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The impact of trade shocks on collective wage bargaining agreements[1]

Juan CARLUCCIO**, Denis FOUGERE*** and Erwan GAUTIER****

Abstract:

We study the impact of international trade on firm-level wage bargaining using a unique administrative firm-level dataset for French manufacturing. Exports have a positive effect on the probability of signing firm-level wage agreements, while offshoring has no significant effect. Results are consistent with the predictions of rent-sharing models of the export wage-premium.

JEL Codes: F16, J52

Keywords: exports, offshoring, collective bargaining

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1. Introduction

The recent empirical literature has shown that firm-level trade participation through exports and offshoring affects firm-level wages, with heterogeneous effects according to the workers' skills and occupation. A rich theoretical literature points to rent-sharing as a key mechanism through which trade-created revenues are transmitted to wages (see Harrison et al., 2011, for a survey). Collective bargaining of wages between workers and firms is the most important formal rent-sharing mechanism in many European countries.[2] Consistently with the theoretical predictions, recent empirical contributions have shown that the impact of trade shocks on firm-level wages differs according to whether wages are bargained collectively or not (e.g. Felbermayr et al., 2014; Carluccio et al., 2015).

An important question that remains open is whether the bargaining level is exogenous to international trade, as assumed in current theoretical and empirical work, or if instead trade liberalization impacts wages also through modifying the wage-bargaining process itself. In this paper we provide an answer to such question. We ask whether the likelihood that firms sign collective firm-level wage agreements is affected by exports and offshoring opportunities. We rely on a unique administrative dataset collected by the French Ministry of Labor that provides information on all collective wage agreements signed at the firm level over the period 1996-2009. We complement it with administrative data on firm-level exports, imports, and balance sheets.

Our results show that international trade affects the wage bargaining process at the firm level. We control for the endogeneity of exports and offshoring using firm-specific instruments based on world demand and supply shocks in the spirit of Autor et al. (2013) and Hummels et al. (2014). We find that a 1% increase in exported values leads to a 0.7 percentage point (pp) increase in the probability of signing a collective wage agreement. We do not find a significant impact of offshoring. The results are robust to the inclusion of firm-level covariates, in particular firm size, and are stable across different time periods.

The results fit well with the long-standing notion that unions are rent-seeking entities. The rents creates by exports shocks provide incentives for workers to bargain collectively to reap a share of those rents. The non-significant effect of offshoring might be the result of the combination of two opposing forces. On the one hand, offshoring boosts productivity, raising

[2] The percentage of workers covered by collective agreements is of over 70% in most countries in continental Europe (Venn, 2009).

profits (Grossman and Rossi-Hansberg, 2008), and thus providing higher incentives for collective bargaining. On the other hand, offshoring can replace tasks previously carried out by domestic workers, eroding worker's bargaining power (Dumont et al., 2006).

The key message of our paper is that the wage bargaining regime is endogenous to export demand shocks. Our results can inform future theoretical and empirical research on the impact of trade on firm-level wages, as the existing literature has concentrated on how the bargaining regime shapes the effect of trade on wages, taking bargaining regimes as exogenous to trade (e.g., Felbermayr et al., 2011; Ranjan, 2013). One exception is Capuano et al. (2014), who finds that exports have a non-significant effect on the choice of bargaining level by German firms, once firm size is controlled for. By pointing to trade as a relevant variable affecting the bargaining level, our results also complement previous analyses that have focused on the role of technology (e.g., Acemoglu et al., 2001 and Hirsch et al., 2014).

2. Data and descriptive statistics

We rely on a large firm-level dataset covering the period 1996-2009. This dataset is obtained by combining three administrative sources with firm-level information on collective agreements, imports and exports, and balance sheet data. Information on firm-level wage agreements come from an exhaustive data set collected by the French Ministry of Labor. Firms are required by law to report on all concluded firm-level agreements every year. Available variables include a firm identifier, year of the agreement and whether the agreements deal with wages. Data on exports and offshoring come from an exhaustive administrative file (source: French Customs). For each firm over the period 1996-2009, the Customs data report the yearly value of exports (by country of destination and product) and imports (by country of origin and product). We follow the methodology of Feenstra and Hanson (1999) and measure offshoring as imports of goods that belong to the industry where the firm operates. This measure attempts to capture the transfer abroad of production activities that were carried out (or could have been carried out) by the same firm in France. These goods produced with foreign labor are more likely to substitute for domestic labor. Finally, the administrative BRN dataset ('Bénéfices Réels Normaux') is used to estimate firm-level total factor productivity (TFP) and other firm-level controls. We match the different datasets using the common firm identifier. We restrict our sample to imports and exports of manufactured products (95% of reported trade values) by firms in the manufacturing sector. We focus on the intensive margin of trade, and keep firms only in the years in which they

both import and export.[3] We also exclude small firms (with less than 20 employees) which are very unlikely to sign a wage agreement since there is generally no union representative in those firms. Overall, our sample contains about 69,000 observations corresponding to 10,800 firms on the period 1996-2009.

