
55	Employés de commerce	Commercial employees	L
56	Personnels des services directs aux particuliers	Direct service personnel to individuals	L
6	**Ouvriers**	**Labourers**	
62	Ouvriers qualifiés de type industriel	Industrial high-skilled Workers	L
63	Ouvriers qualifiés de type artisanal	Skilled craft workers	L
64	Chauffeurs	Drivers	L
65	Ouvriers qualifiés de la manutention, du magasinage et du transport	Skilled workers in handling, storage and transport	L
67	Ouvriers non qualifiés de type industriel	Low-skilled industrial workers	L
68	Ouvriers non qualifiés de type artisanal	Low-skilled craft workers	L
69	Ouvriers agricoles	Agricultural workers	L

Note: This table displays the French classification of occupations (*Nomenclatures des professions et catégories socioprofessionnelles*) excluding retirees. Column (1) classifies occupations into low- and high-skilled ones (respectively denoted L and H).

B Additional material to Section 4

B.1 Additional results on the pro-trade effect of immigrant workers

Table A.2 – Average effects of the two-year lagged number of immigrant workers (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	$\ln \text{Mig}_{it-2}$	
$\ln \text{Mig\_stock}_{rt-2}$	0.061***	0.052***
	(0.005)	(0.004)
Observations	189,540	514,229
Firm FE	yes	yes
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	137.251	190.945
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.3 – Average effects of the two-year lagged number of immigrant workers (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
$\widehat{\ln \text{Mig}_{it-2}}$	0.318***	0.290***	0.196***	0.071***
	(0.106)	(0.051)	(0.052)	(0.019)
Observations	189,540	189,540	189,540	514,229
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.4 – Average effects of the binary variable (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	$D(Mig_{it-1})$	
$\ln Mig\_stock_{rt-1}$	0.019***	0.024***
	(0.002)	(0.002)
Observations	229,830	636,840
Firm FE	yes	yes
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	97.424	158.904
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.5 – Average effects of the binary variable (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
$\widehat{D(Mig_{it-1})}$	1.269***	0.933***	0.782***	0.194***
	(0.358)	(0.177)	(0.180)	(0.041)
Observations	229,830	229,830	229,830	636,840
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.6 – Baseline results without firm fixed effects (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.079***	0.059***
	(0.002)	(0.002)
Observations	240,821	650,690
Firm FE	no	no
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	1749.817	1362.664
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.7 – Baseline results without firm fixed effects (OLS and IV-2SLS second-stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Intensive						Extensive	
Dep. var.	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
$\widehat{\ln \text{Mig}_{it-1}}$	0.472***	0.208***	0.193***	0.233***	0.182***	0.246***	0.061***	0.101***
	(0.010)	(0.048)	(0.006)	(0.040)	(0.004)	(0.023)	(0.002)	(0.016)
Observations	240,821	240,821	240,821	240,821	240,821	240,821	650,690	650,690
R-squared	0.375	-	0.344	-	0.355	-	0.291	-
Firm FE	no	no	no	no	no	no	no	no
Firm-year controls	yes	yes	yes	yes	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	OLS	IV-2SLS	OLS	IV-2SLS	OLS	IV-2SLS	OLS	IV-2SLS

Note: This table reports OLS and IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.8 – Average effects of the share of immigrant workers (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	Mig_sh_{it-1}	
$\ln \text{Mig\_stock}_{rt-1}$	0.008***	0.007***
	(0.001)	(0.001)
Observations	229,830	636,840
Firm FE	yes	yes
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	128.405	165.230
Stock-Yogo critical value	16.38	16.38

Note: This table IV-2SLS reports first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.9 – Average effects of the share of immigrant workers (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
$\widehat{\text{Mig\_sh}_{it-1}}$	3.107***	2.284***	1.914***	0.656***
	(0.891)	(0.416)	(0.442)	(0.132)
Observations	229,830	229,830	229,830	636,840
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.10 – Results across firm size (IV-2SLS first-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive		Extensive	
Dep. Var.	$\ln \text{Mig}_{it-1}$			
Firm size	SME	large	SME	large
$\ln \text{Mig\_stock}_{rt-1}$	0.049***	0.073***	0.042***	0.081***
	(0.004)	(0.012)	(0.003)	(0.012)
Observations	206,853	22,298	611,470	24,609
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	120.405	38.800	165.218	49.135
Stock-Yogo critical value	16.38	16.38	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include the share of high-skilled occupations and the concentration of occupations. *SME* denotes small and medium enterprises (with less than 250 employees) and *large* denote firms with 250 or more employees.

