

Firms' Exports, Volatility and Skills: Micro-evidence from France *

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Abstract

Firms engaged in the global economy affect labor markets. Little is known, however, about the impact of firms' export exposure on employment volatility. This paper aims at disentangling the effects of foreign shocks across employment skills. Using detailed firm level data from France for the period 1996-2007 and instrumental variable estimations, we provide econometric evidence on the causal effect of the export intensity of the firm on the volatility of employment of different skills. Our results show that firms with high levels of exports - as facing exogenous foreign demand shocks - experience a lower volatility for skilled relative to unskilled workers with respect to smaller exporters. These findings suggest that exporting firms increase the stability of skilled jobs and explain part of the precariousness of unskilled ones.

Keywords: Export intensity, employment volatility, labor skill, firm-level data.

JEL Classification: F1, F16, L25, L60

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1 Introduction

A lot of attention has been paid to the effects of globalization on domestic labor markets. Firms engaged in international trade tend to be more skilled intensive and pay higher wages (Bernard et al. (2007)). Several theoretical models show that firms' export activity has an unequal effect on skilled and unskilled labor (Burstein and Vogel, 2016, Harrigan and Reshef, 2015, Verhoogen, 2008, and Yeaple, 2005). Recent micro-econometric evidence highlights that exporting firms, facing idiosyncratic shocks in their export market destinations, affect domestic sales volatility (Berman et al., 2015 and Vannoorenberghe, 2012) and total employment volatility (Kurz and Senses, 2016). However, little is known about the effects of firms' trade exposure on the volatility of employment of different skills.

The aim of this paper is to fill this gap by studying the causal relationship between firms' export intensity and the volatility of employment across skills. This is an important issue that does not lack of economic sense since firms' export intensity might have an unequal effect on the stability of jobs across different skills. This heterogeneous effect of export intensity on employment volatility can be explained by existence of fixed export costs that are skill intensive. Firms facing shocks in their destination markets are going to adjust more unskilled labor demand than the skilled one which is a key asset to export. In that scenario, globalization is one possible explanation of the greater instability of unskilled intensive jobs relative to skilled ones.

Our analysis is developed in two steps. First, we present some facts on employment volatility in France considering the period 1996 and 2007. These facts show that the volatility of unskilled labor is larger for firms with higher export intensity (measured as share in total sales or as number of destinations served). Differently, the volatility of skilled labor is negatively correlated to measures of export intensity. Additionally, we find a positive link between skill intensity and number of reached destinations. This fact is consistent with a theoretical framework in which exporting to a foreign market implies paying a fixed cost that is skill intensive.

Artopoulos et al., 2011, and Cavusgil and Zou, 1994 highlight that fixed export costs are logistical, coordination and distributional operations which are usually more skill intensive. Therefore, without loss of generality, under fixed cost to enter the export market that are paid in units of skilled labor only, the ratio of skilled to unskilled labor volatility increases with firms' export intensity.

Understanding the relationship between employment volatility and export intensity remains an empirical issue. In the second step we use employer-employees data from *Declaration Annuelle des Donneés Sociales* (DADS) and the French trade flows from the French Customs Data, to assess the causal relationship between export and employment volatility of different skills. Our baseline identification strategy relies on the variation of export intensity and employment volatility across firms within a sector, conditional on firms' size and imports. The average effect of export intensity on the ratio of skilled to unskilled labor volatility is negative. This result confirms that larger volumes of exports increase the volatility of low skilled workers relative to high skilled workers. We also address possible endogeneity concerns that may arise in this context. Indeed, firms' export sales and employment demand might be determined by the same firm's supply and demand factors. In particular, technological adoption may affect both export intensity and volatility. We deal with this potential issue using instrumental variables estimator based on exogenous demand shocks faced by firms in their export markets. More specifically, we use sectoral real exchange rates to capture exogenous shocks faced by each firm in destination markets and initial level of firms' exports.

Next, we go one step further and explore the possible channels of transmission. To do so, we break down export intensity into an intensive and an extensive margin, and show that this latter plays a dominant role. The findings suggest that the diversification of export markets (uncreasing the number of destinations reached or the number of products exported) affects positively the volatility of unskilled labor and negatively the volatility of skilled labor. Another related mechanism driving our findings is that employment volatility can be associated to entry and exit into the destination market. We test for this channel by computing export intensity

on continuous destinations served by the firm and in destinations where the firm enters and/exits during the period. Our results show that firms continuously exporting have a lower employment volatility. Then we present a test for the heterogeneous effect of firm export intensity on the volatility of employment of different skills depending on the initial size of the firm. The rationale for this exercise is that firms exporting to more destinations tend to be larger. Our results confirm that the effect of export intensity on employment volatility of different skills is driven by bigger firms.

Lastly, we present several robustness tests. First, we control for alternative explanations to our story. One possible explanation is related to the presence of multinational firms that have the ability to manage employment across plants in different countries. Another alternative explanation is related to the fact that more productive firms are more skilled intensive and export to more destinations. The different level of productivity across exporting firms might explain the heterogeneous effect of export intensity on the volatility of skilled and unskilled labor. When we control for these alternative mechanisms, our results are robust and stable showing that the effect of export intensity on employment volatility is not picked up by the presence of multinational firms, productivity differences across firms. Second, we rely on the entrance of China into WTO in 2001 as an exogenous trade shock increasing export opportunities for French firms to test if our findings are affected by this shock. We show that our main results still hold. Third, our findings are also robust and stable when we rely on alternative dependent variables using the volatility of firms' hours worked instead of employment, coefficient of variation or alternative definition of skills (production vs. non-production workers).

The main contribution of this work to the micro-econometric literature that focuses on the effects of international trade on employment is to show robust empirical evidence on the heterogeneous effect of one mode of globalization, firms' export activity, on the volatility of skilled and unskilled labor. Our results emphasize that firms' export intensity is associated with greater instability of unskilled labor jobs relative to skilled ones reinforcing the findings

in the literature on inequalities in labor markets across workers of different skills due to international trade (Burstein and Vogel (2016), Biscourp and Kramarz (2007))

Finally, our paper also contributes to a recent, small but growing literature that studies the relationship between different firm level volatility's measures and trade.¹ On the one hand, export activity might affect firm's labor demand volatility through the volatility of demand addressed to the firm. When demand in foreign markets is no more volatile than in the domestic market, a diversification effect guarantees that firms exporting to several destinations face lower demand volatility than non-exporters as shown by Vannoorenberghe (2012).² On the other hand, several studies have also emphasized that the export activity is inherently volatile due to the low likelihood to survive for some firms with a short-time period presence in a given foreign market (Besedeš and Prusa, 2006a,b; Hess and Persson, 2011). As a result, the effect of export activity on demand volatility depends on whether the firm exports permanently or not. In this sense, market diversification is only reducing volatility as long as it does not occur at the expenses of the ability of the firm to remain in the export market, a condition which is closely linked to the magnitude of export sales (Vannoorenberghe et al., 2014).³ These effects on demand volatility naturally determine the volatility of labor demand. The empirical analysis carried out by Kurz and Senses (2016) on the United States is consistent with the mechanisms described above. They find firm-level labor demand volatility to be larger for exporters than for non-exporters on average, but to decrease with the export share. Our paper shows that this latter effect is heterogeneous across skills.