The wage bargaining institutional setup in France is similar to the one existing in most continental European countries. Wages can be negotiated at two levels: industry and firm. Industry-level wage agreements define wage floors by occupation (Fougère et al., 2016). These agreements apply to all firms in a given industry through extension procedures implemented by the Ministry of Labor. Opting out of an industry agreement is not possible[4]. Firms and unions can sign firm-level wage agreements, provided that wages are not set below industry-level wage floors. Given this, in our analysis we model firms' decision to sign firm-level agreements.

About 16% of firms in our sample are covered by a wage agreement during the sample period. Between-firm heterogeneity is quite large. On average, 32% of firms with more than 75 employees sign a wage agreement versus less than 5% for firms with less than 75 employees. Firm-level bargaining process is quite persistent over time. A decomposition of the variance of the dummy variable "firm-level wage agreement" reveals that over a half of the total variance is explained by between-firm variation. Over our sample period, the share of firms covered by a wage agreement increases somewhat. However, the within-firm variation is rather weak.

[Figure 1]

Figure 1 plots the frequency of wage agreements against firm-level export and offshoring intensities (normalized by sales as the denominator to account for size effects). The occurrence of a wage agreement is positively correlated with export intensity, even after controlling for size. On average, 10% of firms with the lowest export intensity (i.e., belonging to the first decile) are covered by a wage agreement, whereas 24% of firms with the highest export intensity (i.e., belonging to the highest decile) do so. The correlation between the frequency of wage agreements and offshoring intensity is weaker. It seems quite stable over

[3] Identification of the effect of the extensive margin of trade (i.e. changes in firms' trade status) is made difficult by the limited variation in trade status over time.

[4] This is an important difference with Germany, where firms are allowed to unilaterally opt-out of industry-level agreements.

the deciles of the distribution of offshoring intensity (in particular for small firms, Figure A in the Appendix).

3. Empirical model and results

We estimate a Probit model relating the occurrence of a firm-level wage agreement to exports and imports over the period 1996-2009:

$$y_{it} = 1 \ if \ y_{it}^{*} > 0$$

and

$$y_{it} = 0 \ if \ y_{it}^{*} \leq 0$$

with $y_{it}^{*} = \beta_{exp} \ln exp_{it} + \beta_{imp} \ln imp_{it} + \beta_x x_{it} + \alpha_i \quad + \lambda_t \quad + \varepsilon_{it}$

where y_{it} is a variable equal to 1 if a wage agreement is signed in a given firm *i* and in a given year *t*, $\ln exp_{it}$ is the logarithm of exports by firm *i* in year *t*, $\ln imp_{it}$ is the logarithm of offshoring by firm *i* in year *t*, x_{it} is a vector of covariates including firm-level controls in year *t* (the number of employees, TFP, sales, the share of skilled workers, and the capital-labor ratio) and year- and 4-digit- industry dummies. α_i is a random effect (specific to firm i) and we also include the within-firm average of firm-level controls as regressors; this Mundlak formulation allows us to capture the correlation between the unobserved heterogeneity and the covariates that can make the random effect model inconsistent. λ_t is a year dummy, and ε_{it} is an i.i.d. random term (white noise) with mean 0 and variance ${\sigma_\varepsilon}^2$.

Unobservable shocks can simultaneously affect the occurrence of a firm-level wage agreement and trade flows for a given firm. To account for this potential endogeneity bias we use an instrumental regression. We use demand and supply shocks from the rest of the world as instruments for exports and offshoring (following Autor et al., 2013 and Hummels et al., 2014). Those instruments that we used in a previous study (Carluccio et al., 2015) are specific to a given firm and a given year. More details and the results of the first-stage regression are provided in Table A in the Appendix.[5]

[Table 1]

Table 1 reports the marginal effects from the Probit regressions. In column (1) exports are estimated to have a positive and statistically significant impact on the probability of a wage agreement at the firm level: marginal effects suggest that a 1% increase of exports leads to a

[5] A detailed robustness analysis of the instruments is provided in Carluccio et al. (2015).