Table A.11 – Results across firm size (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Intensive						Extensive	
Dep. var.	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
Firm size	SME	large	SME	large	SME	large	SME	large
$\widehat{\ln \text{Mig}_{it-1}}$	0.617***	0.101	0.451***	0.049	0.343***	0.052	0.115***	0.009
	(0.167)	(0.166)	(0.080)	(0.070)	(0.081)	(0.083)	(0.024)	(0.017)
Observations	206,853	22,298	206,853	22,298	206,853	22,298	611,470	24,609
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include the share of high-skilled occupations and the concentration of occupations. *SME* denotes small and medium enterprises (with less than 250 employees) and *large* denote firms with 250 or more employees.

Table A.12 – Results using alternative definitions of immigrants (IV-2SLS first-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive		Extensive	
Dep. Var.	$\ln \text{Mig}_{it-1}$[rob]	$\ln \text{Mig}_{it-1}$[for]	$\ln \text{Mig}_{it-1}$[rob]	$\ln \text{Mig}_{it-1}$[for]
$\ln \text{Mig\_stock}_{rt-1}$[rob]	0.045***		0.040***	
	(0.003)		(0.003)	
$\ln \text{Mig\_stock}_{rt-1}$[for]		0.026***		0.023***
		(0.003)		(0.002)
Observations	229,830	229,830	636,840	636,840
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	160.992	80.846	214.452	135.624
Stock-Yogo critical value	16.38	16.38	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. Mig_{it-1}[rob] denotes the firm-year number of immigrant workers defined as either foreign citizens or foreign-born French citizens. Mig_{it-1}[for] denotes the firm-year number of immigrant workers defined as foreign-born individuals, independently of their citizenship.

Table A.13 – Results using alternative definitions of immigrants (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Intensive						Extensive	
Dep. var.	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
$\widehat{\ln \text{Mig}_{it-1}[\text{rob}]}$	0.319**		0.267***		0.220***		0.091***	
	(0.134)		(0.060)		(0.066)		(0.022)	
$\widehat{\ln \text{Mig}_{it-1}[\text{for}]}$		0.322		0.299***		0.282**		0.105***
		(0.239)		(0.105)		(0.114)		(0.040)
Observations	229,830	229,830	229,830	229,830	229,830	229,830	636,840	636,840
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. ***, and ** respectively denote significance at the 1% and 5% levels. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. Mig_{it-1}[rob] denotes the firm-year number of immigrant workers defined as either foreign citizens or foreign-born French citizens. Mig_{it-1}[for] denotes the firm-year number of immigrant workers defined as foreign-born individuals, independently of their citizenship.

Table A.14 – Results using a sample of continuous exporters (IV-2SLS first-stage)

	(1)
Sample	Intensive
Dep. Var.	$\ln \text{Mig}_{it-1}$
$\ln \text{Mig\_stock}_{rt-1}$	0.060***
	(0.005)
Observations	154,030
Firm FE	yes
Firm-year controls	yes
Sector-year FE	yes
Method	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	139.471
Stock-Yogo critical value	16.38

Note: This table reports an IV-2SLS first-stage estimation. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes only continuous exporters.

Table A.15 – Results using a sample of continuous exporters (IV-2SLS second-stage)

	(1)	(2)	(3)
Sample	Intensive		
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products
$\widehat{\ln \text{Mig}_{it-1}}$	0.296***	0.276***	0.190***
	(0.103)	(0.055)	(0.059)
Observations	154,030	154,030	154,030
Firm FE	yes	yes	yes
Firm-year controls	yes	yes	yes
Sector-year FE	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes only continuous exporters.