The rest of the paper is organized as follows. Section 2 highlights some key facts that will be

¹Note that there is also a large literature that studied the determinants of volatility using industry-level data (di Giovanni and Levchenko (2009), Kalemli-Ozcan et al. (2014) and Cunat and Melitz (2012))

²Vannoorenberghe (2012) highlights that this is even true, over a given export share, when demand volatility is higher in export markets. In addition, when production costs are convex, pricing behavior creates a negative correlation, for each firm, between the growth rates of exports and domestic sales, therefore creating a negative linkage between shocks in different markets (Vannoorenberghe, 2012; Nguyen and Schaur, 2010).

³Note that import status might also matter because shocks on imported inputs affect firm's demand volatility. However, this relationship is ambiguous since it depends on the substitutability between domestic and imported inputs as well as on the the volatility in intermediate input prices relative to domestic ones Nguyen and Schaur (2010). Offshoring may also increase the volatility of labor demand through substituting domestic by foreign labor as reflected in higher labor demand elasticities (Senses, 2010; Hijzen and Swaim, 2010). In all our estimations we control for this alternative channel related to imports.

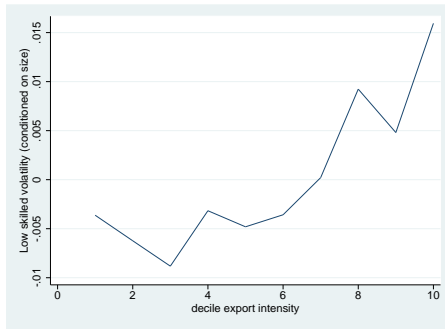
investigated in the subsequent analysis. Section 3 presents the theoretical motivation. Section 4 describes the data. Section 5.1 lays out the estimation strategy and discusses potential endogeneity concerns. Section 6 presents the baseline results. Section 7 explores the channels of transmission and Section 8 proposes robustness checks. Section 9 concludes.

2 A First Glance at the Data

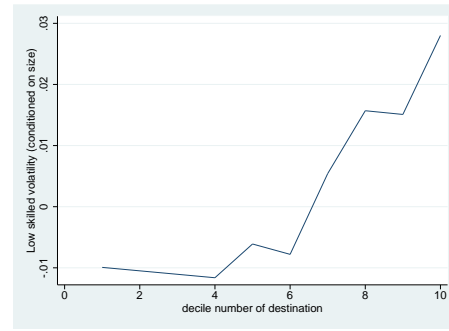
This section presents descriptive evidence on the relationship between export intensity and the volatility of employment of different skills. Relying on firm level data from France for the period 1996-2007 we derive three main empirical facts.

First, we investigate the correlation between export intensity and the volatility of skilled and unskilled labor. The volatility of labor is measured as the standard deviation of the residual of an employment growth rate estimation over the period 1996-2007. Section 5.1 describes the methodology used to estimate this measure. We measure export intensity in two ways: using deciles of export sales and number of export destinations. Figures (1a) and (1b) show that export intensity is positively correlated with unskilled labor volatility. When we look at the correlation between export intensity and the volatility of skilled labor the opposite result hold. Figure (1c) and (1d) show that the negative correlation between firms' exports, the number of destinations and the skilled labor volatility is driven by the highest deciles of export intensity.

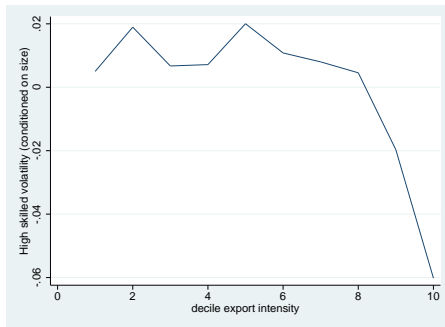
Then, we consider the correlation between firms' export exposure and skilled intensity. We classify firms into different deciles of export intensity using the number of destinations served by each firm. We plot this measure of export intensity against the skilled intensity of the firm. Figure 2 shows a positive correlation between the number of export destinations of a firm and its skilled intensity. This descriptive evidence is in line with the existence of specific destination fixed export costs that are skill intensive. This is consistent with the types of activities related to these fixed costs. For instance, marketing activities, required to adapt



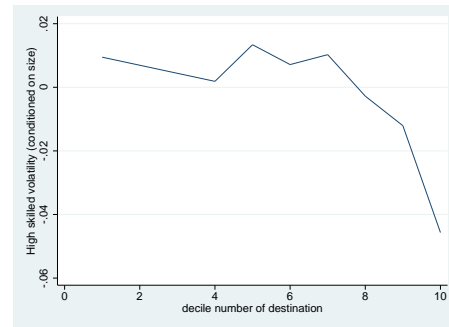
(a) Export and volatility of unskilled labor



(b) N. dest. and volatility of unskilled labor



(c) Export and volatility of skilled labor



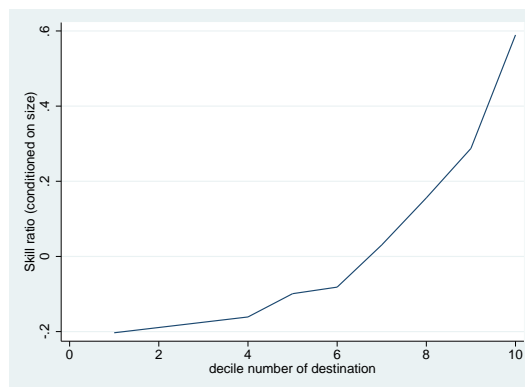
(d) N. dest. and volatility of skilled labor

Figure 1: Export Intensity and Employment Volatility

Source: Authors' calculation using French firm level data for the period 1996-2007.

products to the taste of foreign consumers, or to fulfill standards and regulations in foreign markets, are intensive in skilled labor.