3.5 pp increase in the probability of a firm-level wage agreement. After controlling for endogeneity of exports, the impact remains positive and statistically significant. The effect of offshoring is slightly positive: a 1% increase of offshoring leads to an increase in the probability of a wage agreement at the firm-level of 1 pp. Our results are quite robust to the inclusion of controls that have the expected effects but the magnitude of the impact of trade decreases. The effect of 1% increase of exports is estimated to be 0.7 pp on the probability of a firm-level agreement whereas it is only 0.1 pp for offshoring and not significant after correcting for the endogeneity bias (column 4). As expected, firm size appears as a crucial determinant of wage agreements: the marginal effect is over 4 pp. This size effect might be at least partly associated with the bargaining power of employees since unionization tends to be higher in large firms.[6] Finally, we find a positive and significant effect of the firm's productivity and of the capital-labor ratio; this last result can be rationalized by models with sunk capital and hold up (see, e.g., Grout, 1984).

We ran a series of robustness checks, presented in Tables B and C of the Appendix. First, we estimated the model by firm size and find that the effect of exports on the signing of a wage agreement increases with the size of the firm, whereas the impact of offshoring remains non-significant all across the board. Interestingly, for the largest firms, size, productivity, and exports all have a positive and significant effect on the signing of a wage agreement. We divide the sample into two sub-periods (1996-2002 and 2003-2009) and find that the effect of exports is stable over time, with an almost identical coefficient in each subsample. Finally, to control for high persistence of the bargaining process and to identify the contribution of trade to time variations in wage bargaining, we exclude all firms which never sign any wage agreement over the period: we still find a positive but non-significant effect of exports and a small negative effect of offshoring.[7]

4. Conclusion

In this paper we use detailed firm-level data to test whether trade shocks lead firms to sign collective wage agreements. We find that exports shocks have a positive and significant effect on the probability of signing a wage agreement at the firm level, while the effect of offshoring is not statistically significant. Our findings have implications for the debate on the impact of trade on wage inequality. A consequent body of work, based on the seminal paper by Melitz

[6] Capuano et al. (2014) argue that size, productivity, and exports are highly correlated, and find on German data that the effect of exports disappear once firm size is included in the regression.

[7] We also considered a sample of firms that are present at least 10 years, and find a similar positive effect of exports.

(2003), points out that trade creates between-firm dispersion in revenues that translates into wages through rent-sharing. Our results unveil an extra margin through which trade affects wages. The between-firm variation in export and offshoring participation translates into variation in bargaining regimes between firms. Given that wages are more sensitive to trade in firms with collective bargaining, changes in bargaining regimes enhance the trade-created between-firm wage dispersion.