Table A.16 – Results using a consistent sample of export flows across the EU and the non-EU zones (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.065***	0.048***
	(0.006)	(0.003)
Observations	127,370	636,840
Firm FE	yes	yes
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	120.634	244.393
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes only export flows that are above 150,000 euros for both the EU and the non-EU zones.

Table A.17 – Results using a consistent sample of export flows across the EU and the non-EU zones (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
$\widehat{\ln \text{Mig}_{it-1}}$	0.157**	0.211***	0.142***	0.071***
	(0.067)	(0.044)	(0.051)	(0.015)
Observations	127,370	127,370	127,370	636,840
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes only export flows that are above 150,000 euros for both the EU and the non-EU zones.

Table A.18 – Results using alternative estimation strategies (IV-2SLS first-stage)

	(1)	(2)
Sample	(log) Exports	(log) Exports +1
Dep. var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.060***	0.050***
	(0.004)	(0.002)
Observations	229,834	636,843
Firm FE	yes	yes
Variables demeaned and centered	no	no
Firm-controls	yes	yes
Sector FE	yes	yes
Year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	255.293	585.905
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.19 – Results using alternative estimation strategies (OLS, IV-2SLS second-stage, Poisson and Poisson GMM)

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Intensive					
Dep. var.	(log) Exports		(log) Exports +1		Exports (zeros incl.)	
$\widehat{\ln \text{Mig}_{it-1}}$	0.065***	0.429***	0.109***	1.062***	0.001***	0.007***
	(0.004)	(0.103)	(0.008)	(0.187)	(0.000)	(0.003)
Observations	229,834	229,834	636,843	636,843	650,694	650,694
R-squared	0.887	-	0.876	-	-	-
Firm FE	yes	yes	yes	yes	no	no
Variables demeaned and centered	no	no	no	no	yes	yes
Firm-year controls	yes	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Method	OLS	IV-2SLS	OLS	IV-2SLS	Poisson	Poisson GMM

Note: This table reports OLS, Poisson and Poisson GMM estimations as well as IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. Variables are demeaned and centered in columns (5) and (6) to overcome the fact that it is computationally too intensive to include firm fixed effects in a Poisson and a Poisson GMM model.

B.2 Additional results on the pro-trade effect of immigrant workers across occupation groups

Table A.20 – Average treatment effects by occupation groups - Endogenous treatment variable in the IV-2SLS stage

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	2.211***	0.978***	0.862***	0.030***
	(0.210)	(0.026)	(0.027)	(0.007)
	[229,780]	[229,780]	[229,780]	[636,710]
	10.4	10.4	10.4	10.4
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	2.532***	1.578***	1.754***	0.114***
	(1.050)	(0.460)	(0.422)	(0.030)
	[229,815]	[229,815]	[229,815]	[636,793]
	8.0	8.0	8.0	8.0
Method	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.

Table A.21 – Export outcome means by type of immigrant employment

	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
	$\text{Mig}^{\text{hs}}_{it-1}=0$	$\text{Mig}^{\text{hs}}_{it-1}\geq 1$	$\text{Mig}^{\text{hs}}_{it-1}=0$	$\text{Mig}^{\text{hs}}_{it-1}\geq 1$	$\text{Mig}^{\text{hs}}_{it-1}=0$	$\text{Mig}^{\text{hs}}_{it-1}\geq 1$	$\text{Mig}^{\text{hs}}_{it-1}=0$	$\text{Mig}^{\text{hs}}_{it-1}\geq 1$
$\text{Mig}^{\text{ls}}_{it-1}=0$	1.360	8.482	6.387	14.298	6.305	11.849	0.279	0.601
	[169,734]	[13,120]	[169,734]	[13,120]	[169,734]	[13,120]	[607,074]	[21,837]
$\text{Mig}^{\text{ls}}_{it-1}\geq 1$	2.200	29.749	8.808	21.735	8.299	22.039	0.460	0.760
	[60,236]	[51,455]	[60,236]	[51,455]	[60,236]	[51,455]	[130,957]	[67,739]

Note: This table provides a number of descriptive statistics. The number of observations is reported in brackets. All means are significantly different at the 1% level.

