UNIVERSITÄT BIELEFELD

Faculty of Business Administration and Economics

Working Papers in Economics and Management

No. 15-2019
January 2020

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Léa Marchal Giulia Sabbadini

Bielefeld University
P.O. Box 10 01 31
33501 Bielefeld – Germany

ABCD www.wiwi.uni-bielefeld.de

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Latest version available online

Léa Marchal† and Giulia Sabbadini‡

†Bielefeld University; lea.marchal@uni-bielefeld.de

‡Graduate Institute of International and Development Studies; giulia.sabbadini@graduateinstitute.ch

December 12, 2019

Abstract

This paper investigates the impact of Chinese import competition on firms' performance, and whether firms employing immigrant workers face this shock differently. Using a sample of French manufacturing firms from 1994 to 2015 and an IV-2SLS strategy relying on a shift-share instrument, we find that an increase in Chinese import competition faced by firms on an industry-destination market has a negative effect on both firms' survival probability and sales growth rate on that market. At both margins, the effect is mitigated by the employment of immigrant workers. To the best of our knowledge, this is the first paper that investigates whether firms' immigrant employment helps to understand firms' heterogeneous responses to trade shocks.

Keywords: Firm, Heterogeneity, Immigrant workers, Import competition

JEL Codes: F14 F22 F16

*Acknowledgments: This work is part of the NaWaCC project financially supported by a public grant overseen by the German and the French National Research Agencies; https://nawacc.github.io. We are grateful to Amandine Aubry, Richard Baldwin, Cosimo Beverelli, Julia Cajal Grossi, Julien Martin, Isabelle Mejean and Clément Nedoncelle for their constructive remarks on the different versions of the paper. We also thank the participants to the 2019 ETSG conference, the Geneva Trade and Development Workshop, the 18th GEP-CEPR Annual Postgraduate Conference and the Kiel lunch-time seminar for useful discussions and comments. The usual disclaimer applies.

1 Introduction

In this paper, we analyse how the increase in import competition from China affects French firms' survival and sales growth rate, and to what extent immigrant workers could help firms to better react to this shock. Our assumptions are that firms hiring immigrant workers may not only benefit from productivity gains and reduced trade costs (as shown by existing literature), but also from a greater capacity to adapt their technology over time, hence enabling them to better react to trade shocks.

Our work builds on two strands of literature. On the one hand, the literature on the China shock shows an average negative effect of import competition on wages and employment at the aggregate level (see Autor et al. (2013) among others) as well as at the firm-level in terms of firms' death probability and employment growth (see Bernard et al. (2006) among others).

On the other hand, existing literature on the trade-migration nexus shows that immigrants foster exports. At the firm level, the pro-trade effect of immigrants is conveyed through a *productivity* and a *trade-cost* channel. The productivity gains stem from the imperfect substitution between immigrant and native workers that leads to a more efficient allocation of tasks (Peri and Sparber, 2009; Mitaritonna et al., 2017) and from firms' adoption of different and possibly more efficient technologies (Gandal et al., 2004; Lewis, 2011). This increase in productivity affects both the probability to serve a destination as well as the total sales on that destination (Marchal and Nedoncelle, 2019). In addition, immigrant workers have a superior knowledge of foreign markets which lowers firms' variable and fixed export costs (Andrews et al., 2016; Hatzigeorgiou and Lodefalk, 2016; Hiller, 2013). These workers hence foster export sales at both margins.

Our paper aims at studying the impact of immigrants on firms' resiliency to trade shocks. The canonical model of Melitz (2003) offers the theoretical framework to provide a number of theoretical insights on how immigrant workers help firms to face changes in import competition at both trade margins. First, immigrant workers may help firms to survive on a market by increasing firms' productivity level and by lowering their export costs, but also by helping them to improve their technology over time, hence enabling them to better react to trade shocks. Second, these workers may help firms to smooth a reduction in their sales growth rate. This effect takes place through a technological improvement due immigrant workers over time.

Then, we study whether immigrants impact firms' responses to an increase in import penetration from a low-wage country such as China using a sample of French manufacturing firms from 1994 to 2015. The sample contains 17.01 million firm-industry-destination-year observations. The set of destinations includes the domestic market – France – and all foreign destinations served by our sample of firms. We instrument firms' employment of immigrant workers using a shift-share instrument *à la* Card (2001) based on the distribution of immigrants by occupations and across French administrative districts ("départements") in 1990.

We find that an increase in import competition negatively affects firms' performance in an industry-destination market. At the extensive margin, a 1% increase in the intensity of the China shock lowers firms' survival rate by 0.25%. At the intensive margin, a 1% increase in import

penetration lowers the sales growth rate by 0.85%. Then, we find that immigrant workers mitigate this negative effect. At the extensive margin, the unconditional impact of the import competition shock is about -0.41% for firms that hire no immigrant worker, yet this effect drops to -0.38% for a firm employing the average number of immigrant workers. Similarly, at the intensive margin, the unconditional impact is about -2.18% and the conditional impact amounts to -1.96%. These results hold for both high- and low-skilled immigrant workers.

The contribution of this paper is twofold. First, while there is an extensive literature studying the effect of immigrant workers on firms' trade performance (Andrews et al., 2016; Hatzigeorgiou and Lodefalk, 2016; Hiller, 2013; Marchal and Nedoncelle, 2019; Mitaritonna et al., 2017), our paper is the first to investigate whether firms' immigrant employment also helps to understand firms' heterogeneous responses to trade shocks at both margins. The literature emphasizes the negative effect of an increase in import competition along different firm-level margins. Our paper is the first also providing evidence on firm-level characteristics that can mitigate this effect.

Second, our paper contributes to the literature on the consequences of an increase in import competition from China. While the related literature mostly focuses on the impact of the China shock on the employment growth rate at the aggregate level (Autor et al., 2013; Shen and Silva, 2018), our paper contributes to the emerging literature on the firm-level impact of the China shock. Our paper however departs from existing studies by studying two new firm-level dimensions: the probability of continuously serving a market and the growth rate of sales.

The remainder of the paper is organized as follows. In Section 2, we survey existing papers on the China shock and on the trade-enhancing effect of immigrants. We provide a number of theoretical insights in Section 3. In Section 4, we describe the French firm-level data and the other data we use for our analysis as well as a number of stylized facts. In Section 5, we detail our empirical strategy and how we deal with endogeneity concerns. We present the empirical results in Section 6. Section 7 concludes.

2 Related Literature

This paper relates to two strands of literature. First, it belongs to the growing literature on the effect of the China shock on firms' strategy and performance. Second, it belongs to the literature on the trade-enhancing effect of immigrants by investigating whether immigrant workers also help to explain firms' resiliency to trade shocks.

2.1 The China Shock

The increase in import competition from China has been peaking after its accession to the World Trade Organization in 2001. The effect of the so-called *China shock* has been studied along different dimensions and for various countries. The literature pioneered by Autor et al. (2013) focuses on the causal effect of the increasing exposure to China on US employment and wages. This effect of Chinese import competition is negative and significant in the manufacturing

sector and varies with the position of the industry in the global value chain (Autor et al., 2013; Shen and Silva, 2018). Similar results have been found for a number of European countries. In particular, for Norway, Balsvik et al. (2015) find that workers, especially low-skilled individuals, are negatively affected by the increase in Chinese imports. For France, Malgouyres (2017) finds that both local employment and total labor income are negatively affected by an increase in Chinese import exposure, both for the manufacturing and the non-manufacturing sectors.

Only few papers focus on the effect of the China shock on firm-level outcomes. In their work, Bernard et al. (2006) use U.S. manufacturing firms to show that import competition from low-wage countries such as China and India, has a negative impact on firms' death probability and employment growth. In addition, the authors show that within industry, manufacturing activity relocates towards more capital-intensive firms. Finally, the authors show that firms tend to adjust their product-mix and to switch industry when their are highly exposed to import competition from low-wage countries. Two subsequent papers focus specifically on the China shock. Bloom et al. (2016) find that European firms increase innovation following an increase in Chinese import competition. In addition, the authors show a relocation of employment towards the most technologically advanced firms. Then, using Peruvian firm-level data, Medina (2017) finds that while firms face profitability losses due to an increase in competition from China, they react by upgrading quality and by exporting more high-quality goods. Finally, Mion and Zhu (2013) find that Belgian firms experienced a reduction in employment growth and a skill-upgrade following an increase in Chinese import competition.

2.2 The Pro-trade Effect of Immigrants

There is a vast literature on the casual relationship between trade and immigration that has been addressed at both the aggregate and the firm level. At the aggregate level, gravity analyses show a significant and positive relationship between trade and immigration (Gould, 1994; Parsons and Winters, 2014). Borrowing the terminology from Felbermayr and Toubal (2012), immigrants foster trade through a *preference* and a *trade-cost* channel. The first channel refers to the increase in imports due to the preference for home-country goods, the second one is more general and refers to the increase in both imports and exports induced by lower transaction costs to trade between immigrants' origin and host countries.

Immigrants decrease trade barriers in several ways (Gould, 1994; Girma and Yu, 2002; Head and Ries, 1998). First, they can communicate in both their native and host-country languages which reduces communication barriers. Second, immigrants lower information costs by increasing the availability of information regarding trade opportunities arising from foreign demand as well as from differences in costs and products across markets. Third, immigrants have a better knowledge of the institutional environment of their home countries. As contract enforcement may be difficult to achieve, especially in countries with a low quality of institutions, the development of trust thanks to immigrant workers can decrease the negotiation costs and contract-enforcement costs. For instance, immigrants can help to make the threat of community sanctions credible.

A growing firm-level literature provides the micro-foundations to the aggregate relationship observed between exports and migration flows. The literature has identified additional channels that drive this positive relationship, with a particular focus on whether the effect is contingent on hiring immigrant workers or is due to regional immigration. First, using a sample of Danish firms, Hiller (2013) finds that both regional immigration and immigrant employment help firms to reduce their trade costs. While the former only affects the composition of exports, the latter also affects firm-level export sales. Analogously, for a sample of German firms, Andrews et al. (2016) find that establishments having a higher share of immigrant employees are more likely to export. The effect is stronger for immigrant employees holding a managerial position. Second, Bastos and Silva (2012) for Portuguese firms and Hatzigeorgiou and Lodefalk (2016) for Swedish firms find that migrant networks play an important role in reducing trade costs.