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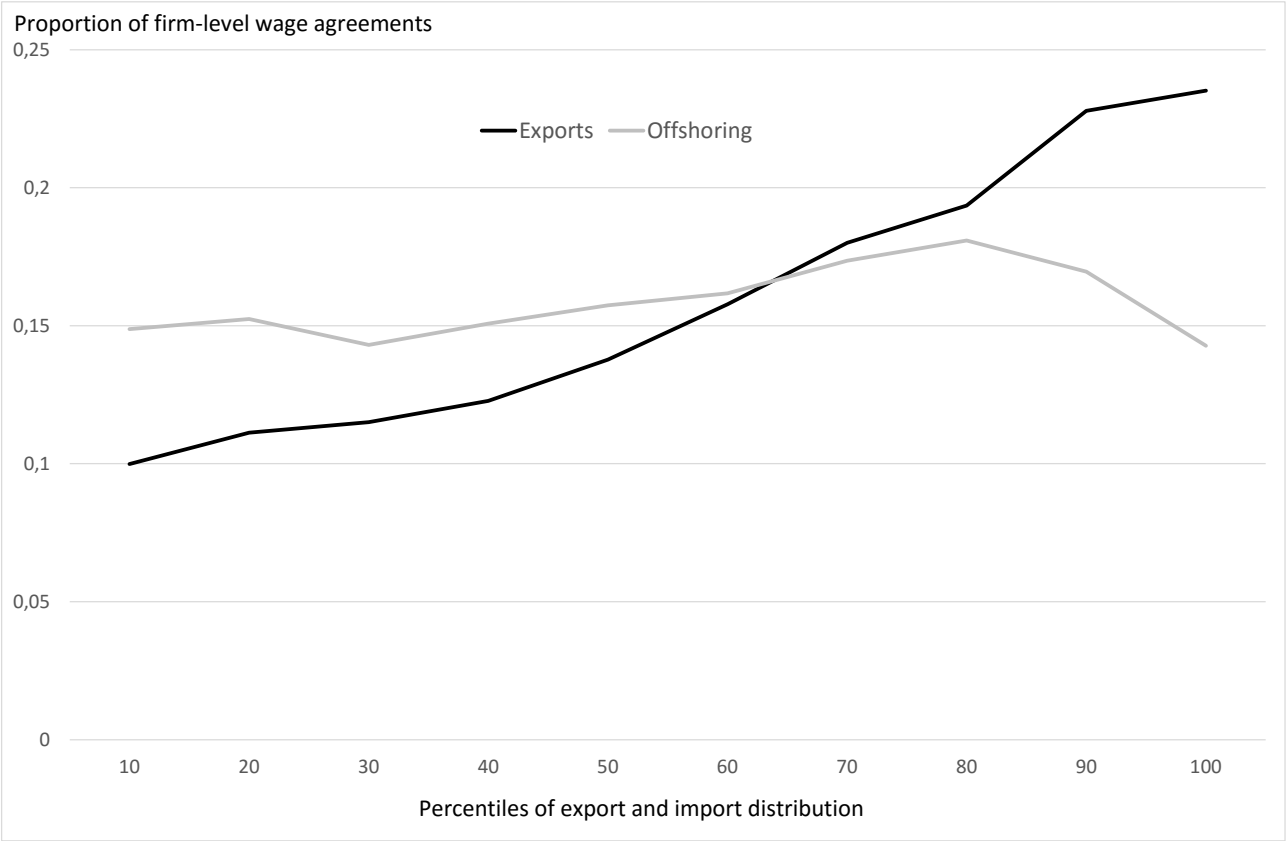
Table 1: Marginal effects of a Probit model for signing a firm-level wage agreement

Dependent variable	Signing of a firm level wage agreement			
	(1)	(2)	(3)	(4)
Ln(exports)	0.035***	0.042***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Ln(offshoring)	0.009***	0.013***	0.001*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Ln(TFP)			0.015***	0.014***
			(0.004)	(0.004)
Ln(firm size)			0.045***	0.044***
			(0.006)	(0.006)
Capital/labor ratio			0.027***	0.027***
			(0.005)	(0.005)
Share of high-skilled workers			0.015	0.015
			(0.015)	(0.015)
Sales			0.001	0.001
			(0.003)	(0.003)
IV	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	70,826	70,826	69,358	69,358
Number of firms	10,842	10,842	10,756	10,756
Average obs. per firm	6.5	6.5	6.4	6.4
Log-likelihood	-21,477.2	-21,320.1	-20,303.1	-20,307.0

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are reported in brackets. Period: 1996-2009. Year dummies, industry dummies and firm-specific random effects are included in all specifications. The sample consists of firms that both export and import at least half of the observation period. Firms with less than 20 employees are excluded.

Figure 1: Frequency of firm-level wage agreements (in %) by export and offshoring intensity (deciles)



Notes: This figure plots the frequency of firm-level wage agreements as a function of the trade intensity of firms. The frequency of wage agreements is computed as the ratio between the number of firms covered by a firm-level wage agreement divided by the total number of firms. Export intensity is calculated as the ratio between the value of exports and the value of total sales (at the firm level). We then compute deciles of the sample distribution of export intensity. We compute the frequency of wage agreements at each decile of the export intensity distribution. Same calculations are made for offshoring intensities.

APPENDIX (not intended for publication)

Instrumentation strategy

Our instrumentation strategy follows a recent strand of literature which uses world demand and supply shocks specific to each product-country pair as exogenous shifters (see, e.g., Autor et al., 2013, Hummels et al., 2014). Each firm in the sample exports and imports a set of products to/from a set of countries. The assumption is that a shock to the demand of a product *p* in a country *c* would translate into higher imports into country *c* of this particular product *p*. French firms exporting the product *p* to country *c* would then raise their exports to that country. Similarly, increases in world exports of product *p* by country *c* reflect increases in the competitiveness of country *c* for the product *p*. French firms importing product *p* from country *c* would respond to this shock by increasing their imports of product *p* from the country *c*. The exclusion restriction is satisfied as long as foreign demand and supply shocks are exogenous to French firms' wage setting. Carluccio et al. (2015) provide a detailed analysis of the instruments along with a wide set of robustness analyses.