Table A.22 – Average treatment effects by occupation groups - Reduced sample

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	10.006***	2.612***	4.802***	-0.210
	(1.276)	(0.541)	(1.008)	(0.208)
	[41,154]	[41,154]	[41,154]	[52,702]
	6.8	6.8	6.8	6.8
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	-24.247**	-4.530**	-2.721*	0.053
	(9.719)	(2.043)	(1.388)	(0.777)
	[41,022]	[41,022]	[41,022]	[52,563]
	10.5	10.5	10.5	10.5
Method	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE

This table reports average treatment effects obtained from a IV-2SLS/DRE method. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations. The sample includes firms that employ no immigrant workers and firms that employ immigrants in both occupation groups at time $t-1$.

Table A.23 – Interaction with the share of high-skilled occupations (IV-2SLS first-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive		Extensive	
Dep. Var.	$\ln \text{Mig}_{it-1}$	$\ln \text{Mig}_{it-1} \times \text{Sh\_hs}_{it-1}$	$\ln \text{Mig}_{it-1}$	$\ln \text{Mig}_{it-1} \times \text{Sh\_hs}_{it-1}$
$\ln \text{Mig\_stock}_{rt-1}$	0.059***	-0.006***	0.049***	-0.006***
	(0.004)	(0.002)	(0.003)	(0.001)
$\ln \text{Mig\_stock}_{rt-1} \times \text{Sh\_hs}_{it-1}$	-0.008**	0.041**	-0.003***	0.031***
	(0.004)	(0.003)	(0.002)	(0.002)
Observations	229,830	229,830	636,840	636,840
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS
Joint Kleibergen-Paap rk Wald F-Stat.	67.464	67.464	109.193	109.193
Stock-Yogo critical value	7.03	7.03	7.03	7.03

Note: This table reports IV-2SLS first-stage estimations. *** and ** respectively denote significance at the 1% and 5% levels. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.24 – Interaction with the share of high-skilled occupations (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
$\widehat{\ln \text{Mig}_{it-1}}$	0.431***	0.317***	0.266***	0.088***
	(0.121)	(0.057)	(0.062)	(0.019)
$\widehat{\ln \text{Mig}_{it-1} \times \text{Sh\_hs}_{it-1}}$	-0.722***	-0.566***	-0.460***	-0.070***
	(0.157)	(0.081)	(0.089)	(0.025)
Observations	229,830	229,830	229,830	636,840
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

C Additional material to Section 5

C.1 Detailed theoretical results

Proposition. The profit realized on a foreign market j is given by $\pi_j\left(l^{ls,d}, l^{hs,d}, l^{ls,m}, l^{hs,m}\right)$. Due to the existence of a positive entry cost on market j (f_j), the zero-profit condition implicitly defines a firm-specific threshold function for market j as a function of $l^{ls,d}$, $l^{hs,d}$, $l^{ls,m}$ and $l^{hs,m}$.

Result for the extensive margin. Given that immigrants have a nil or a positive impact on productivity, the higher the employment of immigrant workers, the higher the probability to enter market j:

$$\frac{\partial \pi_j}{\partial l^{ls,m}} = \frac{\sigma-1}{\sigma} R \left[P\left(\frac{\sigma-1}{\sigma}\right)\right]^{\sigma-1} \left(\frac{\varphi}{\tau_j}\right)^{\sigma-2} \frac{1}{(\tau_j)^2} \left(\frac{\partial \varphi}{\partial l^{ls,m}} \tau_j\right) \geq 0 \tag{A.1}$$

$$\begin{aligned} \frac{\partial \pi_j}{\partial l^{hs,m}} =& \frac{\sigma-1}{\sigma} R \left[P\left(\frac{\sigma-1}{\sigma}\right)\right]^{\sigma-1} \left(\frac{\varphi}{\tau_j}\right)^{\sigma-2} \frac{1}{(\tau_j)^2} \left(\frac{\partial \varphi}{\partial l^{hs,m}} \tau_j - \frac{\partial \tau_j}{\partial l^{hs,m}} \varphi\right) \\ & - \frac{\partial f_j}{\partial l^{hs,m}} \geq 0 \end{aligned} \tag{A.2}$$

A marginal increase in the use of immigrant workers induces an increase in the firm productivity and a decrease in its variable and fixed export costs to market j.