Figure 2: Export destinations and skill intensity



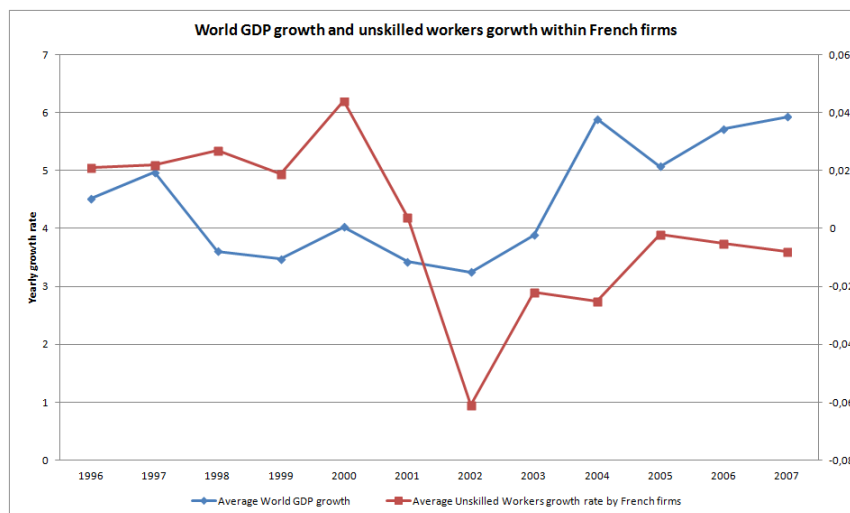
Source: Authors' calculation using French firm level data for the period 1996-2007.

2.1 From Micro-level Evidence to Macro-level Implications

The preliminary descriptive evidence presented in the previous section suggests a positive (negative) correlation between firm's sales in the foreign markets and the volatility of unskilled (skilled) workers. From that micro-economic evidence we can derive some macro-economic implications.

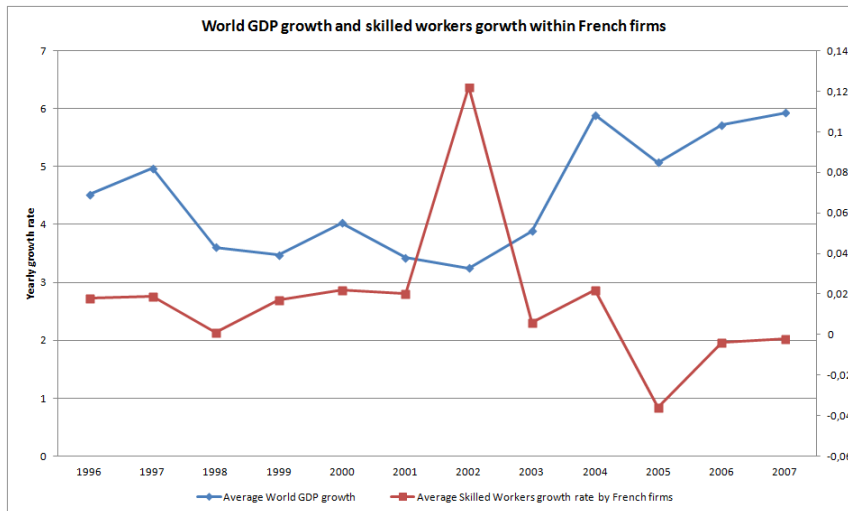
At the aggregate level, the micro evidence implies a pro-cyclical (counter-cyclical) relationship between foreign demand and the growth rate of unskilled (skilled) workers. Using the World GDP as a proxy for the foreign demand, we test for this macro-economic implication. We plot the yearly growth rate of unskilled and skilled workers of the firms in our estimating sample against the evolution of the World GDP yearly growth rate. Figures 3 and 4 here below confirm this intuition. The yearly growth rate of firm's unskilled (skilled) workers is positively (negatively) correlated with the growth rate of world GDP.

Figure 3: Export destinations and skilled intensity



Source: World Bank WDI and authors' calculation using French firm level data for the period 1996-2007.

Figure 4: Export destinations and skilled intensity



Source: World Bank WDI and authors' calculation using French firm level data for the period 1996-2007.

3 Theoretical Motivation

This section discusses a simple theoretical framework that rationalizes the empirical facts and presents the main mechanisms through which firms' export intensity has a heterogeneous effect on the volatility of employment of different skills.

We consider a framework in which a firm serves both its domestic market and possibly foreign destinations, in which case it incurs in sunk export costs. The demand addressed to the firm is stochastic on both markets –it is the only source of uncertainty considered here. Its distribution is known ex-ante but, on export markets, it depends upon the firm's investment in sunk costs of exporting in period t , f_t . This investment must be made before demand uncertainty is resolved for the period. Since higher sunk costs prop up demand by allowing to explore new markets and to increase marketing investment in markets already served (see Eaton et al., 2011 and Arkolakis, 2010), we assume the expected level of exports, $E(x_t)$, to be weakly increasing in the level of sunk costs which implies $\partial E(x_t)/\partial f_t > 0$. This creates a one-to-one correspondence between fixed export costs and expected export level. Once uncertainty is resolved, the firm knows the demand it faces in each market and can produce accordingly,

with output equal to the sum of domestic and foreign sales: $q_t = d_t + x_t$.

For sake of generality, we do not assume any functional form. We simply claim that the production function is homogeneous of degree one and uses two factors, skilled and unskilled labor. For simplicity, we assume that the relative wage remains constant over time. Accordingly, production requires a constant unskilled to skilled labor ratio, called λ . Since sunk costs are relatively skill intensive, we assume they are paid in unit of skilled labor only (f_t is the number of units of skilled labor needed). We indicate with u_t the firm's unskilled labor demand. Therefore, its skilled labor demand can be written as: $s_t = \frac{u_t}{\lambda} + f_t$.

We define volatility as the standard deviation of the growth rate and assume that, for a given firm's size, the volatility of its total sales is an increasing function of its expected exports, and therefore of its sunk export costs. This is in line with empirical findings in [Vannoorenberghe \(2012\)](#), which shows that the volatility of a firm's total sales increases with the share of exports in its total sales. For simplicity, we focus on the case where there is no time trend in the variables of interest. In this context, the stochastic distribution of demand on each market is constant over time. Since unskilled labor is only used for production, and the production function is homogeneous of degree one, we can state what follows:

Prediction 1: For a given firm size, the volatility of unskilled labor demand is an increasing function of the level of exports.

