Firm Labor organization and export performance *

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PRELIMINARY VERSION

Abstract

Using a matched employer-employee dataset over the period 2009-2012, this paper explores the link between French manufacturing firms' internal labor organization – the structure of their hierarchical layers of management – and their export performance. It first illustrates the role of hierarchical layers in explaining the export wage premium as well as the decision to expand trade through larger markets, new products or new destinations. Focusing, in a second step, on exporters, we test whether firms' layer structure is associated with their degree of diversification in terms of destinations and products.

JEL classification: F16, E24, C14, D22.
Keywords: Occupations, hierarchical layer, Employer-employee data, Trade.

1 Introduction

Relative to non-exporters, exporters have been shown to be larger, more productive, and to pay higher wages (e.g Bernard and Jensen, 1999; Verhoogen, 2008; Amiti and Davis, 2012; Irarrazabal et al., 2013). If the literature has mostly focused on the export premium (that is the wedge between exporters and non exporters) in terms of productivity (see Wagner, 2007, for a review of the empirical evidence), the export premium in terms of wage is also documented for a variety of cases (see e.g. Breau and Rigby, 2006 on Los Angeles, Mayer and Ottaviano, 2008; Guillou and Treibich, 2015 on France, Amiti and

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Davis, 2012 on Indonesia, and Irarrazabal et al., 2013 on Norway). All these studies show that on average, exporters' employees receive higher wages than employees working in their non-exporters counterparts.

The New New Trade Theory (Melitz, 2003; Melitz and Ottaviano, 2008), explains exporters' higher productivity by emphasizing the existence of fixed and variable costs for entering and serving foreign markets. Melitz (2003)'s seminal paper initiated a theoretical literature where a firm productivity level drives its export status, building on the idea that trade is costly and only the most productive and competitive firms can incur such cost. More recent models provide additional reasons why productivity matters for trade. The theoretical literature has investigated the hypotheses that this premium arises because of increasing returns to skills in companies with greater access to foreign markets, hence exporting firms have a greater incentive to adopt more advanced technologies of production (Yeaple, 2005; Helpman et al., 2010; Amiti and Davis, 2012) or to produce higher quality products (Verhoogen, 2008). Caliendo and Rossi-Hansberg (2012) focused on the change of internal labor organization required to raise productivity in order to sustain the trade cost. In their model, firms that start exporting will increase the number of layers of management. We borrow from this theoretical framework to build our empirical research.

Empirical evidence suggests that in addition to being more productive, exporting firms pay relatively higher wages than non exporters. Such wage premium of exporting does not vanish once observable and unobservable workers' and workplaces' characteristics are controlled for (e.g., Schank et al., 2007). Empirical studies have confirmed that the extension of trade, as a consequence of trade liberalization for instance, increases wage inequality within industries (Verhoogen, 2008; Helpman et al., 2010; Baumgarten, 2013).[1] The relation between trade and firms' skill structure has been further studied in different contexts (Bernard and Jensen, 1997; Biscourp and Kramarz, 2007; Serti et al., 2010; Iodice and Tomasi, 2015). These studies have pointed to the fact that, because exporters demand more skilled workers, this induces a rise in their wage bill, explaining the wage premium. Moreover, though trade and offshoring shocks both have a positive effect on wages, only offshoring has heterogenous effects across occupational categories (Carluccio et al., 2015; Hummels et al., 2014). The availability of detailed information on firms' *distribution* of wages and skills in matched employer-employee datasets has recently opened the way to a more precise evaluation of the link between export status, wages and skills. Frias et al. (2012) used Mexican plant-level employer-employee data to evaluate the impact of an exchange-rate devaluation on within-plant wage distributions. They show that the effect of export participation on wages is non-linear, as it does not affect low wages but positively impacts wages above the 10th percentile.

[1] Technological upgrading following trade liberalization has also been documented by Bustos (2011) in the case of Argentina.

Few studies have looked into the role of firm labor organization in firm export decisions and performance. Following Caliendo and Rossi-Hansberg (2012)'s model, Caliendo et al. (2012) and Caliendo et al. (2015) provide evidence about the change in Production hierarchies – or number of layers of management – when firms decide to expand.

Following Caliendo et al. (2012), we want to investigate the relation between the change in internal labor organization and the increase in export performance, whether this means entry into foreign markets, an increase in export intensity or a rise in trade diversisification in terms of products or destinations. By doing so, we explain the demand in managerial skills due to an increase in export performance. Additionnally, we provide new evidence on the export wage premium and the trade-wage inequality nexus.