Result for the intensive margin. Given that immigrants have a nil or a positive impact on productivity, the higher the employment of immigrant workers, the higher the exported quantity toward market j:

$$\frac{\partial q_j}{\partial l^{ls,m}} = \sigma Q \left[P \left(\frac{\sigma - 1}{\sigma} \right) \right]^{\sigma} \left(\frac{\varphi}{\tau_j} \right)^{\sigma - 1} \frac{1}{(\tau_j)^2} \left(\frac{\partial \varphi}{\partial l^{ls,m}} \tau_j \right) > 0 \tag{A.3}$$

$$\frac{\partial q_j}{\partial l^{hs,m}} = \sigma Q \left[P \left(\frac{\sigma - 1}{\sigma} \right) \right]^{\sigma} \left(\frac{\varphi}{\tau_j} \right)^{\sigma - 1} \frac{1}{(\tau_j)^2} \left(\frac{\partial \varphi}{\partial l^{hs,m}} \tau_j - \frac{\partial \tau_j}{\partial l^{hs,m}} \varphi \right) > 0 \tag{A.4}$$

A marginal increase in the use of immigrant workers entails an increase in the firm productivity and a decrease in its variable export cost to market j.

C.2 Additional results on the multi-destination effect of immigrant workers

Table A.25 – Average effects across destinations (IV-2SLS first-stage)

	(1)	(2)
Sample	Exp. concentration	$\hat{\gamma_{it}}$
Dep. var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.058***	0.061***
	(0.004)	(0.005)
Observations	229,830	161,131
Firm FE	yes	yes
Firm-controls FE	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	190.500	137.032
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table A.26 – Average treatment effects across destinations by occupation groups - Endogenous treatment variable in the IV-2SLS stage

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	-0.202***	0.395***
	(0.016)	(0.018)
	[229,780]	[161,098]
	10.4	10.4
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	-0.395***	3.041***
	(0.100)	(1.032)
	[229,815]	[161,128]
	8.0	8.0
Method	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.

Table A.27 – Average treatment effects across destinations by occupation groups - Reduced sample

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	-3.125***	42.832***
	(0.998)	(13.751)
	[41,154]	[36,759]
	6.8	6.8
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	-0.586***	-1.609
	(0.115)	(1.229)
	[41,022]	[36,636]
	10.5	10.5
Method	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations. The sample includes firms that employ no immigrant workers and firms that employ immigrants in both occupation groups at time $t-1$.

Table A.28 – Average effects across destinations for firms with zero or 1 immigrant worker (IV-2SLS first-stage)

	(1)	(2)
Sample	Exp. concentration	$\hat{\gamma_{it}}$
Dep. var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.026***	0.033***
	(0.004)	(0.006)
Observations	85,217	48,299
Firm FE	yes	yes
Firm-controls FE	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	36.046	26.397
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes firms that employ either no immigrant workers or one single immigrant worker at time $t-1$.

Table A.29 – Average effects across destinations for firms with zero or 1 immigrant worker (IV-2SLS second-stage)

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
$\widehat{\ln \text{Mig}_{it-1}}$	-0.353***	1.170***
	(0.096)	(0.405)
Observations	85,217	48,299
Firm FE	yes	yes
Firm-controls FE	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations. The sample includes firms that employ either no immigrant workers or one single immigrant worker at time $t-1$.

Table A.30 – Average treatment effects across destinations by occupation groups for firms with zero or 1 immigrant worker

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	0.653***	-2.235***
	(0.039)	(0.126)
	[84,446]	[47,854]
	1.9	1.9
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	-0.165***	0.378***
	(0.011)	(0.030)
	[85,131]	[48,256]
	2.0	2.0
Method	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations. The sample includes firms that employ either no immigrant workers or one single immigrant worker at time $t-1$.