The implications are less straightforward for skilled labor, which is used not only in production, but also in sunk costs. Given the constant ex-ante distribution of demand, though, these sunk costs are constant over time ($f_t \equiv f$). The volatility of skilled labor demand thus writes

$$\sigma_{is}^2 = \sigma_{is} \left(\frac{s_t - s_{t-1}}{s_{t-1}} \right) = \sigma_{is} \left(\frac{u_t - u_{t-1}}{u_{t-1}} \times \frac{u_{t-1}}{u_{t-1} + \lambda f} \right), \quad (1)$$

where σ_{is}^2 denotes volatility of high skilled for firm i , and σ_{is} is the standard deviation. Absent any time trend, the latest term on the right hand side can be considered approximately constant

so that,

$$\sigma_{is}^2 = \frac{\bar{u}}{\bar{u} + \lambda f} \sigma_{us}^2 \quad (2)$$

where \bar{u} is the average firm's unskilled employment level over the period, and σ_{us}^2 denotes volatility of low skilled. The above equation can be rewritten as the ratio of the volatility of skilled labor over unskilled one:

$$\frac{\sigma_{is}^2}{\sigma_{us}^2} = \frac{\bar{u}}{\bar{u} + \lambda f} \quad (3)$$

Given the one-to-one correspondence between sunk cost and expected export level, this leads to the following:

Prediction 2: For a given firm size, the ratio of skilled to unskilled labor demand volatility is an increasing function of the level of exports.

Note finally that, even for a given firm size, the impact of increased exports on the volatility of the firm's skilled labor demand is not known a priori: the increased volatility of sales tends to raise it, while the higher sunk costs reduces it. The final effect remains thus an empirical question.

4 Data

Our empirical analysis combines two main sources of firm level data from France for the period 1996-2007: the Declaration Annuelle des Donneés Sociales (DADS) and the French Customs Data. DADS is an administrative dataset of matched employer-employee information collected by the INSEE (*Institut Nationale de la Statistique et des Etudes Economique*). It contains firm-level information on employment and wage by occupation category (4-digit classification). It also provides information on each firm's main industry of activity (NAF700, 4-digit industry classification). The data are based on mandatory reports of gross earnings, filed by employers to comply with French payroll taxes. All wage-paying individuals and legal entities established

in France are required to file payroll declarations.

To disentangle the effects of export exposure across employment skills, we classify employees into two main categories according to their wage. We consider skilled those workers whose initial wage is above the median wage in the sample, and unskilled the others. This definition of skills reflects firms' appreciation of workers' qualification. We also consider an alternative measure for skills based on occupations instead of wages. We distinguish between production and non-production workers according to the type of occupation within in the firm.

Trade data come from the French Customs, which provides annual export data for French manufacturing firms over the 1996-2007 period by country of destination. The customs data are at the product level (8-digit Combined Nomenclature), which we translate into the 6-digit Harmonized System (HS6), which gives us 5349 categories. We aggregate trade data at the firm-year level in order to match with the employer-employee information in DADS dataset. Since we are interested in measuring the effects of foreign shocks on the domestic labor market, we restrict our analysis to exporting firms. In fact, accounting also for purely domestic firms would inflate our story due to the zeros. In addition, in the IV estimation we would not have instruments for those firms uniquely serving the domestic market. Therefore, we decide to drop purely domestic firms and focus mainly on the intensive margin channel.

5 Estimation Strategy

5.1 Measuring Employment Volatility across Skills

We measure volatility as the standard deviation of the residual growth rate of firms' employment from an estimation for the period 1996-2007.⁴ The residuals come from the following estimation which uses as a dependent variable the logarithm of growth rate of employment for

⁴This is a standard measure of volatility used in the literature (Kurz and Senses (2016) and Vannoorenberghe (2012))

high and low skilled workers respectively, in firm i at time t :

$$\gamma_{ijkt} = \ln(E_{ijkt}) - \ln(E_{ikt-1}) = \phi_i + \mu_{kt} + \sum_d^{max} \nu_{idt} + v_{it}, \quad (4)$$

where γ_{ikt} is employment growth of firm i , worker type j (for high and low skilled workers), in 4-digit industry k and time t . E_{ikt} is the total employment of firm i by skill level j , ϕ_i are firm fixed effects that capture the unobserved time-invariant firm's characteristics and μ_{kt} are sector-year fixed effects. These latter should capture time-varying shocks affecting firms producing in the same sector (i.e., demand, supply or technology shocks). Lastly, to capture destination-specific time varying shocks we include destination-year dummies, ν_{idt} . These dummies also capture price indices in the destination countries. The estimated residual from equation (4), v_{it} , represents the deviation of employment growth from the firm-average and from the sector-average at year t . Volatility of high and low skilled employment is then computed as the standard deviation of the estimated residual of growth rate for the period 1996-2007:

$$\sigma_{ij} = \sqrt{\frac{1}{11} \sum \hat{v}_{it}^2} \quad (5)$$

This measure of firm-level employment volatility for each type of skill is already purged from firm unobservable characteristics and unobservable time-varying shocks across industries (sector-year fixed effects).

5.2 Identification strategy

We investigate the differentiated effect of firm's export intensity on skilled and unskilled employment volatility. To study this relationship, we run the following estimation:

$$\frac{\sigma_{is}}{\sigma_{iu}} = \beta_0 + \beta_1 Exports_i + \beta_2 Size_i + \beta_3 Imports_i + \alpha_k + \epsilon_{ik}, \quad (6)$$

where σ_{is}/σ_{iu} is ratio between high and low skilled employment volatility in firm i .⁵ The export intensity measure, $Exports_i$, is the logarithm of average export sales over the period 1996-2007, and $Size_i$ is the logarithm of total employment. The heterogeneous effect of export exposure on the volatility of different skills might be driven by the outsourcing strategy of firms. If imported inputs are complements to skilled workers or/and substitute to unskilled ones, outsourcing intermediate goods from foreign countries might also have an heterogeneous effect on the volatility of employment. For this reason, we include as a control variable the average imports of firm i over the period 1996-2007 ($Imports_i$). Finally, to account for unobservable shocks affecting industries, we control for industry fixed effects (2-digit), α_k . Therefore the specification in (6) captures variations in employment volatility across firms within a sector. β_1 is our coefficient of interest, and shows the effect of firms' exports on the volatility of different type of skills. Since we control for firms' size using total employment, the coefficient on firms' exports captures the impact of firms' export intensity conditional on firm size. This specification enable us to highlight the effect of different export intensities on the volatility of high versus low skilled labor between two firms producing in the same industry and with a similar size in terms of employment.