A limited number of papers have studied the triad of immigration, firm productivity and trade outcomes. Using French data on manufacturing firms, Mitaritonna et al. (2017) find that an exogenous increase in the local supply of immigrants is associated with an increase in firms' total factor productivity. This result emphasizes the fact that firm-specific productivity may depend on the regional share of immigrants through knowledge externalities. This effect is found to be stronger for firms with initially low productivity and small size. In addition, the authors find that this positive effect is associated with higher exports at both trade margins. This productivity effect comes from the fact that firms improve their technology thanks to immigrant workers (Lewis, 2011; Gandal et al., 2004) and from the imperfect substitution in tasks existing between native and immigrant workers (Peri and Sparber, 2009). Using data on French manufacturing firms, Marchal and Nedoncelle (2019) study the export-enhancing effect of immigrant workers and how this effect varies across occupations. They find that immigrants in both low- and high-skilled occupations foster exports at both trade margins, and that this effect is spread across all export destinations. The authors provide suggestive evidence of a productivity-enhancing effect of immigrants, especially for low-skilled occupations. Moreover, Ottaviano et al. (2018) use a sample of service-producing firms in the UK to explore the effect of an increase in immigration in firms' districts on their exports, imports and productivity. First, the authors find that an increase in the exogenous supply of immigrants has a positive effect on labour productivity, stemming from a cost reduction in production due to a diversification of skills and from a complementary in tasks between natives and immigrants. Second, they find that an increase in the supply of immigrant workers fosters bilateral exports for language-intensive and culture-specific services. Third, the authors identify an *import substitution effect* of immigrants: an increase in the regional share of immigrants coming from a specific country reduces the imports from that country because instead of off-shoring trade-related tasks, the firm can have them performed by immigrants which is less costly.

Finally, ethnic fractionalization has been found to exert an ambiguous effect on firms' productivity. As pointed out by Trax et al. (2015), cultural diversity may enhance productivity through communication and knowledge spillovers but it may also have a negative effect if it induces social

conflicts between employees or communication barriers that hamper buyer-supplier relationships. Using German firm-level data, the authors find that while the size of the group of immigrant employees has no significant impact on productivity, the diversification of the workforce in term of citizenship increases total factor productivity. On the contrary, using a sample of Danish firms, Parrotta et al. (2014) find a negative effect of ethnic workforce diversity on productivity.

3 Theoretical Insights

In this section, we provide a number of theoretical insights that guide our empirical analysis. We consider a simple heterogeneous firm model in which mono-product firms – that are heterogeneous in their productivity level as well as in their employment of immigrant workers – maximise their profits jointly across markets[1] such that they can react to a shock in one market by adjusting their sales in another market[2]. We consider a world with n markets; a domestic market d and $n-1$ foreign markets.

3.1 Model Set-up

The inverse demand function faced by a firm i on a market k at time t is given by:

$$p_{ikt} = \left(\frac{1}{\zeta_{kt}} \frac{\chi_{ik}}{q_{ikt}} \right)^{\frac{1}{\sigma}} \tag{1}$$

where $\sigma > 1$ is the price elasticity of demand and q_{ikt} is the quantity supplied by the firm. The price is a function of two parameters. First, χ_{ik} denotes a time invariant and market specific parameter that captures firms' heterogeneity with respect to market k's conditions. Second, ζ_{kt} denotes a time-varying idiosyncratic shock related to foreign import competition. ζ_{kt} is drawn independently in each period from a time invariant market-specific distribution and is defined over $1 \leq \zeta_{kt} < \infty$. Following previous literature, we assume that there is no auto-correlation in the ζ_{kt} and no correlation between shocks across countries (Vannoorenberghe, 2012).

At time t, each firm i is characterized by a productivity level denoted φ_{it} and determined by the composition of its workforce and its technology such that:

$$\varphi_{it} = \lambda(l^d_{it-1}, l^m_{it-1}, \rho_{it}) \tag{2}$$

where l^d_{it-1} and l^m_{it-1} are the numbers of domestic and immigrant workers employed by the firm in the previous period[3] and ρ_{it} denotes the technology of the firm at time t. The technology

[1] Note that we consider mono-product firms. Therefore, a *market* equivalently identifies an industry-destination market or a destination market.

[2] For a similar model, see the study of Vannoorenberghe (2012) showing theoretical and empirical evidence of a negative correlation between firms' sales volatility on the domestic and the export market.

[3] Note that we use the stock of workers in the previous period in order to guarantee a minimal level of exogeneity in our instrumentation strategy, but also to take into account that workers may need time after their recruitment to start being fully operational. We however remain agnostic regarding the distribution functions of l^d_{it-1} and l^m_{it-1} and implement an instrumentation strategy in the empirical part of the paper.

is randomly drawn from a given distribution function at time t_0 (ρ_{it0}). It is then upgraded at each time period based on the following relationship $\rho_{it} = \rho_{it-1}u_{it}$, where $u_{it} \geq 0$ and given by $u_{it} = u(\varrho_{it}, l^d_{t-1}, l^m_{t-1})$ with ϱ_{it} being randomly drawn at each time period.

The cost function faced by the firm is given by a $nx1$ vector whose k^{th} element is the following:

$$c_{ikt} = \frac{1}{\varphi_{it}} \left(\sum_{j=1}^{n} \tau_{jt} q_{ijt} \right)^{\beta} + f_{kt} \tag{3}$$

where $\beta > 1$ ensures that the marginal cost is convex, φ_{it} denotes the firm's productivity level at time t, τ_{jt} is a time-varying iceberg export cost specific to market j (with $\tau_{jt} \geq 0 \forall j \neq d$ and $\tau_{dt} = 0$) and f_{kt} is a time-varying fixed export cost specific to market k (with $f_{kt} \geq f_{dt} \forall k \neq d$).

The ex-post profit on market k and the corresponding ex-post quantity can be described as two functions of the model's exogenous parameters: $\pi_{ikt}(\varphi_{it}, \zeta_{kt}, \chi_{ik}, \tau_{1t}, ..., \tau_{nt}, f_{kt})$ and $q_{ikt}(\varphi_{it}, \zeta_{kt}, \chi_{ik}, \tau_{1t}, ..., \tau_{nt})$.

3.2 Chinese Import Competition, Firm Performance and Immigrants

After studying firms' level consequences of an increase in import competition, we study to what extent differences in the employment of immigrant workers may induce different firms' responses in terms of survival rate and sales growth rate following an increase in import competition[4].

3.2.1 The Effect of an Increase in Chinese Import Competition

We start by analysing firm-level consequences of an increase in import competition. When the firm is hit by an import competition shock on market k between time t and $t+1$ (*i.e.* when $\zeta_{kt+1} > \zeta_{kt}$), then its survival probability on that market decreases:

$$\frac{\mathrm{d}P\left(\pi_{ikt+1} \geq 0 | \pi_{ikt} \geq 0\right)}{\mathrm{d}\Delta\zeta_k} < 0 \tag{4}$$

as well as the quantity it sells on that market:

$$\frac{\partial \Delta q_{ik}}{\partial \Delta \zeta_k} < 0 \tag{5}$$

where the variation in a variable x between time t and $t+1$ is given by $\Delta x = x_{t+1} - x_t$.

3.2.2 The Conditional Effect of an Increase in Chinese Import Competition

We now model the impact of immigrant workers on firms performance as follows. First, we assume that a firm employing immigrant workers is, *ceteris paribus*, more productive than a firm

[4] We consider that firms have no impact on the general equilibrium over time, which allows us to study whether differences in the employment of immigrant workers induce different firm responses. Note that we can study first-order selection effects because we assume that (i) a general equilibrium exists and (ii) the profit is continuous and decreasing in the marginal cost (Mrázová and Neary, 2018).

employing none such that $\frac{\partial \varphi_{it}}{\partial l^m_{it-1}} \geq 0$. This assumption follows the theoretical model provided by Marchal and Nedoncelle (2019) and empirical evidence provided by Mitaritonna et al. (2017).

Second, we consider that immigrant workers have an impact on the firm's capacity to improve its technology in the next time period. For instance, immigrants may have a general knowledge of foreign markets and foreign competing firms that enable firms to implement adaptive sales strategy.Such an adjustment effect can be formalized by the following condition: $\frac{\partial u_{it+1}}{\partial l^m_{it-1}} \geq 0$. Given two identical firms only differing in their employment of immigrant workers, *ceteris paribus*, the firm employing immigrant workers has a higher technological upgrade in the next period. This translates into a higher productivity level at time $t+1$ such that $\frac{\partial \varphi_{it+1}}{\partial l^m_{it-1}} \geq 0$. This assumption is in line with the empirical studies provided by Gandal et al. (2004) and Lewis (2011).

Third, we assume that immigrant workers decrease the variable and fixed export costs of the firm such that $\frac{\partial \tau_{kt}}{\partial l^m_{it-1}} \leq 0 \, \forall k \neq d$ and $\frac{\partial f_{kt}}{\partial l^m_{it-1}} \leq 0 \forall k \neq d$. In line with empirical evidence, we assume that these workers provide operational information about their origin country that eventually allows firms to overcome trade barriers for that particular destination; we also consider that these immigrant workers have a general knowledge of foreign markets that allows firms to lower export costs towards other destinations (Andrews et al., 2016; Hatzigeorgiou and Lodefalk, 2016; Hiller, 2013; Parsons and Winters, 2014).

We now analyse to what extent the employment of immigrant workers at time $t-1$ help firms to smooth the negative effects of an import competition shock. At the extensive margin, the effect of a shock conditional on the firm's employment of immigrant workers is given by the following second-order mixed derivative:

$$\frac{\mathrm{d}^2 P\left(\pi_{ikt+1} \geq 0 | \pi_{ikt} \geq 0\right)}{\mathrm{d}\Delta\zeta_k \mathrm{d}l^m_{it-1}} \Leftrightarrow \frac{\mathrm{d}}{\mathrm{d}\Delta\zeta_k}\left[\frac{\mathrm{d}P\left(\pi_{ikt+1} \geq 0 | \pi_{ikt} \geq 0\right)}{\mathrm{d}l^m_{it-1}}\right] \tag{6}$$

Knowing that $\frac{\partial \tau_{kt}}{\partial l^m_{it-1}} \leq 0 \forall k \neq d$, $\frac{\partial f_{kt}}{\partial l^m_{it-1}} \leq 0 \forall k \neq d$, $\frac{\partial \varphi_{it}}{\partial l^m_{it-1}} \geq 0$, $\frac{\partial \varphi_{it+1}}{\partial l^m_{it-1}} \geq 0$ and that other partial derivatives with respect to l^m_{it-1} are nil, we can infer that $\frac{\mathrm{d}P(\pi_{ikt+1} \geq 0 | \pi_{ikt} \geq 0)}{\mathrm{d}l^m_{it-1}} \geq 0$. Hence, immigrant workers mitigate the negative effect of an import competition shock on the survival rate of the firm on market k. This mitigation effect is channeled through a productivity effect (at time t and $t+1$) and a reduction in trade costs induced by immigrant workers (at time t).