World demand WD_{it} and world supply WS_{it} addressed to firm *i* in year *t* are:

$$WD_{it} = \sum_{c,p} s_{icp} WD_{cpt} \qquad\qquad WS_{it} = \sum_{c,p} s_{icp} WS_{cpt}$$

where WD_{cpt} and WS_{cpt} are respectively world demand and supply for a product-country pair at time *t* computed using data at the 6-digit level of the Harmonised System HS from the BACI dataset constructed by CEPII.[8] We calculate the firm-specific shares s_{icp} of each pair (product *p*, country *c*) in total exports (respectively, offshoring) using average shares of the products actually exported (respectively, imported) over the period 1996-2009.

Our instrumentation equation is:

$$\ln exp_{it} = \gamma_{WD}^{exp} \ln WD_{it} + \gamma_{WS}^{exp} \ln WS_{it} + \gamma_{exp} x_{it} + \alpha_i^{exp} + \lambda_t^{exp} + \epsilon_{it}$$

$$\ln off_{it} = \gamma_{WD}^{off} \ln WD_{it} + \gamma_{WS}^{off} \ln WS_{it} + \gamma_{off} x_{it} + \alpha_i^{off} + \lambda_t^{off} + \zeta_{it}$$

where x_{it} is a vector of firm-level controls identical to the one used in our Probit model, λ_t^{exp} and λ_t^{off} are year dummies, and ϵ_{it} and ζ_{it} are i.i.d. random terms with mean 0 and variances σ_ϵ^2 and σ_ζ^2, respectively.

[8]The BACI dataset is constructed using bilateral trade data at HS 6-digit level from COMTRADE. It can be downloaded at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=1