Table A.31 – Average treatment effects of the exposure to immigrants from country j - Endogenous treatment variable in the IV-2SLS stage

	(1)	(2)	(3)	(4)
Dep. var.	(log) Exports (j)	(log) Exports ($-j$)	(log) Nr. of products (j)	(log) Nr. of products ($-j$)
ATE(Mig_sh_{jrt-1})	6.580***	3.612***	1.238***	1.468***
	(0.038)	(0.036)	(0.011)	(0.015)
	[624,283]	[624,284]	[624,284]	[624,284]
	8.1	8.1	8.1	8.1
Method	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.

Table 1 – Descriptive statistics

	Obs.	Mean	Std. Dev.
Balance-sheet data			
Profit (in millions of Euros)	827,607	0.283	9.661
Total revenue (in millions of Euros)	779,947	18.324	243.514
Revenue from domestic sales (in millions of Euros)	827,607	10.305	145.282
Revenue from export sales (in millions of Euros)	779,947	7.966	135.782
Own resources (in millions of Euros)	774,741	6.251	110.105
Assets (in millions of Euros)	827,607	11.826	174.469
Value added (in millions of Euros)	799,922	3.063	49.673
Age (since creation)	786,349	18.448	13.802
Apparent labour productivity (value added/nr. of employees)	799,922	0.039	0.334
Total revenue per worker (in millions of Euros)	779,947	0.182	2.150
Export performance			
Participation dummy	827,607	0.356	0.479
Export value, zeros incl. (in millions of Euros)	827,607	2.423	45.175
Export value, zeros excl. (in millions of Euros)	294,545	6.808	75.527
Nr. of destinations	294,545	9.916	14.364
Nr. of exported products	294,545	9.708	18.829
Export concentration (Herfindahl index)	294,545	0.581	0.334
Employment data			
Nr. of employees	827,607	58.047	303.607
SME (firms with less than 250 employees)	827,607	0.963	0.188
Share of employees in high-skilled occupations	827,607	0.184	0.234
Occupation concentration (Herfindahl index)	827,607	0.383	0.297
Share of immigrant workers	827,607	0.051	0.133
Immigrant employment across occupations			
Share of immigrant workers within high-skilled occupations	484,956	0.036	0.143
Share of immigrant workers within low-skilled occupations	571,445	0.060	0.153

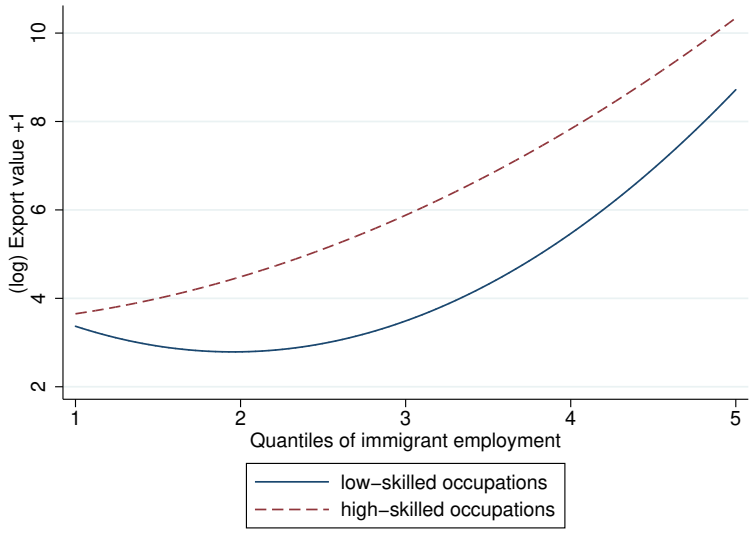
Note: This table provides a number of descriptive statistics.