At the intensive margin, the effect of a shock conditional on the firm's employment of immigrant workers reads as follows:

$$\frac{\partial^2 \Delta q_{ik}}{\partial \Delta\zeta_k \partial l^m_{it-1}} \Leftrightarrow \frac{\partial}{\partial \Delta\zeta_k}\left(\frac{\partial \Delta q_{ik}}{\partial l^m_{it-1}}\right) \tag{7}$$

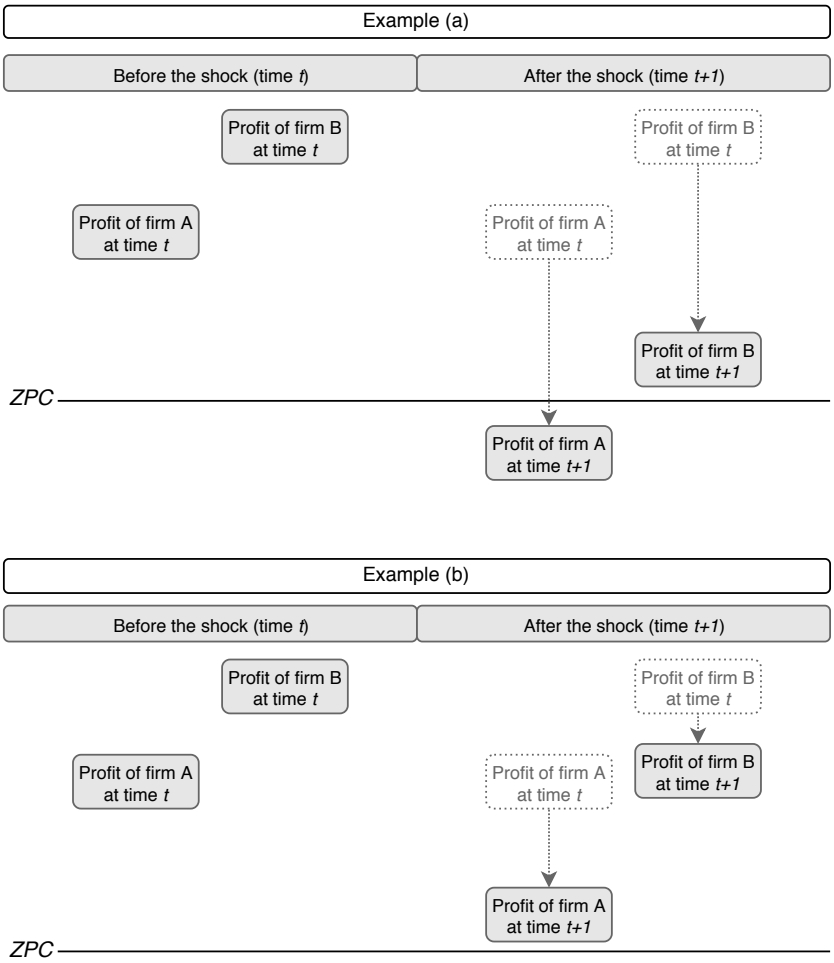
where $\frac{\partial \Delta q_{ik}}{\partial l^m_{it-1}}$ is only determined by $\frac{\partial \Delta \varphi_i}{\partial l^m_{it-1}}$ (other partial derivatives being nil). Because $\frac{\partial \Delta \varphi_i}{\partial l^m_{it-1}} \geq 0$, we can infer that $\frac{\partial \Delta q_{ik}}{\partial l^m_{it-1}} \geq 0$. Therefore, immigrant workers mitigate the negative effect of an import competition shock on the sales growth rate of the firm by helping it to adjust its productivity over time. Note that this technological adjustment effect is the only channel at play at the intensive margin.

For an illustration of these theoretical insights, consider Figure 1. For simplicity, consider two firms, A and B, that serve a unique market. A and B only differ in their employment of immigrant workers: firm A employs no immigrant workers while firm B employs a positive number of immigrant workers.

In example (a), both firms' profits lie above the zero-profit condition (ZPC) at time t. Hence, they both serve the considered market. Yet, firm B's profit is higher due to its employment of immigrants. We then assume that both firms are hit by an increase in import competition occurring between time t and $t+1$. As a consequence, both firms' profits decrease at time $t+1$ such that firm A no longer serves the market while firm B can still match the ZPC and serve the market. At the extensive margin, one can observe a difference between the survival rates of firm A (exiting the market) and firm B (continuously serving the market). A similar change can be observed in terms of supplied quantities instead of profits. Note that when the profits decrease by the same proportion (like in this example), it implies that immigrants workers only have an impact on firm B's initial characteristics at time t (and do not impact its characteristics at time $t+1$). Firm B's could however see its profit decrease by a lower amount than firm A because of a technological improvement induced by immigrants between time t and $t+1$. The result of example (a) would however be the same.

In example (b), we consider that both firms' profits decrease in response to the import competition shock, yet both firms are still able to serve the market at time $t+1$ (their profits still lie above the ZPC). At the extensive margin, one can observe no difference between the survival rates of firms A and B. At the intensive margin, one can only observe a difference in the sales growth rate of the two firms because their profits vary by different proportions. If their profits were varying by the same proportion, no effect could be observed. This example shows that if both firms keep on serving the market at time $t+1$, the only way through which immigrant workers can mitigate the negative impact of an import shock on the sales growth rate of firm B is through an improvement in the technology level between time t and $t+1$.

Figure 1: Illustration of the theoretical predictions



4 Data and Descriptive Statistics

In this section, we describe the French firm-level data and other publicly available data that we use for our analysis. We then provide a number of descriptive statistics and stylized facts that characterise the relationship between immigrant workers, Chinese import competition and firms' performance over time.

4.1 Firm-level Data

We use three sources of confidential administrative data on French firms from 1994 to 2015 that we combine using a unique firm identifier (the SIREN number).

Administrative data on employees. First, we use an administrative data consisting of annual employee declarations by wage-paying establishments located on the French mainland territory (*Déclarations Annuelles des Données Sociales*, DADS postes). 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 firms over time, but not workers because the dataset does not contain a consistent worker-identifier over time.

For each year, this data contains information on the characteristics of the workers such as their administrative district of residence and of work, wage, type of contract, occupation and citizenship (French *versus* foreign citizen). In the remainder of the paper, we therefore define an immigrant worker as a foreign citizen. Note that we do not observe the exact origin country of foreign individuals. In addition, the French classification of occupations (*Nomenclatures des professions et catégories socio-professionnelles*) allows us to identify workers in low- and high-skilled jobs. Additional information about the occupation codes are provide in Appendix A.1.

The dataset contains about 60 million individual-firm observations per year. After aggregating the data at the firm-level, we obtain the number of employees by nativity for each firm-year observation. Once aggregated at the firm-year level, the dataset contains 33,950,206 firm-year observations among which 2,301,873 firm-year observations pertain to the manufacturing sector.

Tax records. We then use balance-sheet data consisting of tax reports filled in by firms located in France (*Fichier de comptabilité unifié dans SUSE*, FICUS and *Fichier approché des résultats d'Esane*, FARE). This dataset contains firms in the manufacturing and service sectors. Importantly, it contains both small and large firms since no threshold applies on the number of employees for reporting to the tax administration. This dataset provides us with information on firms' sales, main industry, main administrative districts (French "départements"), value added, capital stock, total assets, debt structure and other variables related to their accounting. Each firm is assigned only one NACE industry code (NACE rev. 1 until 2007, NACE rev. 2 from 2008). Note that there is a discontinuity in the data in 2008 as the NACE nomenclature changes. In addition, all domestic sales are reported as missing in 2008. The dataset contains 57,720,020 firm-year observations. After keeping firms whose main activity belongs to the manufacturing sector *i.e.* to the divisions 10-33 of the NACE Rév.2 classification, we obtain a sample of 3,422,583 out of which 2,062,256 also have administrative data on employees available in the DADS data.

Customs data. Finally, we use a dataset from the French customs that contains shipments in value (Euros) and in volume (tons) by CPA6 product and origin/destination country. Firms located on the French mainland territory are required to report their imports and exports of goods only if they reach the following thresholds: Shipments to/from EU countries are reported only if larger than 150,000 Euros and shipments to/from other countries are reported only if larger than 1,000 Euros or one ton. This however accounts for only a small share of total exports (Berman et al., 2015).

The dataset contains 40,241,102 export flows at the firm-year-destination-product level. We use a time-invariant CPA6 code whose first four digits provide the main industry of the good exported by the firm (NACE rev. 2). We obtain 26,103,154 observations at the firm-year-destination-industry level. Firms possibly serve several industries as well as several destinations. Note that the firm may serve each of its industry-destination market in a discontinuous way. We therefore fill in the dataset with zeros when the firm does not serve an industry-destination in a year, while it serves it at least one year before and one year after. We are then able to merge 13,589,505 observations into the DADS-tax sample.

4.2 Aggregate Data

In addition to the firm-level data, we use two publicly available sources of information: the 1982 and 1990 French population censuses as well as the Comtrade dataset.

Census data. We use the 1982 and 1990 French population censuses (*Données harmonisées des recensements de la population à partir de 1968*)[5]. These censuses contain information on stocks of native and immigrant populations by 1-digit occupation codes and by administrative districts. Note that two definitions are available for immigrants, foreign citizens and foreign-born individuals. We use these data to build spatial weights of the supply of foreign citizens across occupations that we then use to build our instrumental variables. We are then able to match the census data with our sample of interest for all districts of the French mainland territory.

Trade data. We also use the Comtrade dataset that contains bilateral trade flows at the HS6 product level by origin and destination countries[6]. We use the classification of HS codes labelled *as reported* in order to match these data with the French customs data that contains a time-varying HS code. Once the data are matched, we are able to build a time-varying proxy for the Chinese import competition faced by firms on each of their industry-destination market. Details on the match of the Comtrade data to the French firm-level data are provided in Appendix A.2.

4.3 Descriptive Statistics

Our final sample contains 17,012,088 firm-industry-destination-year observations (or 3,422,583 firm-year observations). This sample consists of manufacturing firms that appear in the tax records. These firms account for 13.89% of the French employment observed in the DADS. In our dataset, exporters (firms which export at least once over the sample period) account for 87.43% of the final dataset (14,873,894 observations), while domestic firms (firms that never export over the sample period) account for 12.57% of the final dataset (2,138,177 observations). The data nonetheless contains more domestic firms (412,427 unique firm identifiers) than exporters (125,332 unique firm identifiers).