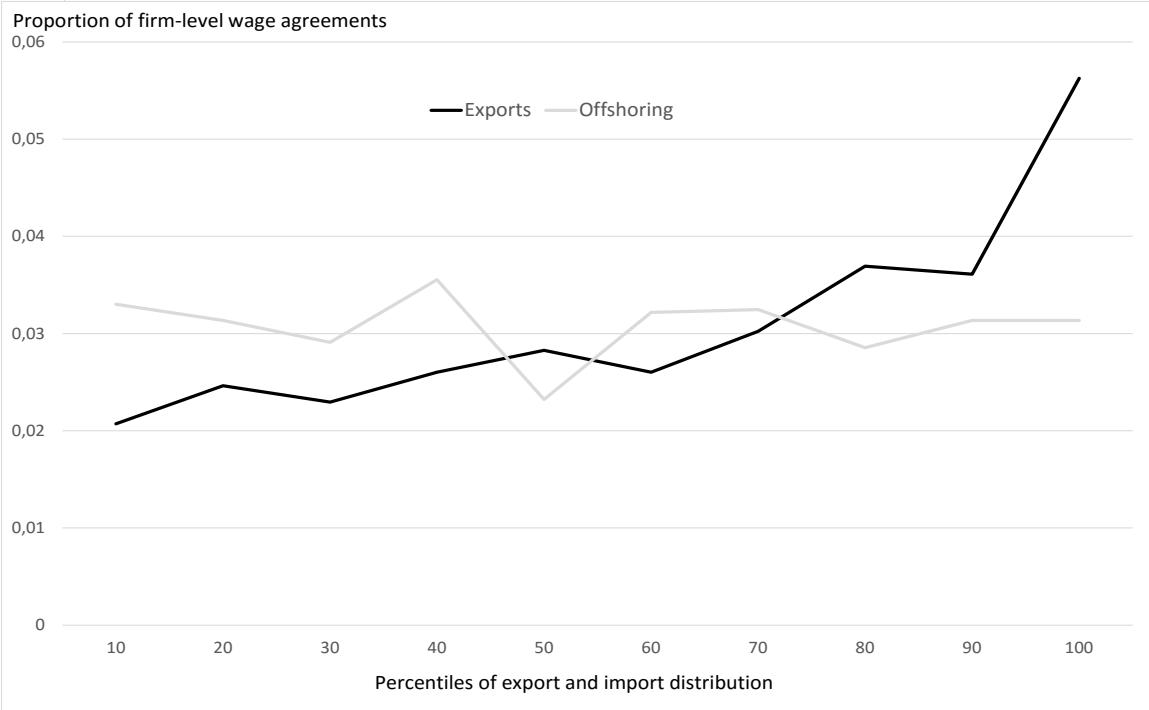
TABLE A: Instrumental regression

Dependent variable	Exports		Offshoring	
World demand (exports)	0.353***	0.232***	0.119***	0.019
	(0.032)	(0.030)	(0.041)	(0.039)
World supply (imports)	0.097***	0.046**	0.560***	0.487***
	(0.026)	(0.023)	(0.042)	(0.040)
TFP		0.446***		0.220***
		(0.017)		(0.026)
Firm size		0.979***		0.541***
		(0.027)		(0.039)
Capital/labor ratio		0.227***		0.121***
		(0.018)		(0.026)
Share of high-skilled workers		0.141**		0.288***
		(0.056)		(0.077)
Sales		-0.071***		0.278***
		(0.017)		(0.026)
Intercept	9.172***	4.962***	4.138***	-0.151
	(0.419)	(0.399)	(0.867)	(0.839)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	71,104	69,626	71,104	69,626
Number of firms	10,887	10,800	10,887	10,800
Average obs. per firm	6.5	6.4	6.5	6.4
Within R-squared	0.086	0.201	0.117	0.156
Between R-squared	0.042	0.456	0.033	0.182
Overall R-squared	0.039	0.471	0.033	0.183

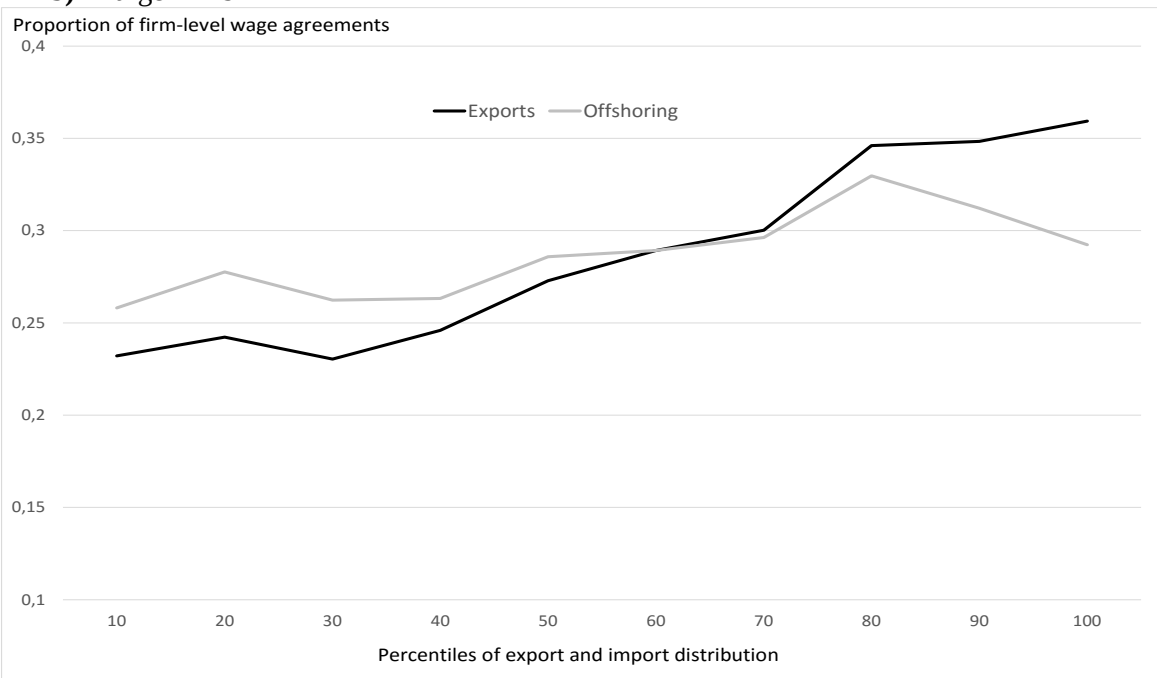
Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors are clustered at the firm level and reported in brackets. Year dummies and firm fixed-effects are included in all specifications. 'Exports' is the log of the value of exports. 'Offshoring' is the log of the value of imports of goods belonging to the same industry as that of the importing firm. Firm-level controls (size, TFP, capital/labor and domestic sales) are in logs. Product shares entering world demand and world supply are calculated at their overall sample (1996-2009) firm value.