Table 2 – Immigrant employment and export performance

	$\mathbf{Mig}_{it} = 0$			$\mathbf{Mig}_{it} > 0$			
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Diff.
Participation dummy	534,799	0.259	0.438	292,808	0.533	0.499	***
Export value (in millions of Euros)	138,392	0.950	8.865	156,153	12.000	103.116	***
Nr. of destinations	138,392	5.784	8.137	156,153	13.578	17.378	***
Nr. of exported products	138,392	5.622	9.201	156,153	13.330	23.787	***
Export concentration (Herfindahl index)	138,392	0.664	0.320	156,153	0.508	0.329	***

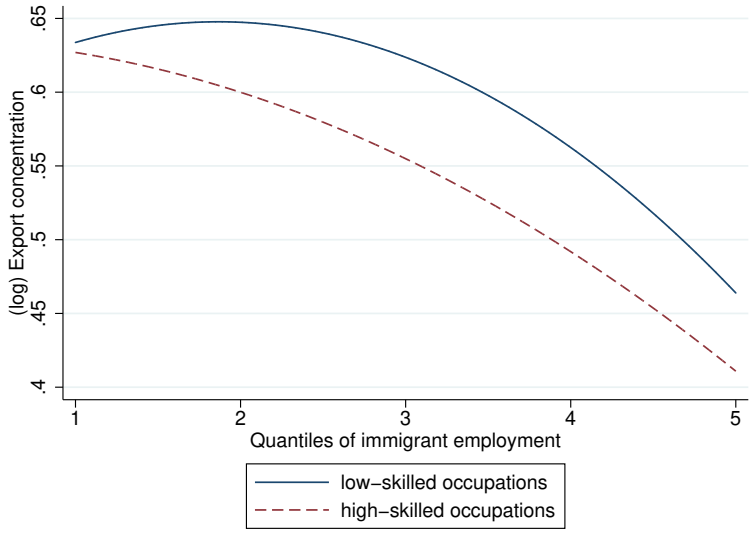
Note: This table provides a number of descriptive statistics. *** denotes significance at the 1% level.

Figure 1 – Immigrant employment and exports



Note: This figure plots the prediction for the export value from a linear regression of the export value on the immigrant employment (by quantiles) and the squared immigrant employment (by quantile).

Figure 2 – Immigrant employment and export concentration



Note: This figure plots the prediction for the export concentration from a linear regression of the export concentration on the immigrant employment (by quantile) and the squared immigrant employment (by quantile). Export concentration across destinations is measured as an Herfindahl index of export values for a given firm-year observation.

Table 3 – Baseline results (IV-2SLS first-stage)

	(1)	(2)
Sample	Intensive	Extensive
Dep. Var.	$\ln \text{Mig}_{it-1}$	
$\ln \text{Mig\_stock}_{rt-1}$	0.058***	0.049***
	(0.004)	(0.003)
Observations	229,830	636,840
Firm FE	yes	yes
Firm-year controls	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS
Kleibergen-Paap rk Wald F-Stat.	190.500	244.393
Stock-Yogo critical value	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table 4 – Baseline results (OLS and IV-2SLS second-stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Intensive						Extensive	
Dep. var.	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
$\widehat{\ln \text{Mig}_{it-1}}$	0.064***	0.423***	0.029***	0.311***	0.028***	0.261***	0.007***	0.094***
	(0.005)	(0.115)	(0.002)	(0.055)	(0.002)	(0.058)	(0.001)	(0.019)
Observations	229,830	229,830	229,830	229,830	229,830	229,830	636,840	636,840
R-squared	0.887	-	0.908	-	0.859	-	0.796	-
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	OLS	IV-2SLS	OLS	IV-2SLS	OLS	IV-2SLS	OLS	IV-2SLS

Note: This table reports OLS and IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table 5 – Results using alternative instruments (IV-2SLS first-stage)

	(1)	(2)	(3)	(4)
Census year	1990		1982	
Sample	Intensive	Extensive	Intensive	Extensive
Dep. Var.	$\ln \text{Mig}_{it-1}$			
$\ln \text{Mig\_stock}_{rt-1}$	0.047***	0.040***	0.057***	0.048***
	(0.005)	(0.004)	(0.004)	(0.003)
$\ln \text{Mig\_stock}_{rt-2}$	0.022***	0.017***		
	(0.005)	(0.003)		
Observations	195,139	529,387	229,830	636,840
Firm FE	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS
Joint Kleibergen-Paap rk Wald F-Stat.	87.142	123.109	-	-
Kleibergen-Paap rk Wald F-Stat.	-	-	188.147	242.539
Stock-Yogo critical value	19.93	19.93	16.38	16.38