[5] For more details, see: https://www.insee.fr/fr/statistiques/2414232
[6] For more details, see: https://comtrade.un.org

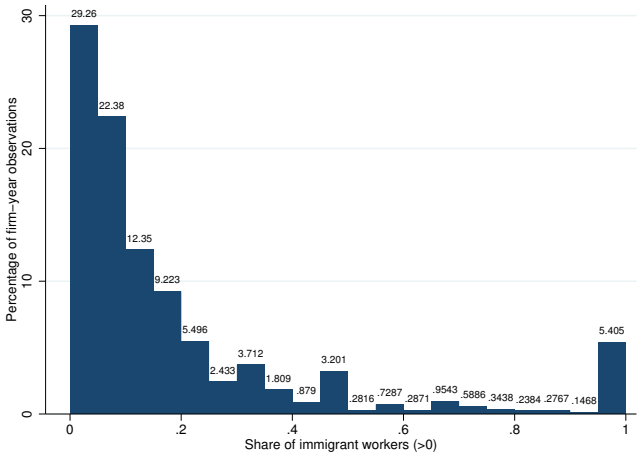
We report a number of summary statistics on firms' characteristics in Appendix A.3, Table A.2. Our sample includes both small and large firms in terms of profit, financial resources and employment, which is in line with the fact that the French economy is characterized by a high level of granularity *i.e.* it exhibits a large number of very small firms (about 44.75% of firms hire less than 20 employees). Although not reported in the table, only 26.52% of firm-year observations exhibit a positive employment of immigrant workers. Finally, manufacturers employ on average about 5.20% of immigrant workers. The average is slightly higher when we consider low-skilled immigrant workers 5.75% and drops to 3.61% for high-skilled immigrant workers.

In Figures 2 and 3, we focus on the distribution of immigrant workers across firms and on their characteristics with respect to native workers. Figure 2 shows that among the 26.52% of firm-year observations that exhibit a positive employment of immigrant workers, 29.26% of them employs less than 5% of immigrant workers. We report the distribution of the (log) number of immigrant employment which is consistently skewed towards the left in Appendix A.3.

Figure 3 shows that the within-firm mean gross wage of immigrant workers does not differ much from that of native workers over our sample period. This fact suggests that French firms do not hire immigrant workers because they are paid less on average. The figure rather points at a positive selection of immigrant workers.

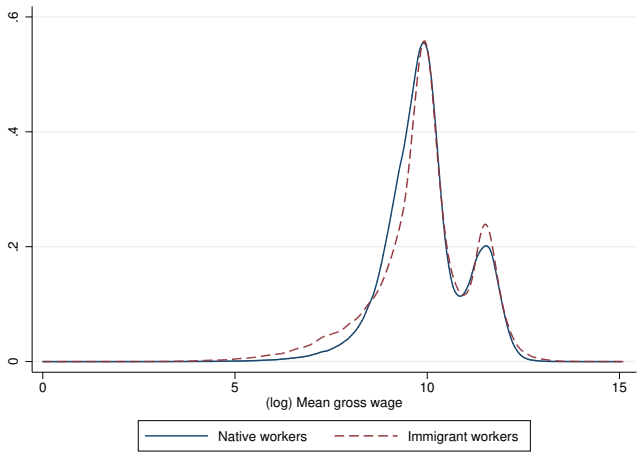
Another interesting fact concerns the persistence of immigrant employment over time. Out of the 2.06 million firm-year observations displaying a non-missing number of immigrant workers, about 91.27% of them do not change their status in terms of immigrant employment. In other words, most firms that do (not) employing immigrant workers at time t do (not) employ immigrant workers at time $t+1$. Among firm-year observations that change their immigrant employment status from one year to another, 50.59% of them change their status from not employing any immigrant worker to employ at least one. Similarly, about 79.76% of the firm-year observations display no change in their number of immigrant workers. This percentage slightly drops to 59.63% when considering the *share* of immigrant workers. This time persistence in the employment of immigrant workers mitigate our reverse causality concerns according to which firms hire immigrant workers in light of the negative effect that import competition has on their performance.

Figure 2: Distribution of immigrant workers



Data source: French firm-level data

Figure 3: Distributions of the mean gross wage



Data source: French firm-level data

4.4 Stylized Facts

4.4.1 Immigrant Workers and Firm Performance

Following existing theoretical and empirical evidence, immigrant workers increase firms' productivity and decrease export costs. We now provide some suggestive evidence on these two

channels, which are deemed to be the reasons why firms employing immigrant workers may react differently to import competition.

To identify a productivity effect of immigrants, we analyse whether immigrant workers employed at time $t-1$ have an impact on firms' level of domestic sales at time t. We focus on domestic sales and split the sample between non-exporting and exporting firms[7]. In doing do, we exclude the possibility that a trade-cost channel is at play.

The second-stage equation of our IV-2SLS estimation strategy reads as follows:

$$\ln \text{Sales}_{it} = \beta_0 + \beta_1 \widehat{\text{Immig}_{it-1}} + \Gamma' X_{it} + \gamma_i + \gamma_t + \varepsilon_{it} \tag{8}$$

where the left-hand side variable is the domestic sales of firm i at time t and $\widehat{\text{Immig}_{it-1}}$ denotes the (log) number of immigrant workers (plus one) employed by firm i at time $t-1$ (instrumented by a shift-share variable described herein-after in Section 5). The specification includes a number of time-varying firm-level controls (X_{it}) as well as firm and year fixed effects (γ_i and γ_t).

Table 1: The pro-trade effect of immigrant workers

	(1)	(2)	(3)	(4)	(5)
	$\ln \text{Sales}_{it}$			$\ln \text{Exports}_{ikt}$	
$\widehat{\text{Immig}_{it-1}}$	0.443***	0.338***	0.793***	0.631***	0.677***
	(0.087)	(0.051)	(0.090)	(0.085)	(0.079)
$\widehat{\text{Immig}_{it-1}} D_{\Omega_k}$				0.208***	0.465***
				(0.075)	(0.110)
Observations	745,830	729,018	4,128,722	4,057,939	4,057,939
Sample	Non-exporters	Exporters	Exporters	Exporters	Exporters
Ω_k	All	All	All	Non-fr. speaking	Developing
Firm-controls	yes	yes	yes	yes	yes
Firm FE	yes	yes	no	no	no
Firm-destination FE	no	no	yes	yes	yes
Time FE	yes	yes	no	no	no
Method	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%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Second-stage results are reported in columns (1) and (2) of Table 1 for both samples of non-exporting and exporting firms. We find a positive and significant effect of immigrant workers on the value of domestic sales for both samples of firms. Since immigrants have virtually no trade-cost effect on domestic sales, we interpret their impact on domestic sales as their effect on their

[7]Note that we only analyse the intensive margin as there is not much variation in firms' participation to their domestic market in our dataset.

firms' productivity. This result lends support to a productivity effect of immigrant workers and corroborate existing literature on the productivity-enhancing effect of immigrants (Mitaritonna et al., 2017).

We then explore the presence of a trade-cost effect of immigrants according to which individuals provide information that lowers firms variable and fixed export costs. The main drawback of the data at hands is that it contains no information on the origin country of immigrants. To overcome this difficulty, we exploit the variation in firms' export destinations. The second-stage equation of our IV-2SLS estimation strategy is the following:

$$\ln \text{Exports}_{ikt} = \beta_0 + \beta_1 \widehat{\text{Immig}_{it-1}} + \beta_2 \widehat{\text{Immig}_{it-1}} D_{\Omega_k} + \Gamma' X_{it} + \gamma_{ik} + \varepsilon_{ikt} \tag{9}$$

where the left-hand side variable is the export sales of firm i at time t, Ω is a sub-sample of export destinations k and D_k denotes a dummy variable equal to one if destination $k \in \Omega$. The specification includes a number of time-varying firm-level controls (X_{it}) as well as firm-destination fixed effects, (γ_{ik}).

Second-stage results are reported in columns (3) to (5) of Table 1. In column (3), we show the results without the interaction term and find a positive and significant effect of immigrant workers on the value of export sales. When then include the interaction term to control for a sample of non-French-speaking destinations (column 4). The classification of countries by official language is taken from the CEPII[8]. We find that the pro-trade effect of immigrants is reinforced for destination countries that have a different official language than France. Similarly, when we include an interaction term to control for developing destination countries in column (5), we find a stronger pro-trade effect of immigrants for this sample of destinations. In line with the literature, these results suggest that the pro-trade effect of immigrant workers is stronger when firms trade with countries that are more distant in terms of language and institutions and for which trade costs are necessarily higher (Parsons and Winters, 2014).

Information on the exact origin country of immigrants could however be useful to evaluate the trade-cost channel of immigrant workers highlighted in the literature (Andrews et al., 2016; Hiller, 2013). This effect may be destination-specific *i.e.* immigrant workers can foster exports towards their origin countries, or more general *i.e.* immigrant workers can foster exports towards other (possibly similar) destinations if they have a general export know-how or specific language abilities.

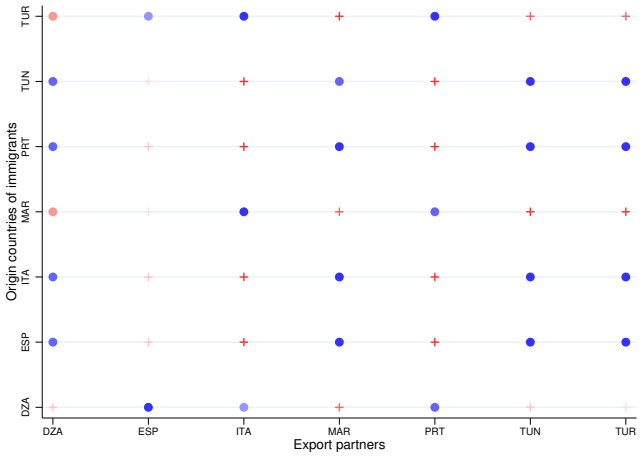
We thus use aggregate data to analyse the correlation between stocks of immigrants and exports towards their origin countries as well as towards other countries, specifically for France. We use export data from the Comtrade dataset and migration data from the IAB Brain Drain Data[9]. Figure 4 shows the correlation between the aggregate share of immigrants for the seventh largest source countries of immigration in France over the period 1995-2010, and the French export share towards the corresponding partner country. These countries are Algeria (DZA),

[8] For more details, see http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=19

[9] For more details, see: https://www.iab.de/en/daten/iab-brain-drain-data.aspx

Spain (ESP), Italy (ITA), Morocco (MAR), Portugal (PRT), Tunisia (TUN) and Turkey (TUR). A blue dot indicates a negative correlation while a red cross indicates a positive correlation. The stronger the correlation, the darker the color of the dot/cross. In line with the literature, this figure illustrates a positive correlation between bilateral immigration and export flows as the diagonal contains only red dots (except for Tunisia). Moreover, the red dots off-the-diagonal point to a more general pro-trade effect of immigrants.