Figure A: Frequency of firm-level wage agreements (in %) by export and offshoring intensity (deciles) and by firm size

a) Small firms



b) Large firms



Notes: This figure plots the frequency of firm-level wage agreements as a function of the trade intensity of firms. The frequency of wage agreements is computed as the ratio between the number of firms covered by a firm-level wage agreement divided by the total number of firms. Export intensity is calculated as the ratio between the value of exports and the value of total sales (at the firm level). We then compute deciles of the sample distribution of export intensity. We compute the frequency of wage agreement at each decile of the export intensity distribution. Same calculations are made for offshoring intensities.

Table B: Marginal effects of a Probit model for signing a firm-level wage agreement (by firm size)

Dependent variable	Signing of a firm level wage agreement			
	Less than 40 workers	40-75 workers	76-180 workers	More than 180 workers
Ln(exports)	0.001*	0.002**	0.007*	0.017***
	(0.001)	(0.001)	(0.004)	(0.006)
Ln(offshoring)	0.000	0.001	0.003	0.003
	(0.000)	(0.001)	(0.003)	(0.005)
Ln(TFP)	-0.000	0.006*	0.012	0.054***
	(0.002)	(0.003)	(0.010)	(0.016)
Ln(firm size)	0.005	0.025***	0.070***	0.074***
	(0.004)	(0.007)	(0.015)	(0.024)
Capital/labor ratio	0.003	0.005	0.033***	0.068***
	(0.002)	(0.003)	(0.011)	(0.009)
Share of high-skilled workers	0.009*	0.015	0.024	-0.023
	(0.005)	(0.012)	(0.036)	(0.064)
Sales	-0.001	-0.002	0.003	0.006
	(0.002)	(0.002)	(0.007)	(0.010)
IV	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	13,354	15,612	17,076	17,522
Number of firms	3,439	3,750	3,426	2,695
Average obs. per firm	3.9	4.2	5.0	6.5
Log-likelihood	-959.3	-2,538.5	-6,179.6	-10,076.4

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are reported in brackets. Period: 1996-2009. Year dummies, industry dummies and firm-specific random effects are included in all specifications. The sample consists of firms that both export and import at least half of the observation period. Firms with less than 20 employees are excluded.

Table C: Marginal effects of a Probit model for signing a firm-level wage agreement – robustness checks

Dependent variable	Signing of a firm level wage agreement			
Subsample:	1996-2002	2003-2009	*At least one agreement*	*Surviving firms*
Ln(exports)	0.008***	0.007***	0.005	0.005
	(0.002)	(0.002)	(0.004)	(0.003)
Ln(offshoring)	0.001	0.000	-0.004	0.001
	(0.001)	(0.002)	(0.003)	(0.002)
Ln(TFP)	0.003	0.019***	0.060***	0.015***
	(0.006)	(0.006)	(0.012)	(0.006)
Ln(firm size)	0.038***	0.040***	0.164***	0.059***
	(0.009)	(0.010)	(0.017)	(0.009)
Capital/labor ratio	0.021***	0.030***	0.103***	0.020***
	(0.007)	(0.008)	(0.014)	(0.007)
Share of high-skilled workers	0.006	0.011	0.073	0.041*
	(0.020)	(0.027)	(0.046)	(0.020)
Sales	0.000	0.008*	0.004	-0.001
	(0.004)	(0.005)	(0.008)	(0.004)
IV	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	36,321	32,831	28,325	36,519
Number of firms	8,841	7,505	3,320	3,006
Average obs. per firm	4.1	4.4	8.5	12.1
Log-likelihood	-10,539.0	-9,858.8	-16,758.1	-11,781.1

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors are reported in brackets. Period: 1996-2009. Year dummies, industry dummies and firm-specific random effects are included in all specifications. The sample consists of firms that both export and import at least half of the observation period. Firms with less than 20 employees are excluded. The "At least one agreement" subsample includes only firms that sign at least one wage agreement during the sample period. The "Surviving firms" subsample includes firms that are present in the sample for at least 10 years.