5.3 Identifying the Causal Effect of Export on Employment Volatility

There is a potential endogeneity concern that arises when studying the relationship between firms' export intensity and the volatility of employment. Technological change affects both firms exports and labor demand volatility. Thereby, OLS results might be biased downward because the upgrade in technology should increase exports but reduce the volatility of employment. This would generate artificially small coefficients.

To correct for this potential reverse causality concern from export performance to employment volatility we use instrumental variable techniques. We choose two instruments to capture exogenous determinants of exports. First, we construct an industry level real exchange rate

⁵In Appendix B we provide results for estimation of volatilities in levels.

averaged over the period as an exogenous foreign demand shock affecting firms in their export destinations. The firm-level exchange rate faced by exporting firms in export destinations is then aggregated at the 4-digit industry level using fixed initial weights. Then, as a second instrument, we use firm total export at the beginning of the period to instrument average exports (excluding the initial year). Initial exports are a good predictor of the average exports of the firm and should not be correlated with ex-post employment volatility once we control for firm's size and firm-fixed effects in the estimation of labor volatility. Both instruments satisfy the exclusion restriction.

6 Results

Previous studies on the average effect of export exposure on employment volatility do not consider the different effects across skills. To investigate this relationship, we estimate equation (6). Table 1 presents the results. Our findings show that export intensity has a negative and significant effect on the ratio of skilled over unskilled labor volatility (column 1). This result suggests that firms' exposure to foreign demand has an unequal effect on the volatility of different skills. Within an industry and conditional on firm's size and imports, firms that are more exposed to export have a greater volatility of unskilled labor and a lower volatility of skilled one relative to firms that export less. This result remains valid even when we exclude French-speaking destinations (column 2). Note that our measure of firm-level employment volatility is already purged from firm and sector-year unobservable characteristics.

In Appendix B we provide results for estimation of volatilities in levels. When we split the sample between skilled and unskilled labor volatility and run the previous estimation, we find that firms with greater export status have a higher volatility of unskilled labor and a lower volatility of skilled one relative to smaller exporting firms.

As discussed in section 5.3, we should be cautious in interpreting the OLS estimates as causal. In fact, there might be a potential reverse causality between export exposure and

employment volatility. Firm's export sales and employment demands are determined by the same firm's demand and supply factors. We deal with this potential endogeneity concern relying on instrumental variables estimator, where export intensity is instrumented using the sectoral real exchange rate and the initial level of exports of the firm. The real exchange rate (RER) is used as an exogenous foreign demand shock faced by firms in the destination market, which affects volatility only through the export intensity channel. The initial level of exports is uncorrelated with the volatility of employment over the period. These exclusion restrictions are validated by the exogeneity test of instruments presented in Appendix C. Column (3) in Table 1 reports the IV estimates. As can be noticed, the OLS estimates underestimate the effects of export intensity on the volatility of employment. The bias can be explained considering the opposite effect on export intensity and employment volatility of an upgrade in technology. Technology adoption should increase exports while reducing the volatility of employment. This tension would generate artificially small OLS coefficients.

The last three columns in Table 1 present results using an alternative measure of labor volatility. Specifically, we replace employment growth with the growth rate of hours worked in equation 4. While the magnitude of the coefficients is larger, the results are qualitatively similar to those in columns (1) to (3). Notice that the sample size is reduced because we lack of information in terms of hours worked. Appendix D reports additional robustness checks. In Table 11 we use a different definition of skills based on production versus non-production workers. While in Table 12 we use the coefficient of variation as a measure of employment volatility. Results are consistent with those in Table 1.

Table 1: Export exposure and firms' employment volatility, skilled/unskilled.

Dep Var:	S.D. residual employment growth skilled/unskilled			S.D. residual hours worked growth skilled/unskilled		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Intensity	-0.029*** (0.005)		-0.050*** (0.008)	-0.051*** (0.016)		-0.086* (0.049)
Export Intensity (no French)		-0.012*** (0.003)			-0.010 (0.008)	
Firm' size	0.344*** (0.020)	0.332*** (0.018)	0.363*** (0.032)	0.213*** (0.062)	0.177*** (0.069)	0.247*** (0.047)
Import Intensity	-0.001 (0.003)	-0.004** (0.002)	0.004 (0.004)	0.000 (0.006)	-0.010 (0.008)	0.011 (0.011)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS	OLS	OLS	2SLS
IV: RER			0.585*** (0.106)			0.576*** (0.114)
IV: Export (t=0)			0.248*** (0.018)			0.251*** (0.019)
Observations	17,694	17,694	17,694	13,118	13,118	13,118
R-squared	0.056	0.055	0.039	0.028	0.028	0.000
F-stat first Stage			103			85
Sargan Test			0.719			0.958

Notes: The dependent variable is the ratio between skilled and unskilled employment (columns (1) to (3)) and hours worked volatility (columns (4) to (6)). Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment (or hours worked) growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export (import) intensity is measured by the logarithm of average exports (imports) of the firm during the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in columns (1), (2), (4) and (5) and clustered by sector in columns (3) and (6).

Overall, our empirical results suggest that firm's export intensity, altered by exogenous foreign demand shocks, increases by a larger amount the volatility of unskilled labor relative to skilled one. All the instrumental variable estimations confirm the previous results on the heterogeneous effect of export exposure on employment volatility of different skills.

7 Testing the Mechanisms at Play

In this section we explore the possible channels of transmission. First, we consider how the degree of firm's diversification, in terms of destination markets and portfolio of exported products, is related to the volatility of its employment. Second, we explore the relationship between firm's dynamics into destination markets (entry and exit) and employment volatility. Third, we examine the heterogeneous effect that firm's size might have on the volatility of employment.

7.1 Number of Destinations and Products Exported

The previous section present robust and stable evidence on the differentiated effect of export intensity on the volatility of employment of different skill levels. Our theoretical framework highlights that the main source of this heterogeneous effect comes from different skilled labor requirements in fixed relative to variable costs. This section provides reinforcing evidence of the theoretical mechanism by looking at differences in employment volatility across exporting firms depending on the number of destinations and products exported. The logic behind this exercise is that each firm is adapting its products to a specific destination market. Therefore, the fixed export cost varies by destination and product.