Figure 4: Stocks of immigrants by main origin countries and bilateral exports for France



Data source: Comtrade Dataset and IAB Brain Drain Data for 1995-2010

4.4.2 Immigrant Workers, Firm Performance and Chinese Import Competition

We now analyze the relationship between immigrant workers and import competition from China for both trade margins in Figure 5. In Figure 5a, we present graphically the full set of non-parametric interaction terms between quantiles of the (log) number of immigrant workers (plus one) at time $t-1$ (instrumented by a shift-share variable described herein-after in Section 5) and the growth rate in Chinese import competition between time t and $t+1$, plotted against firms' survival rate at time. The survival rate is a binary variable equal to one if a firm serves an industry-destination market at time t *and* $t+1$. This figure shows that employing immigrant workers translates into a lower impact of Chinese import competition on firms' survival rates. The effect of the import competition shock on the survival rate becomes less negative when the employment of immigrant workers increases (starting from the second quantile) *i.e.* when firms' employment of immigrant workers is above the 40^{th} percentile.

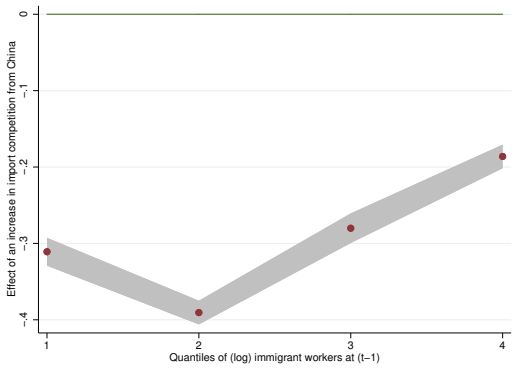
In Figure 5b, we show a similar graph for the intensive margin. We present the full set of non-parametric interaction terms between quantiles of the (log) number of immigrant workers (plus one) at time $t-1$ (instrumented by a shift-share variable) and the growth rate in Chinese import competition between time t and $t+1$, plotted against firms' growth rate of sales between time t

and $t+1$. We find that the negative and significant effect of import competition decreases with immigrant employment *i.e.* it becomes less negative as the employment of immigrant workers increases. The effect of import competition is the largest for firms that do not employ any immigrant worker.

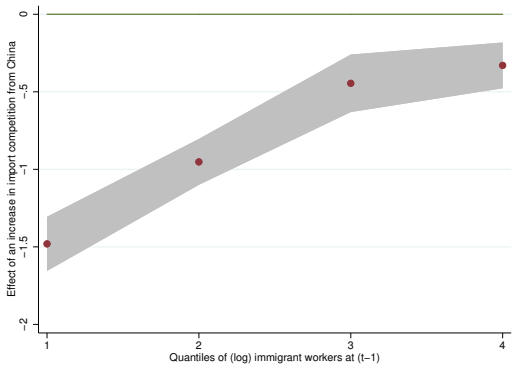
All in all, this set of results provides suggestive evidence that immigrant employment explains, to some extent, firms' heterogeneous responses to trade shocks. Note that this is only one firm characteristics among others that could explain this heterogeneity. In this section, we focus our attention on immigrant employment and control for other time-varying firm characteristics such as the firm size and industry fixed effects to capture additional sources of heterogeneity. In the reminder of the paper, we provide causal evidence for this relationship by controlling for additional firm characteristics and by implementing an instrumentation strategy.

Figure 5: Immigrant workers and firm performance

(a) Firms' survival rate



(b) Firms' sales growth rate



Note: Regressions include firm size as a control as well as industry and time fixed effects. The grey area represents the 10% confidence interval. In both figures, the first point represents the observations with no employment of immigrant workers and accounts for 30% of the total sample. The second point includes the observations displaying an employment of immigrant workers below the 40^{th} percentile. The third point includes the observations displaying an employment of immigrant workers between the 50^{th} and the 70^{th} percentile. The fourth point includes the observations displaying an employment of immigrant workers above the 70^{th} percentile.

5 Empirical Strategy

In this section, we describe the econometric model we use to study the relationship of interest. We detail the main endogeneity concerns and the instrumentation strategy that we implement in order to obtain causal results.

5.1 Empirical Specification

The baseline econometric specifications for the extensive and the intensive margins are given by the following equations:

$$\begin{aligned} D(X_{ijkt+1} = 1 | X_{ijkt} = 1) = &\beta_0 + \beta_1 \Delta \text{Comp}_{jk} + \beta_2 \text{Immig}_{it-1} \\ &+ \beta_3 \Delta \text{Comp}_{jk} \text{Immig}_{it-1} + \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \Delta \varepsilon_{ijk} \end{aligned} \tag{10}$$

$$\begin{aligned} \Delta \ln \text{Sales}_{ijk} = &\beta_0 + \beta_1 \Delta \text{Comp}_{jk} + \beta_2 \text{Immig}_{it-1} + \beta_3 \Delta \text{Comp}_{jk} \text{Immig}_{it-1} \\ &+ \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \Delta \varepsilon_{ijk} \end{aligned} \tag{11}$$

The dependent variable in Equation (10) is a binary variable taking the value one if firm i serves an industry-destination market jk at time t *and* $t+1$, and zero otherwise. In order to build this binary variable, we take into account that a firm may serve discontinuously an industry-destination market over time and that this discontinuity may precisely be due to an increase in import competition from China. Details on the structure of the dataset are provided in Appendix A.4.

The dependent variable in Equation (11) is the sales growth rate of firm i in an industry-destination market jk between periods t and $t+1$. Here again, the way we structure the data allows us to compute the growth rate of sales for any industry-destination combination that the firm serves, even if it serves that market discontinuously over time. Otherwise, we would not be able to capture the fact that the quantity sold on a market may drop from positive to zero precisely because of an increase in import competition.

The variables of interest are the following. ΔComp_{jk} denotes the growth rate in import competition from China faced in the industry-destination market jk between time t and $t+1$. The measure of firms' exposure to Chinese competition is built following the literature on the China shock (Bloom et al., 2016). It reads as follows:

$$\Delta \text{Comp}_{jk} = \frac{M_{jt+1}^{\text{CH},k}}{M_{jt+1}^{\text{WLD},k}} - \frac{M_{jt}^{\text{CH},k}}{M_{jt}^{\text{WLD},k}} \tag{12}$$

where $M_{jt}^{\text{CH},k}$ denotes country k's imports of industry j from China at time t and $M_{jt}^{\text{WLD},k}$ denotes country k's imports of industry j from the world at time t. Note that firms operating in the same industry-destination market face the same level of Chinese import competition.

Then, Immig_{it-1} denotes the (log) number of immigrant workers (plus one) employed by firm i at time $t-1$[10]. $\Delta \text{Comp}_{jk} \text{Immig}_{it-1}$ is the interaction between the two aforementioned variables. We include a number of time-varying firm-level controls (X_{it}) such as the share of high-skilled occupations in the firm and size dummies (less than 20 employees, between 20 and 250

[10] The literature presents instances using the share of immigrants in the district of the firm (Mitaritonna et al., 2017; Ottaviano et al., 2018). However, the firm's immigrant employment better captures the direct contribution of these workers to their firm. We thus follow Hiller (2013) and Marchal and Nedoncelle (2019) and use the *firm-level* employment of immigrant workers.

employees, and more than 250 employees). Our main specification includes firm and industry-year fixed effects. This set of covariates and fixed effects enables us to control for other sources of firm heterogeneity than immigrant employment that could explain firms' heterogeneous responses to trade shocks. Finally, errors are clustered at the industry level.

In equations (10) and (11), β_1 gives the effect of an increase in import competition on firms' survival rate and sales growth rate. In line with the literature, we expect this coefficient to be negative. β_3 is our coefficient of interest. Following existing literature and our theoretical insights, we expect this coefficient to be positive. In other words, we expect immigrants to mitigate the negative effect of an increase in import competition on firms' survival rate and sales growth rate.

5.2 Endogeneity Concerns

5.2.1 Immigrant Employment

The empirical specification presented in equations (10) and (11) may suffer from several endogeneity issues concerning the immigration variable. First, there might be a problem of reverse causality as firms may anticipate the negative effect of import competition and therefore decide to hire immigrant workers accordingly. Second, there might be a selection bias if larger and more international firms are also those which are more likely to hire immigrant workers. Therefore, these firms might be more resilient to an increase in import competition because they are larger and more productive, and not necessarily because they hire immigrant workers. Finally, it is possible that some non-observable regional factors that vary over time affect both the growth rate of firms' sales as well as their demand of immigrant workers.

To minimize reverse causality concerns, we include firm fixed effects in the model. As shown in Section 4, the number of immigrant workers does not vary a lot over time within a firm. Therefore, adding firm fixed effects should mitigate endogeneity concerns related to reverse causality. To further ensure causal inference and to overcome issues related to selection and omitted variables, we use an instrumental variable (IV) approach in a two-stage least square estimation (2SLS).

So far, studies intending to tackle endogeneity issues using IV-2SLS strategies have instrumented the immigrant employment either by the lagged employment of immigrants, 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/stock of immigrants with an imputed share (or shift-share instrument) *à la* Card (2001). We follow this literature (Mitaritonna et al., 2017; Ottaviano et al., 2018; Marchal and Nedoncelle, 2019) and instrument the number of immigrant workers employed by firm i located in district d at time t by the imputed stock of immigrant workers in district d at time t that we build as follows:

$$\text{IV}_{dt} = \sum_{o} \frac{\text{Immigrants}_{o,d,1990}}{\text{Immigrants}_{o,\text{FR},1990}} \text{Immigrants}_{o,\text{FR},t} \tag{13}$$

This instrument consists in weighting the total number of immigrants in France at time t in a specific 1-digit occupation o (available in the DADS data) by the share of immigrants in that occupation group in each French district in 1990 (available in the census data).

Our identification strategy relies on the fact that the distribution of immigrant workers across districts and occupations is persistent over time due to network effects. Therefore, the imputed stock of immigrant workers in the district of the firm is highly correlated to the supply of immigrant workers to which firms are exposed to. The past distribution of immigrant workers should however not have any effect on firms' outcomes.