Note: This table reports IV-2SLS first-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table 6 – Results using alternative instrument (IV-2SLS second-stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Census year	1990	1982	1990	1982	1990	1982	1990	1982
Sample	Intensive						Extensive	
Dep. var.	(log) Exports		(log) Nr. of destinations		(log) Nr. of products		Participation	
$\widehat{\ln \text{Mig}_{it-1}}$	0.392***	0.427***	0.331***	0.312***	0.240***	0.260***	0.089***	0.093***
	(0.107)	(0.116)	(0.054)	(0.054)	(0.058)	(0.058)	(0.019)	(0.019)
Observations	195,139	229,830	195,139	229,830	195,139	229,830	529,387	636,840
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-year controls	yes	yes	yes	yes	yes	yes	yes	yes
Sector-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS
Hansen J-stat. p-value	0.847	-	0.317	-	0.232	-	0.167	-

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table 7 – Average treatment effects by occupation groups

	(1)	(2)	(3)	(4)
Sample	Intensive			Extensive
Dep. var.	(log) Exports	(log) Nr. of destinations	(log) Nr. of products	Participation
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	2.254***	1.009***	0.865***	0.024***
	(0.211)	(0.026)	(0.027)	(0.007)
	[229,780]	[229,780]	[229,780]	[636,710]
	10.4	10.4	10.4	10.4
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	2.677**	1.502***	1.424***	0.082***
	(1.050)	(0.459)	(0.422)	(0.030)
	[229,815]	[229,815]	[229,815]	[636,793]
	8.0	8.0	8.0	8.0
Method	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** and ** respectively denote significance at the 1% and 5% levels. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.

Table 8 – Immigrant employment and the margins of trade

	Total effect	Productivity channel (φ)	Iceberg cost channel (τ_j)	Fixed cost channel (f_j)
Extensive margin				
$\partial \Pr(\pi_j \geq 0) / \partial l^{ls,m}$	+	+	0	0
$\partial \Pr(\pi_j \geq 0) / \partial l^{hs,m}$	+	+	−	−
Intensive margin				
$\partial q_j / \partial l^{ls,m}$	+	+	0	0
$\partial q_j / \partial l^{hs,m}$	+	+	−	0

This table reports partial derivatives with respect to the employment of immigrants for the extensive and the intensive margins.

Table 9 – Average effects across destinations (IV-2SLS second-stage)

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
$\widehat{\ln \text{Mig}_{it-1}}$	-0.077***	0.112
	(0.018)	(0.078)
Observations	229,830	161,131
Firm FE	yes	yes
Firm-controls FE	yes	yes
Sector-year FE	yes	yes
Method	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. Firm-year controls include size dummies, the share of high-skilled occupations and the concentration of occupations.

Table 10 – Average effects across destinations by occupation groups

	(1)	(2)
Dep. var.	Exp. concentration	$\hat{\gamma_{it}}$
ATE($\text{Mig}^{\text{hs}}_{it-1}$)	-0.208***	0.312***
	(0.016)	(0.019)
	[229,780]	[161,098]
	10.4	10.4
ATE($\text{Mig}^{\text{ls}}_{it-1}$)	-0.407***	3.198***
	(0.100)	(1.032)
	[229,815]	[161,128]
	8.0	8.0
Method	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.

Table 11 – Average treatment effects of the exposure to immigrants from country j

	(1)	(2)	(3)	(4)
Dep. var.	(log) Exports (j)	(log) Exports ($-j$)	(log) Nr. of products (j)	(log) Nr. of products ($-j$)
ATE(Mig_sh_{jrt-1})	7.107***	5.816***	1.905***	2.151***
	(0.039)	(0.039)	(0.012)	(0.016)
	[624,283]	[624,284]	[624,284]	[624,284]
	8.1	8.1	8.1	8.1
Method	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE	IV-2SLS/DRE

Note: This table reports average treatment effects obtained from a IV-2SLS/DRE method. *** denotes significance at the 1% level. Robust standard errors clustered at the 2-digit sector-year level are reported in parentheses. The number of observations is reported in brackets. The mean bias between the characteristics of treated and untreated firms is also provided under the number of observations.