Table 2 presents the results. Columns 1 and 2 quantify the effect of portfolio diversification in the destination country using exports per market and total number of destinations by firm respectively. As can be noticed, firms that are more diversified in export markets have a stronger volatility of unskilled labor relative to skilled labor. Then, in column 3 we consider the role of diversification in terms of the number of exported products. Firm' export scope is positive correlated with the volatility of unskilled labor and negatively correlated with the volatility of skilled one. In the last two columns, we gradually include all proxies for portfolio diversification. Results suggest that diversification in terms of destination markets matter the most in explaining the heterogeneous effect of export intensity on employment volatility across skills. These findings support our theoretical framework with skilled intensive fixed export.

Table 2: Export exposure and firms' employment volatility, skilled/unskilled. Testing the mechanism.

Dep Var:	S.D. residual employment growth, skilled/unskilled				
	(1)	(2)	(3)	(4)	(5)
Export per market	-0.032*** (0.008)			-0.009 (0.008)	-0.008 (0.008)
N. destinations		-0.130*** (0.012)		-0.124*** (0.015)	-0.090** (0.040)
N. products			-0.097*** (0.012)		-0.029 (0.035)
Firm's size	0.333*** (0.014)	0.355*** (0.016)	0.353*** (0.014)	0.358*** (0.020)	0.358*** (0.020)
Import Intensity	-0.005** (0.003)	0.001 (0.002)	0.001 (0.003)	0.001 (0.003)	0.002 (0.003)
Industry FE	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS	OLS
Observations	17694	17694	17694	17694	17694
R-squared	0.036	0.058	0.058	0.056	0.058

Notes: The dependent variable is the ratio between skilled and unskilled employment volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export per market is the ratio between total export and the number of destinations (mean over the period). The number of destinations is the average number of destinations served over the period. The number of products is the average number of HS6 item exported over the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in all columns.

7.2 Entry and Exit from Export Markets

One possible mechanism driving our findings is that employment volatility can be related to entry and exit into the destination market. Firms in our sample might change their export status several times, entering and exiting some destinations, as a consequence of specific market shocks. These firms might have a larger employment volatility of the less skilled workers.

We test for this channel by simultaneously controlling for two measures of export intensity. One measure is based on destinations always served by the firm (continuous). The other measure captures firm's entry and exit into specific destination (churning). Column 1 in Table 3 shows the results. Firms that enter/exit destinations have a larger volatility of unskilled workers relative to firms that are continuously exporting to the same destinations during the period.

On the same line, we test for the differential effect of export intensity towards EU versus non-EU destinations. As a consequence of the common market, similar cultures and tastes,

we expect EU-destinations to be more easily accessible for French firms relative to non-EU destinations. Additionally, since French firms should face higher uncertainty (greater demand shocks) in more difficult and remote markets like extra-EU destinations, the associated fixed costs should be greater. Column (2) in Table 3 shows that firms with greater export intensity towards more difficult markets (extra EU) have a relatively higher volatility of low skilled labor.

Table 3: Export exposure and firms' employment volatility, skilled/unskilled by type of exports.

Dep Var:	S.D. residual employment growth skilled/unskilled	
	(1)	(2)
Export Intensity (continuous)	-0.008*** (0.002)	
Export Intensity (churning)	-0.025*** (0.006)	
Export Intensity (EU)		-0.006** (0.003)
Export Intensity (extra EU)		-0.020*** (0.004)
Firm' size	0.350*** (0.020)	0.343*** (0.019)
Import Intensity	-0.001 (0.003)	-0.002 (0.003)
Industry FE	Yes	Yes
Estimator	OLS	OLS
Observations	17,694	17,694
R-squared	0.057	0.056

Notes: The dependent variable is the ratio between skilled and unskilled employment volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export intensity is measured by the logarithm of average exports of the firm during the period by type of destination. Continuous destinations are those in which the firm export continuously over the period, while churning destinations are those in which the firms occasionally exports. EU and non-EU export intensity refer respectively to EU and non-EU destination country exports. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in all columns.

7.3 Testing for Firm Size

The previous findings suggest that the differential impact of export intensity on the volatility of skilled and unskilled labor depends on the number of destinations and the complexity of the markets reached by the firm.

Firms' exporting to more destinations tend to be larger. This section test for the heterogeneous effect of export intensity on the volatility of employment of different skills depending

on the initial size of the firm. We classify firms into three categories of initial size measured as the total employment of the firm in the initial year: big, medium and small size firms. Big firms are those with initial total employment above 75th percentile. Medium size firms are those with initial size between the 25th and 75th percentile. Small firms are those with initial total employment below 25th percentile. Next we have interacted export intensity with the size bins.

Results presented in Table 4 show that effect of export intensity on the ratio of skilled over unskilled labor volatility are significant only for larger firms.

Table 4: Export exposure and firms' employment volatility by firms' size.

Dep Var:	S.D. residual employment growth skilled/unskilled	
	(1)	(2)
Export Intensity × Big	-0.047*** (0.006)	-0.054*** (0.010)
Export Intensity × Medium	0.008 (0.005)	-0.005 (0.011)
Export Intensity × Small	0.029 (0.032)	0.043 (0.060)
Import Intensity	-0.000 (0.003)	0.003 (0.005)
Industry FE	Yes	Yes
Estimator	OLS	2SLS
Observations	17,694	17,694
R-squared	0.058	0.043

Notes: The dependent variable is the ratio between skilled and unskilled employment volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export intensity is measured by the logarithm of average exports of the firm during the period by type of destination. Big firms are those with initial total employment above 75th percentile. Small firms are those with initial total employment below 25th percentile. Medium size firms are those in between. Size bins included in the estimation but not reported. Standard errors are bootstrapped in all column (1) and cluster by sector in column (2).

8 Alternative Explanations

In the previous section, we proposed different mechanisms to explain the heterogeneous impact of firms' export intensity on the ratio of skilled over unskilled labor volatility. Nevertheless, there might be other potential forces driving our results. This section accounts for additional robustness checks and shows that our initial findings continue to hold.

8.1 The role of MNFs

The presence of multinational firms (MNFs) in our sample might affect our results. MNFs have the possibility of adjusting employment across firms (plants) in different countries. This in turns might affect their employment volatility.

We thus test whether our results are robust to the exclusion of French multinational firms. In order to identify multinational firms, we combine our main dataset with the *Enquete Echanges Internationaux Intra-Groupe* provided by the French Office of Industrial Studies and Statistics (SESSI).⁶ The results, presented in Table 5, are very similar to those on the full sample. The impact of export intensity on the ratio of skilled over unskilled labor volatility is not driven by the specific characteristics of French multinational firms.

Table 5: Export exposure and firms' employment volatility, skilled/unskilled. Robustness check excluding MNEs.