Using this instrumental variable, we can estimate the following first-stage equations:

$$\begin{aligned}\text{Immig}_{it-1} =&\alpha_0 + \alpha_1 \Delta\text{Comp}_{jk} + \alpha_2 \text{IV}_{dt-1} + \alpha_3 \Delta\text{Comp}_{jk}\text{IV}_{dt-1} \\ &+ \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \epsilon_{it}\end{aligned} \tag{14}$$

$$\begin{aligned}\Delta\text{Comp}_{jk}\text{Immig}_{it-1} =&\lambda_0 + \lambda_1 \Delta\text{Comp}_{jk} + \lambda_2 \text{IV}_{dt-1} + \lambda_3 \Delta\text{Comp}_{jk}\text{IV}_{dt-1} \\ &+ \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \nu_{ijkt}\end{aligned} \tag{15}$$

We then use the predicted dependent variables of equations (14) and (15) to estimate the following second-stage equations for the extensive and the intensive margins:

$$\begin{aligned}D(X_{ijkt+1} = 1 | X_{ijkt} = 1) =&\beta_0 + \beta_1 \Delta\text{Comp}_{jk} + \beta_2 \widehat{\text{Immig}_{it-1}} + \beta_3 \widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}} \\ &+ \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \varepsilon_{ijk}\end{aligned} \tag{16}$$

$$\begin{aligned}\Delta \ln \text{Sales}_{ijk} =&\beta_0 + \beta_1 \Delta\text{Comp}_{jk} + \beta_2 \widehat{\text{Immig}_{it-1}} + \beta_3 \widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}} \\ &+ \Gamma' X_{it} + \gamma_i + \gamma_{jt} + \Delta\varepsilon_{ijk}\end{aligned} \tag{17}$$

where $\widehat{\text{Immig}_{it-1}}$ and $\widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}}$ respectively denote the predicted share of immigrant workers in the district of firm i at time $t-1$ and the predicted interaction term.

5.2.2 Chinese Import Competition

Regarding the exogeneity of the Chinese import competition measure, we cannot exclude that some unobserved industry-destination specific demand shocks may affect simultaneously both the measure of import competition as well as the measure of firm performance. Such a simultaneity bias would bias our estimates downward.

For instance, it is possible that a negative (positive) demand shock in a given industry-destination market generates a simultaneous decrease (increase) in the demand addressed to both French and Chinese firms. Such a shock would simultaneously decrease the sales of French firms as well as those of Chinese firms hence decreasing the Chinese import competition faced by French firms on that industry-destination market. Nonetheless, if we assume that French, Chinese and other firms are affected in a similar way by such a demand shock, then the simultaneity bias induced by the shock should be already controlled for by our competition variable since ΔComp_{jk} is the variation in the *share* of Chinese competition with respect to the world. We can however

not exclude that firms from different origin countries are affected in a different way by such a demand shock as Armington-type preferences may exists.

Ideally, we would like to isolate the increase in import competition coming from an improvement of Chinese competitiveness *i.e.* an increase in import competition that would only be akin to a supply shock from the perspective of French firms. Note that in addition of finding an instrumental variable for the increase in import competition, we also need to instrument the interaction of this variable with the employment of immigrant workers. We have however found no valid instruments in the context of our study. We therefore consider our results regarding the increase in import competition, which we expect to be negative, as lower bound estimates.

6 Results

In this section, we start by presenting our baseline results. We find that immigrant workers help firms to mitigate the negative impact of an increase in Chinese import competition at both trade margins. We then look at the sub-sample of high- and low-skilled immigrant workers and find that this mitigation effect is at play for both groups of workers. Finally, we present a test to asses the validity of our instrumentation strategy as well as a number of robustness tests.

6.1 Main Results

6.1.1 The conditional impact of import competition on firms' performance

Baseline results are reported in Table 2. We start by describing the second-stage results obtained with our IV-2SLS strategy (columns 1 to 4). We find that an increase in import penetration lowers both firms' survival rate and sales growth rate in an industry-destination market. At the extensive margin, a 1% increase in the intensity of the China shock lowers firms' survival rate by 0.25% (column 1). At the intensive margin, we find that an increase in import penetration by 1% lowers the growth rate of sales by 0.85% (column 3). As explain herein-before, we consider these estimates as lower bound estimates. These results are in line with the fact that an increase in import competition has detrimental effects on firms as it has been shown for employment growth in both the aggregate- and the firm-level literature (see Malgouyres (2017) and Bernard et al. (2006)).

Then, we find that the effect of immigrant workers is not significant at the extensive margin (column 1). This result is not surprising given the high level of disaggregation of our data (firm-industry-destination level). This result is also in line with the literature at the firm and the firm-destination level showing that the pro-trade effect of immigrants is much lower in both magnitude and significance at the extensive than at the intensive margin (Marchal and Nedoncelle, 2019). On the contrary, the effect of immigrants is negative at the intensive margin (column 3). Even though the coefficient is only significant at the 10% level, this result could point towards a redirection effect according to which firms employing immigrant workers may enter more easily

an industry-destination market thus redirecting their sales across markets more easily, which then lowers their growth rate in a single market. This is also consistent with our theoretical model in which firms maximize their profit across markets.

We now analyse the *conditional* impact of an increase in Chinese import competition by introducing the interaction term of interest in the regression (columns 2 and 4). In column (2), we find that immigrant workers mitigate firms' reactions to an increase in import penetration from China. The unconditional impact of the import competition shock amounts to -0.41% which corresponds to the effect for firms that hire no immigrant workers. The coefficient associated with the interaction term is positive and significant at the 5% level. This results indicates that the negative effect of the China shock is mitigated by the employment of immigrant workers. On average, firms hire about 0.376 log immigrant workers (or 0.02 immigrants). Thus, for a firm hiring the average number of immigrants, the effect of an increase in import penetration amounts to -0.38%, which is lower than the effect for a firm employing none.

As far as the intensive margin is concerned, we find that the unconditional impact of the import competition shock amounts to -2.18% (column 4). The interaction term is positive and highly significant which indicates that the negative effect of the China shock tends to be mitigated in firms that employ immigrant workers. For a firm hiring the average number of immigrants, the effect of an increase in import penetration amounts to -1.96%, which is lower than the effect for a firm employing none. Note that at the intensive margin, our estimation strategy which consists in analysing our dependent variable in first differences, offers a clean identification of the mitigation effect of immigrants taking place through a technological adjustment over time.

First-stage results are reported in Table 3. Column (1) reports the first-stage results for specifications (1) and (3) in Table 2, and columns (2i) and (2ii) report the first-stage results for specifications (2) and (4) in Table 2. Our shift-share instrument positively and significantly predicts the firm-level employment of immigrant workers. Once interacted with the import competition variable, it correctly predicts the interaction term of interest. Finally, the Kleibergen-Paap F statistic is well above the Stock-Yogo critical value which allows us to infer that our instruments are not weak.

Finally, we compare the baseline results obtained with the IV-2SLS strategy and reported in columns (1) to (4) of Table 2 to the OLS results presented in the same table (columns 5 to 8). Doing so, we can assess the direction of the endogeneity bias for the immigration variable that we intend to control for using an IV strategy. While the magnitude and sign of the coefficients are in line with the IV strategy, their significance level changes. At the extensive margin, the coefficient associated with the immigration variable is significant at the 1% level and amounts to 0.002 using an OLS strategy (column 5), while it becomes insignificant using an IV strategy (column 1). At the intensive margin, the coefficient associated with the immigration variable using an OLS strategy is significant at the 5% level (column 7), while it becomes barely significant using an IV strategy (column 3).

Table 2: Baseline Results

	(1) $D(X_{ijkt+1}=1\|X_{ijkt}=1)$	(2) $D(X_{ijkt+1}=1\|X_{ijkt}=1)$	(3) $\Delta \ln \text{Sales}_{ijk}$	(4) $\Delta \ln \text{Sales}_{ijk}$	(5) $D(X_{ijkt+1}=1\|X_{ijkt}=1)$	(6) $D(X_{ijkt+1}=1\|X_{ijkt}=1)$	(7) $\Delta \ln \text{Sales}_{ijk}$	(8) $\Delta \ln \text{Sales}_{ijk}$
ΔComp_{jk}	-0.247***	-0.411***	-0.847***	-2.181***	-0.243***	-0.273***	-0.843***	-0.968***
	(0.026)	(0.087)	(0.086)	(0.535)	(0.026)	(0.031)	(0.086)	(0.141)
$\widehat{\text{Immig}_{it-1}}$	0.004	0.004	-0.114*	-0.118*	0.002***	0.002***	-0.006**	-0.007**
	(0.009)	(0.009)	(0.067)	(0.067)	(0.000)	(0.000)	(0.003)	(0.003)
$\widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}}$		0.074**		0.600***		0.013*		0.056
		(0.033)		(0.225)		(0.008)		(0.048)
Observations	11,201,123	11,201,123	11,201,123	11,201,123	11,366,667	11,366,667	11,366,667	11,366,667
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	OLS	OLS	OLS	OLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table 3: Baseline Results - First-stage estimations

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	0.005	-0.019	0.087
	(0.007)	(0.103)	(0.342)
IV_{dt-1}	0.032***	0.032***	-0.001***
	(0.002)	(0.002)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$		0.002	0.151***
		(0.007)	(0.027)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	343.672	171.809	171.809
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

6.1.2 Results Across Skill Groups

We further investigate the mitigation effect of immigrants at the both margins by studying the relationship of interest for high- and low-skilled immigrant workers. On the one hand, it as been shown in the literature that high-skilled immigrant workers are driving the trade-enhancing effect of immigrants (Andrews et al., 2016; Hatzigeorgiou and Lodefalk, 2016; Parsons and Winters, 2014). These immigrant workers are more likely to provide firms with relevant information about foreign destinations than low-skilled immigrant workers because they are more likely to hold decision-making jobs or to be in a position to transfer operative information about foreign markets to their employer. Similarly, the employment of high-skilled immigrants may generate larger productivity gains than the employment of low-skilled immigrants because these workers hold high value-added positions. On the other hand, Marchal and Nedoncelle (2019) show a trade-enhancing effect at play for both high- and low-skilled immigrants and infer that the effect stemming form low-skilled immigrants can only be associated to a productivity effect as these workers are less likely to detain and gainfully transfer information about foreign markets.