Dep Var:	S.D. residual employment growth skilled/unskilled		
	(1)	(2)	(3)
Export Intensity	-0.022*** (0.005)		-0.041*** (0.009)
Export Intensity (no French)		-0.009*** (0.003)	
Firm' size	0.374*** (0.022)	0.366*** (0.017)	0.390*** (0.016)
Import Intensity	-0.002 (0.003)	-0.004 (0.003)	0.003 (0.004)
Industry FE	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	16,825	16,825	16,825
R-squared	0.062	0.062	0.061

Notes: The dependent variable is the ratio between skilled and unskilled employment volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export intensity is measured by the logarithm of average exports of the firm during the period and firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in columns (1) and (2) and clustered by sector in column (3).

⁶This dataset is based on a firm-level survey of manufacturing firms belonging to groups with at least one affiliate in a foreign country and with international transactions totalling at least one million Euros. The survey year is 1998. The data provide a good representation of the activity of international groups located in France. These data cover around 82% of total trade flows by multinationals, and 55% and 61% of total French imports and exports respectively.

8.2 Controlling for Firm Productivity

More productive firms are more skilled intensive and export to more destinations. The different level of productivity across exporting firms might then explain the heterogeneous effect of export intensity on the volatility of skilled and unskilled labor. It is important to notice that we constructed our dependent variable so that it is already purged from firm's unobservable time-invariant characteristics. Additionally, all estimations also control for differences in firm's size, through total employment and total imports, which are both positively correlated with firm productivity.

Nevertheless, in this section, we go one step further and explicitly deal with potential omitted variable concerns that might affect the previous results, and include labor productivity. To add information on firms' value added, we match our main dataset with the Annual French Business Surveys (EAE), available from INSEE. This is a survey of firms with more than 25 employees. This survey allows us to have information on firms' value added and labor productivity (computed as the average ratio of value added over total employment of the firm over the period). Since this implies restricting the sample to exporters with more than 25 employees which have manufacturing as their main activity, the number of observations is reduced by almost a half.

The results are presented in Table 6. Despite the reduction in the number of observations, our coefficient of interest remains negative and significant implying that within an industry firms with greater export sales have a lower ratio of skilled over unskilled labor volatility relative to smaller exporting firms. These findings confirm that the previous results are not driven by differences in firm productivity and that they do not suffer from omitted variable concerns.

Table 6: Export exposure and firms' employment volatility, skilled/unskilled. Controlling for labor productivity.

Dep Var:	S.D. residual employment growth skilled/unskilled		
	(1)	(2)	(3)
Export Intensity	-0.045*** (0.008)		-0.063*** (0.021)
Export Intensity (no French)		-0.019*** (0.005)	
Firm' size	0.203*** (0.023)	0.185*** (0.024)	0.219*** (0.044)
Import Intensity	-0.009* (0.005)	-0.015*** (0.005)	-0.002 (0.007)
Firm Labor Productivity	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.001)
Industry FE	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	9,134	9,134	9,134
R-squared	0.046	0.044	0.011

Notes: The dependent variable is the ratio between skilled and unskilled employment or hours worked volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment (or hours worked) growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export (import) intensity is measured by the logarithm of average exports (imports) of the firm during the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Firm labor productivity (average over the period) computed on a sample of surveyed firms with more than 25 employees. Standard errors are bootstrapped in columns (1), (2), (4) and (5) and clustered by sector in columns (3) and (6).

8.3 The impact of China's entrance to WTO

This section considers whether the exogenous trade shock related to the entrance of China into WTO in 2001 might drive some of our results. The period after the entrance of China is characterized by larger export opportunities for French firms. In fact, the tariffs faced by French firms were significantly reduced.

In order to see if our findings are affected by this exogenous export shock, we estimate our main specifications on two different sub-samples: before (1996-2000) and after (2001-2007) the entrance of China into WTO. All the variables are then computed for these two different sub-sample periods. The results are presented in Table 7. While the coefficient of interest on firms' export intensity is always significant during the second period after the entrance of China into WTO, it is only significant for the baseline specification during the first period (column 1).

Table 7: Export exposure and firms' employment volatility, skilled/unskilled. Before vs after China in the WTO.

Dep Var:	S.D. residual employment growth skilled/unskilled			S.D. residual employment growth skilled/unskilled		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Intensity	-0.034*** (0.009)		-0.024 (0.017)	-0.030*** (0.007)		-0.046*** (0.017)
Export Intensity (no French)		-0.006 (0.005)			-0.010** (0.005)	
Firm' size	0.345*** (0.046)	0.320*** (0.034)	0.335*** (0.052)	0.240*** (0.032)	0.226*** (0.033)	0.257*** (0.046)
Import Intensity	0.008 (0.006)	0.003 (0.006)	0.006 (0.004)	-0.002 (0.004)	-0.005 (0.005)	0.003 (0.005)
Period	<i>Before China WTO</i>			<i>After China WTO</i>		
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS	OLS	OLS	2SLS
Observations	14,252	14,252	14,252	15,755	15,755	15,755
R-squared	0.019	0.018	0.013	0.019	0.018	0.006

Notes: The dependent variable is the ratio between skilled and unskilled employment or hours worked volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment (or hours worked) growth rate on firm, sector-year fixed effects and destination-year dummies for the two sub-periods 1996-2000 and 2001-2007. Export (import) intensity is measured by the logarithm of average exports (imports) of the firm during over the two periods. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in columns (1), (2), (4) and (5) and clustered by sector in columns (3) and (6).

9 Conclusion

This paper investigates how globalization shapes labor markets. We look at the impact of firms' export intensity on the volatility of different skilled workers. Relying on an econometric strategy that deals with reverse causality, our results show that exporting firms facing foreign demand shocks adjust more their unskilled labor demand relative to the skilled one. Firms with greater export sales, exporting more products to more destinations have a lower volatility of skilled labor and a higher volatility of unskilled labor compared with small exporters conditional on firm size and imports.

Our findings show that inequalities between skilled and unskilled labor associated to international trade are reinforced when looking at the heterogeneous effect of one of the firms' mode of globalization, export activity, on the volatility of labor demand of different skills. These findings suggest that firms that are more engaged in export markets contribute to explain the stability of skilled labor jobs and part of the increase in precariousness of unskilled workers.

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A Appendix

A Descriptive Statistics

Table 8 presents descriptive statistics for the exporting firms in our sample.