We define high-skilled workers as individuals holding occupations described as "executive and higher intellectual professions" (group 3) and "intermediate occupations" (group 4) of the French

classification of occupations (see Appendix A.1). We define low-skilled workers as individuals holding occupations described as "clerical" (group 5) and "labourers" (group 6). Note that the shift-share instrument for the firm-level employment of high- and low-skilled immigrants is then computed accordingly, using the distribution of immigrants in the corresponding two occupation groups.

Second-stage results for high-skilled immigrants are presented in Table 4 (columns 1 to 4) and first-stage results are reported in Appendix A.5, Table A.3. In Table 4, the coefficients associated to the increase in import penetration from China are in line with our baseline results (columns 1 and 3). High-skilled immigrants have no significant impact at the extensive margin (column 1), while their impact is negative and significant (at the 10% level) at the intensive margin (column 3). Looking at the interaction term of interest, we find a positive effect at both the extensive and the intensive margins which is very similar to our baseline results (columns 2 and 4). This set of results is in line with our expectations and theoretical insights that immigrants mitigate the effect of import competition shocks on firms' survival and sales growth rate. Finally, note that we report OLS results in the same table as to provide information on the direction of the bias (columns 5 to 8).

We then reproduce this exercise for low-skilled immigrant workers. Second-stage results are reported in Table 5 (columns 1 to 4) and first-stage results are reported in Appendix A.5, Table A.4. Looking at Table 5, we find a negative impact of an increase in import penetration from China (columns 1 and 3). We find no significant effect of low-skilled immigrants at the extensive margin (column 1) and a negative and barely significant impact at the intensive margin (column 3). In addition, we find a significant mitigation effect of low-skilled immigrants (columns 2 and 4). Note that we do not expect the trade-cost channel to be at play for low-skilled workers. Their pro-trade effect may however take place through a productivity effect as well as a technological adjustment over time. This is indeed what our results suggest since we find a significant mitigation effect of these workers at both trade margins. In addition, note that the coefficients associated to the interaction term cannot be directly compared to those of Table 4 as the sample of firms hiring high-skilled immigrants is different from the sample of firms hiring low-skilled immigrants (not all firms hire both types of immigrants). Finally, OLS results are provided in Table 5 (columns 5 to 8).

Table 4: Baseline Results: High-Skilled Workers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$		$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$	
ΔComp_{jk}	-0.247***	-0.371***	-0.847***	-1.796***	-0.243***	-0.278***	-0.843***	-0.974***
	(0.026)	(0.067)	(0.086)	(0.392)	(0.026)	(0.031)	(0.086)	(0.125)
$\widehat{\text{Immig}_{it-1}}$	0.006	0.005	-0.178*	-0.183*	0.004***	0.004***	-0.002	-0.003
	(0.015)	(0.015)	(0.102)	(0.102)	(0.001)	(0.001)	(0.003)	(0.003)
$\widehat{\Delta \text{Comp}_{jk}\text{Immig}_{it-1}}$		0.083**		0.633***		0.023**		0.087
		(0.035)		(0.240)		(0.009)		(0.056)
Observations	11,201,123	11,201,123	11,201,123	11,201,123	11,366,667	11,366,667	11,366,667	11,366,667
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	OLS	OLS	OLS	OLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table 5: Baseline Results: Low-skilled Workers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$		$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$	
ΔComp_{jk}	-0.247***	-0.416***	-0.847***	-2.280***	-0.243***	-0.254***	-0.843***	-0.870***
	(0.026)	(0.092)	(0.086)	(0.579)	(0.026)	(0.028)	(0.086)	(0.122)
$\widehat{\text{Immig}_{it-1}}$	0.004	0.003	-0.120*	-0.125*	0.002***	0.002***	-0.011***	-0.011***
	(0.010)	(0.010)	(0.070)	(0.071)	(0.000)	(0.000)	(0.003)	(0.003)
$\widehat{\Delta \text{Comp}_{jk}\text{Immig}_{it-1}}$		0.098**		0.830***		0.006		0.016
		(0.045)		(0.313)		(0.007)		(0.047)
Observations	11,201,123	11,201,123	11,201,123	11,201,123	11,366,667	11,366,667	11,366,667	11,366,667
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS	OLS	OLS	OLS	OLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

6.2 Validity of the Instrument and Robustness Tests

We now present a number of tests to validate our instrumentation strategy and to assess the robustness of our results. All tables are presented in Appendix A.5.

6.2.1 Validity of the Instrumentation Strategy

Although the shift-share instrument we use in our baseline specification is rather standard in the firm-level literature (Mitaritonna et al., 2017; Marchal and Nedoncelle, 2019), we check the validity of our instrumentation strategy by using the 1982 census instead of the 1990 census to build the imputed regional supply of immigrant workers. On the one hand, this instrument may be less precise because 1982 is more distant to the first year of our sample (1994) as compared to 1990. On the other hand, this instrument may be more exogenous exactly for the same reason. We therefore use the 1982 census to further guarantee that variations in the shift-share instrument only come from variations in the total number of immigrants over time.

Second- and first-stage results are presented in Appendix, Tables A.5 and A.6. Second-stage results are in line with our baseline estimates both in terms of magnitude and level of significance, for both trade margins. In addition, the weak identification test confirms that this instrument cannot be considered as weak. First-stage results show that this alternative instrument predicts well the number of immigrants employed by the firm and is very similar to our baseline instrument.

6.2.2 Robustness tests

Using a binary variable to measure immigrant employment. First, we test whether our specification is robust to the use of a binary variable (instead of a continuous one) to measure the employment of immigrant workers. Doing so, we take into account the fact the effect of immigrant workers may not be linear *i.e.* that the marginal benefit of hiring immigrant workers may be decreasing such that only the first immigrant worker hired matters for the firm. It also enable us to avoid increasing our variable by one when we use its logarithm. We thus modify our specification to use a binary variable which equals one if the firm employs a positive number of immigrant workers at time $t-1$ and zero otherwise. The instrumental variable remains unchanged with respect to the baseline specification.

Second and first-stage results are reported in Appendix, Tables A.7 and A.8. The results confirm the baseline estimates. At the extensive margin, we find evidence of a mitigation effect of immigrants which is significant at the 5% level. At the intensive margin, the interaction term is positive and highly significant which indicates that immigrant workers mitigate the impact of an import competition shock from China on firms' sales growth rate.

Using the share of immigrant workers. We then study whether our results are robust to the use of the share of immigrant workers instead of the number, as proposed by Mitaritonna et al.

(2017) and Marchal and Nedoncelle (2019). In doing so, we take into account that employing one additional immigrant worker may have a larger effect for small firms than for large ones. In addition, using a share allows us to normalize immigrant employment by firm size.

Second and first-stage results are reported in Appendix, Tables A.9 and A.10. The signs of the coefficients associated to the interaction terms are in line with our baseline estimates for both trade margins. The mitigation effect is significant at the 5% level at the extensive margin and only significant at the 10% level at the intensive margin. Looking at the first-stage results (Table A.10), we find indeed that the Kleibergen-Paap F Statistic is rather low (as compared to our baseline estimation), which may indicate the presence of a weak instrument.

7 Conclusion

This paper investigates the impact of Chinese import competition on firms' performance, and whether firms employing immigrant workers face this shock differently. To this end, we exploit the increase in Chinese import competition that firms face on their industry-destination markets, including their domestic market.

We start by describing a simple heterogeneous firm model to illustrate the mechanisms through which immigrants impact firms' survival and sales growth rate. In this model, firms – that are heterogeneous in their productivity level as well as in their employment of immigrant workers – maximise their profits across markets. This model highlights that immigrant workers help firms to mitigate import competition shocks at both the extensive and the intensive margins. At the extensive margin, this mitigation effect is driven by a productivity effect, a trade-cost effect as well as a technological adjustment taking place over time. At the intensive margin, the effect is driven by a technological adjustment only.

Using a sample of French manufacturing firms from 1994 to 2015, we find that a change in Chinese import competition has a negative impact on both firms' survival rate and sales growth rate. Both high- and low-skilled immigrant workers mitigate this negative effect. At the extensive margin, the unconditional impact of the import competition shock is about -0.41% for firms that hire no immigrant worker, yet this effect drops to -0.38% for a firm employing the average number of immigrant workers. Similarly, at the intensive margin, the unconditional impact is about -2.18% and the conditional impact amounts to -1.96%. According to our theoretical illustration, our results for the intensive margin provide evidence that the effect is channeled through a technological adjustment induced by immigrant workers over time. Finally, our results are consistent across skill groups and across a number of specifications.

Our results are important from a policy perspective for the following reasons. First, our results are instructive because strong and negative effects of import competition from low-wage countries on firms' survival rate and sales growth rate may translate into lower growth and lower employment at the aggregate level. Second, we show that immigrant workers allow firms to smooth negative trade shocks, which is crucial to assess their impact on their host country and

to evaluate their contribution to the economic growth. Our results point towards the beneficial effects of immigrants in terms of survival and sales growth potential of French firms for both high- and low-skilled immigrant workers.

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A Appendix

A.1 Additional Information on the Data

Table A.1: French 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

Column (1) classifies occupations into low- and high-skilled (respectively denoted L and H).

A.2 Data Structure

The observational unit in our specification is at the firm-destination-industry-year level. The set of destinations includes the domestic and the foreign markets served by the firm. Regarding the domestic market, the French tax records only contain the time-varying industry of the firm's main activity in a year[11]. As for the export sales, the French custom data contains information on the sales of French firms in each industry-destination markets served. We are then able to identify the quantity sold in each industry for each foreign destination served by the firm.

Given that we use first differences in our empirical set-up, the structure of the data has to account for this feature:

- As far as the intensive margin is concerned, we compute the growth rate of sales between two consecutive years t and $t+1$ as the log-difference of sales in an industry-destination (jk) market.

  Regarding the export sales, when the firm is discontinuously serving an industry-destination, we fill in the variable "sales" with a zero in the custom data between the first and the last year in which the firm appears to be serving that industry-destination. Otherwise, we would only be able to construct the growth rate for the industry-destination combination that we observe at time t and $t+1$, thus not capturing the fact that a firm may discontinuously serve an industry-destination market precisely because of the competition it faces.

  As for the domestic sales coming from the tax records, we do not fill in with zero between the first and last year that a firm serves an industry in France. The reason is that a firm changing its main activity between time t and $t+1$ does not necessarily stop serving the (main) industry it served at time t, but rather that this industry is no longer the main activity of the firm.