Table 8: Descriptive Evidence (Only Exporters)

	Obs	Mean	Std Dev	Min	Max
Volatility total employment	18,081	0.186	0.096	0.015	0.699
Volatility high skilled	17,703	0.369	0.197	0.000	1.878
Volatility low skilled	18,072	0.241	0.146	0.005	1.225
Volatility skilled/unskilled	17,694	1.953	1.571	0.002	46.512
Volatility hours skilled/unskilled	13,118	2.067	8.228	0.001	859.02
Export (ln)	18,082	10.446	3.233	1.422	20.010
Employment (ln)	18,082	3.203	1.076	0.693	5.871

We classify a firm as an exporter if the firm did export during at least one year during the period 1996-2007. The table reports information on number of observations, mean values, standard deviation, minimum and maximum values for: volatility of total employment, volatility of high and low skilled labor, the ratio of labor demand volatility, the ratio of volatilities of hours worked, the logarithm of export, and of employment. The average exporting firm employs 25 workers.

B Volatility of Employment in Level

We estimate the following equation separately for skilled and unskilled workers respectively:

$$\sigma_i = \beta_0 + \beta_1 Exports_i + \beta_2 Size_i + \beta_3 Imports_i + \alpha_k + \epsilon_{ik},$$

where the dependent variable, σ_i , is our firm-level employment volatility measure explained in section 5.1.⁷

⁷We also followed [Kurz and Senses \(2016\)](#) and estimate the volatility of total employment. Results are available upon request.

Table 9: Employment Volatility: Skilled versus Unskilled

Dep Var:	S.D. residual skilled growth		S.D. residual unskilled growth	
	(1)	(2)	(3)	(4)
Exporter Intensity	-0.011*** (0.001)	-0.010*** (0.001)	0.001*** (0.000)	0.001* (0.000)
Export Status	0.119*** (0.005)		-0.005* (0.003)	
Continuous Exporters		0.105*** (0.011)		-0.001 (0.005)
Churning Exporters		0.113*** (0.007)		-0.006 (0.004)
Firm' size	0.007*** (0.001)	0.007*** (0.001)	-0.065*** (0.001)	-0.065*** (0.001)
Import Intensity	0.000 (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Industry FE	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS
Observations	30899	30899	36977	36977
R-squared	0.023	0.023	0.252	0.252

Notes: The dependent variable is the logarithm of firm level volatility of labor computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination dummies for the period 1996-2007. Export intensity is measured by the logarithm of average exports of the firm during the period and firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in all columns.

C Exogeneity Test

Table 10: Export exposure and firms' employment volatility, skilled/unskilled. First stage regression results.

Dep Var:	Export Intensity		
	(1)	(2)	(3)
Sector RER	1.131*** (0.120)		0.585*** (0.106)
Initial Export		0.254*** (0.018)	0.248*** (0.018)
Firm' size	0.928*** (0.064)	0.536*** (0.047)	0.545*** (0.045)
Import Intensity	0.252*** (0.013)	0.173*** (0.008)	0.167*** (0.008)
Industry FE	Yes	Yes	Yes
F-stat	88	189	103
Sargan Test			0.557
Observations	17694	17694	17694

Notes: Export intensity does not include the export value in initial year (as it is used as IV). It is measured by the logarithm of average exports of the firm during the period. Standard errors are clustered by sector in columns.

D Additional Robustness Checks

Table 11: Export exposure and firms' employment volatility, skilled/unskilled. Robustness check using alternative definition of skills.

Dep Var:	S.D. residual employment growth, non-production/production		
	(1)	(2)	(3)
Export Intensity	-0.031*** (0.004)		-0.037*** (0.008)
Export Intensity (no French)		-0.012*** (0.003)	
Firm' size	0.257*** (0.018)	0.244*** (0.019)	0.263*** (0.037)
Import Intensity	-0.003 (0.003)	-0.006*** (0.002)	-0.001 (0.004)
Industry FE	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
IV: RER			0.586*** (0.103)
IV: Export (t=0)			0.247*** (0.018)
Observations	17,763	17,763	17,763
R-squared	0.046	0.045	0.023
F-stat first Stage			102
Sargan Test			0.356

Notes: The dependent variable is the ratio between non-production and production workers volatility. Firm level volatility of employment is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export (import) intensity is measured by the logarithm of average exports (import) of the firm during the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in columns (1) and (2) and clustered by sector in column (3).

Table 12: Export exposure and firms' employment volatility, skilled/unskilled. Robustness check using coefficient of variation.

Dep Var:	Coeff. Variation residual employment growth, skilled/unskilled		
	(1)	(2)	(3)
Export Intensity	-0.036*** (0.006)		-0.032* (0.017)
Export Intensity (no French)		-0.017*** (0.004)	
Firm' size	-0.004 (0.017)	-0.015 (0.018)	-0.008 (0.037)
Import Intensity	-0.022*** (0.004)	-0.025*** (0.005)	-0.023*** (0.007)
Industry FE	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
IV: RER			0.589*** (0.103)
IV: Export (t=0)			0.247*** (0.017)
Observations	17,911	17,911	17,911
R-squared	0.035	0.034	0.011
F-stat first Stage			105
Sargan Test			0.242

Notes: The dependent variable is the ratio between skilled and unskilled employment volatility. Firm level volatility of employment is computed as the coefficient of variation of the estimated residual of employment growth rate on firm, sector-year fixed effects and destination-year dummies for the period 1996-2007. Export (import) intensity is measured by the logarithm of average exports (import) of the firm during the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in columns (1) and (2) and clustered by sector in column (3).

Table 13: Export exposure and firms' employment volatility, skilled/unskilled. Robustness check with unbalanced panel data.

Dep Var:	S.D. residual employment growth		S.D. residual hours worked growth	
	(1)	(2)	(3)	(4)
Export Intensity	-0.040*** (0.013)		-0.031 (0.018)	
Export Intensity (no French)		-0.018*** (0.006)		-0.026** (0.012)
Firm' size	0,328*** (0.031)	0.315*** (0.031)	0.149** (0.061)	0.153** (0.057)
Import Intensity	-0,002 (0.031)	-0.006* (0.003)	-0.002 (0.008)	0.000 (0.057)
Industry FE	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS
Observations	28943	28943	28943	28943
R-squared	0.007	0.007	0.001	0.001

Notes: The dependent variable is the ratio between skilled and unskilled employment or hours worked volatility. Firm level volatility of employment or hours worked is computed as the standard deviation of the estimated residual of employment growth rate on firm, sector-year fixed effects, firm's labor productivity and destination dummies for the period 1996-2007. Export intensity is measured by the logarithm of average exports of the firm during the period. Firm' size is measured as the logarithm of total employment of the firm in the initial year. Standard errors are bootstrapped in all columns.