  Regarding the last year available for a jk market (including the domestic market) which we denote T, we distinguish two cases. i) If T is also the last year in which we observe the firm in the dataset, then the sales are considered to be missing at time $T+1$ and it is not possible to compute the growth rate at time T. ii) On the contrary, if the firm is serving some other market jk' at time $T+1$, then the sales of the jk market at time $T+1$ can be considered to be zero. We are therefore able to compute the growth rate between time T and $T+1$.

- A similar procedure applies when we build the continuity variable which takes the value 1 when the firm participates in a industry-destination at time t *and* time $t+1$.

  Regarding the export markets, when the firm is discontinuously serving an industry-destination market, its participation in the market is equal to zero because its sales are zero (we fill in the sales variable with a zero for the years between the first and the last year that the firm serves that industry-destination). Therefore it is possible to compute

[11] We therefore assume that the main activity of the firm comes from its domestic sales.

the continuity variable for all the years between the first and the last one in which the firm is serving a particular industry-destination.

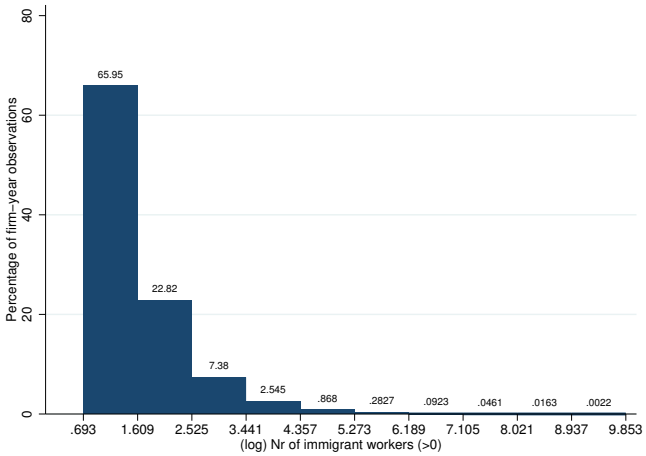
Regarding the continuity in an industry-destination at time T, the last year available for a jk combination, we distinguish two cases. i) If T is also the last year in which we observe the firm in the dataset, then the participation at time $T+1$ is considered as missing and it is not possible to compute the continuity variable at time T. ii) On the contrary, if the firm is serving some other market jk' at time $T+1$, then the participation of the firm in the jk market at time $T+1$ can be considered to be zero. We are thus able to compute the continuity variable between time T and $T+1$.

A.3 Additional Statistics

Table A.2: Summary statistics

	Exporters			**Non-exporters**			
	Obs.	**Mean**	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**	Signif.
Firm characteristics							
Gross operating surplus (in thousands euros)	1,284,400	744	1.21e+04	2,138,159	39	5,217	***
Total revenue (in thousands euros)	1,284,385	1.18e+04	1.82e+05	2,138,152	724	1.07e+05	***
Assets (in thousands euros)	1,284,261	7,854	1.52e+05	2,138,005	438	7.70e+04	***
Nr. of employees	921,708	74.492	447.905	1,140,548	9.501	27.532	***
1-19 employees	921,708	0.539	0.498	1,140,548	0.907	0.291	***
20-250 employees	921,708	0.410	0.492	1,140,548	0.092	0.290	***
250+ employees	921,708	0.051	0.220	1,140,548	0.001	0.028	***
Share of employees in high-skilled occupations	921,708	0.263	0.242	1,140,548	0.134	0.244	***
Share of immigrant workers	921,708	0.056	0.144	1,140,548	0.048	0.163	***
Share of immigrant workers within high-skilled occupations	751,833	0.036	0.139	433,840	0.035	0.162	***
Share of immigrant workers within low-skilled occupations	884,229	0.064	0.159	1,070,823	0.052	0.172	***
Firm-industry-destination characteristics							
Sales, zeros incl.	14,778,449	908	3.95e+04	1,894,714	494	3.64e+04	***
Participation	14,778,449	0.770	0.421	1,894,714	-	-	***

Figure A.1: Distribution of immigrant workers



Data source: French firm-level data

A.4 Import Competition Measure

To construct the measure of import competition that a French firm faces at time t in an industry-destination pair jk, we follow the following four-step procedure.

1. We use the Comtrade data to obtain imports from China and from the World for each product-destination-year triplet nkt.

2. We then construct a conversion table that uniquely assigns a time-invariant NACE Rév.2 code to each HS6 code. The conversion table is built using the French custom data. In these data, an harmonized unique NACE Rév.2 code is assigned to each product that firms export. Note that there are only 145 product lines (out of 6,000) that are assigned to more than one industry and only 8 products that are assigned a different industry code over time. In order to overcome this problem, we construct time-invariant export-based weights to assign an industry to these products. On average, the industry assign to these product represents 84% of the export volume of that product. We are therefore able to assign a NACE Rév.2 industry to more than 6,000 products, which is roughly the same number of HS6 product lines contained in the Comtrade data every year[12].

3. We then merge the Comtrade data with the conversion table, we collapse the data by destination-industry-year triplet (jkt).

[12]Our conversion table covers roughly 6,000 HS6 lines belonging to 118 (out of 272) NACE Rév. 2 industries. The NACE categories that are not covered in the conversion table are those belonging to service sector whose trade is not recorded in the custom data.

4. Finally, we merge this dataset with the custom data by industry-destination-year triplet jkt. We also append this dataset with the tax records by industry-destination-year triplet jkt where the destination denotes the domestic market (France) and for which only the main industry j of the firm is available[13].

A.5 Additional Results

Table A.3: Baseline Results: High-Skilled - First stage

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	0.003	-0.050	-0.163
	(0.006)	(0.084)	(0.300)
IV_{dt-1}	0.018***	0.018***	-0.001***
	(0.001)	(0.001)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$		0.004	0.131***
		(0.007)	(0.029)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	210.752	105.376	105.376
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

[13] Here, there are two main concerns. The first one is the change in industry classification in 2008, from NACE Rév.1 to NACE Rév.2. In order to overcome the problem of NACE Rév. 1 codes mapping into several NACE Rév.2 codes, we rely on the conversion table provided by the French Statistical Agency (INSEE). The second one is the discontinuity in the data in 2008, where all the domestic sales are missing. We remain agnostic about how to treat these observations and therefore when we consider the the participation variable for the French market in $t+1$ when $t = 2007$ as missing

Table A.4: Baseline Results: Low-skilled Immigrants - First stage

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	0.005	0.058	0.192
	(0.007)	(0.079)	(0.218)
IV_{dt-1}	0.032***	0.032***	-0.000***
	(0.002)	(0.002)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$	-0.004	0.111***	
		(0.006)	(0.017)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	336.532	168.271	168.271
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.5: Validity of the Instrument - Second-stage results

	(1)	(2)	(3)	(4)
	$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$	
ΔComp_{jk}	-0.247***	-0.408***	-0.847***	-2.154***
	(0.026)	(0.086)	(0.086)	(0.527)
$\widehat{\text{Immig}_{it-1}}$	0.005	0.004	-0.119*	-0.123*
	(0.010)	(0.010)	(0.067)	(0.067)
$\widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}}$		0.072**		0.588***
		(0.032)		(0.221)
Observations	11,201,123	11,201,123	11,201,123	11,201,123
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.6: Validity of the Instrument - First-stage results

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	0.005	-0.012	0.092
	(0.007)	(0.102)	(0.344)
IV_{dt-1}	0.031***	0.031***	-0.001***
	(0.002)	(0.002)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$		0.001	0.150***
		(0.007)	(0.027)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	341.305	170.622	170.622
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.7: Robustness Test: Binary Variable for Immigrants

	(1)	(2)	(3)	(4)
	$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$	
ΔComp_{jk}	-0.247***	-0.639***	-0.848***	-4.009***
	(0.026)	(0.183)	(0.086)	(1.159)
$\widehat{\text{Immig}_{it-1}}$	0.033	0.029	-0.901*	-0.927*
	(0.076)	(0.076)	(0.541)	(0.542)
$\widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}}$		0.489**		3.938***
		(0.211)		(1.399)
Observations	11,201,123	11,201,123	11,201,123	11,201,123
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.8: Robustness Test: Binary Variable for Immigrants - First-stage results

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	-0.001	0.008	0.476***
	(0.002)	(0.029)	(0.038)
IV_{dt-1}	0.004***	0.004***	-0.000***
	(0.000)	(0.000)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$		-0.001	0.023***
		(0.002)	(0.003)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	74.156	37.076	37.076
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.9: Robustness Test: Share of Immigrants

	(1)	(2)	(3)	(4)
	$D(X_{ijkt+1}=1\|X_{ijkt}=1)$		$\Delta \ln \text{Sales}_{ijk}$	
ΔComp_{jk}	-0.248***	-0.315***	-0.837***	-1.341***
	(0.026)	(0.050)	(0.086)	(0.286)
$\widehat{\text{Immig}_{it-1}}$	0.324	0.312	-3.862**	-3.949**
	(0.244)	(0.243)	(1.670)	(1.659)
$\widehat{\Delta\text{Comp}_{jk}\text{Immig}_{it-1}}$		0.910**		6.785*
		(0.432)		(3.748)
Observations	11,201,123	11,201,123	11,201,123	11,201,123
Firm FE	yes	yes	yes	yes
Firm-controls	yes	yes	yes	yes
Industry-Time FE	yes	yes	yes	yes
Method	IV-2SLS	IV-2SLS	IV-2SLS	IV-2SLS

Note: This table reports IV-2SLS second-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.

Table A.10: Robustness Test: Share of Immigrants - First-stage results

Dep. var.	(1) Immig_{it-1}	(2i) Immig_{it-1}	(2ii) $\Delta\text{Comp}_{jk}\text{Immig}_{it-1}$
ΔComp_{jk}	0.002	0.002	0.059***
	(0.001)	(0.002)	(0.002)
IV_{dt-1}	0.019***	0.019***	-0.001***
	(0.004)	(0.004)	(0.000)
$\Delta\text{Comp}_{jk}\text{IV}_{dt-1}$		-0.000	0.143***
		(0.020)	(0.031)
Observations	11,750,063	11,750,063	11,750,063
Kleibergen-Paap F Stat.	28.588	14.315	14.315
Stock-Yogo critical value (10%)	16.38	7.03	7.03
Firm FE	yes	yes	yes
Firm controls	yes	yes	yes
Industry-year FE	yes	yes	yes
Method	OLS	OLS	OLS

Note: This table reports IV-2SLS first-stage estimations. ***, ** and * respectively denote significance at the 1%, 5% and 10% levels. Robust standard errors clustered at the industry level are reported in parentheses. Firm-year controls include size dummies and the share of high-skilled occupations.