In this article, we use a combination of datasets on French firms' balance sheet variables, export behavior (sales, products and destinations) and employee information (wages and occupations at the individual level) along with information coming from the Customs administration regarding the products and destinations served by a firm. Firms' occupational structure is measured by their number of "hierarchical layers". Firms expand by increasing their number of layers when they enter foreign markets. Such reorganization is a precise way to understand the usually fuzzy defined "fixed cost of exporting". The link between the fixed cost of exporting and internal labor organization is confirmed by associating heterogeneity in fixed costs of exporting (e.g. number of destinations and products, degree of "toughness" of destinations) and heterogeneity in the hierarchical structure of exporters. The additional costs associated with increasing the number of destinations or products in a firm's portfolio can also be understood as a *cost of diversification.*

Our preliminary descriptive work is driven by two questions: i) Is the labor organization of exporters different from that of non-exporters?; ii) Is exporters' trade-diversification linked to their labor organization?

Our results show that exporters have more complex organization of labor than non-exporters, as evident from a higher number of layers. We also observe that the number of layers of management is correlated with export performance (i.e. export intensity, number of products and number of destinations) and that firms' number of layers explains the export wage premium. Moreover, firms that augment their number of products of their number of destinations have a higher probability of augmenting their number of layers. All results suggest that labor reorganization is a pre-requisite to raise productivity and sustain higher trade costs.

2 Data

2.1 Datasets

Three main sources of data are required. The first one, the 'Déclaration Annuelle de Données Sociales' (DADS), gathers compulsory information provided by firms each year to the social administration about their employees. Each observation corresponds to a combination of a worker and an establishment, both with a unique identifier. The variables of interest are the workers' gross wage, number of hours worked, type of contract (mainly used for data cleaning purposes) and occupational category (PCS, 'Professions et catégories socioprofessionnelles', 2003) at the 4-digit level. The second dataset gathers accounting and performance variables per firm (FARE). Both DADS and FARE are provided by the French National Institute of Statistics (INSEE) and cover the universality of French firms, with the exception of firms with no employees, or belonging to the agricultural or banking and financing sectors. The third dataset is provided by the French customs services (Custom-DGDDI) and records all flows of imports and exports by product, destination and firm. Such "customs dataset" reports, at the product-firm level, the quantity (in Kg), the country of destination, the product category (CN8), and the value of the export flow. This dataset allows us to trace more precisely firms' performance in foreign markets (i.e., their portfolio of exported products, their prices proxied by their unit-values, patterns of entry and exit to/from foreign markets, and variations in exported value over time).

All three datasets can be matched by using the firm identifier (SIREN) into a longitudinal dataset covering the period 2009-2012. Note that we restrict our analysis to the manufacturing sectors (NACE rev.2 sectors 10-33) to provide results comparable with the existing literature.[2] Finally we end up with two samples of firm-level data: the larger sample includes all manufacturing firms present in FARE and DADS (sample 1); when we focus on exporters only we use a smaller subset of these firms which are also present in the Customs dataset (sample 2). Table 1 gives the description of the population in these two samples.

[2] In a second stage, we will check whether our results stand when we enlarge sectors to tradable sectors defined as the sectors which are registered by the customs administration. The tradable sector is identified through a data-driven approach (instead of an assumption-based approach as in Moretti, 2010). Indeed, we keep the sectors which represent a significant number of observations in the CUSTOMS dataset (i.e. more than 100 firm-year observations). As a consequence, the tradable sector is composed of Manufacturing (sector C in the NACE classification), Trade, Information and communication (J) and M (specialised and scientific services, e.g R&D, accounting). Note that contrary to the assumption-based approach, we keep some service sectors.

Table 1: Observations description across samples, after cleaning, manufacturing sector.

Year	DADS & FARE (sample 1)			sample 1 & Customs (sample 2)
	All	Non-exporters	Exporters	Exporters
2009	122,094	84,866	37,228	24,211
2010	117,594	81,447	36,147	23,877
2011	114,485	80,624	33,861	22,301
2012	107,115	74,328	32,787	21,874
Total nb. obs.	461,288	321,265	140,023	92,263
Total nb. firms	151,876	117,802	54,599	33,462

2.2 Construction of variables

Each employee in the DADS database is assigned a "hierarchical layer" based on the first digit of his occupational category. Coherently with the definition of Caliendo et al. (2015), the first layer corresponds to clerks and production workers (blue collar workers); layer 2 corresponds to intermediate professions and technicians (supervisors); layer 3 corresponds to white collars (executives or senior staff) and layer 4 is the top management (CEO, directors). We drop firms which do not have the first layer of occupations (which amount to 9% of observations), as we expect that manufacturing firms should have clerks or production workers. Starting from the DADS employee database, we then construct firm-level variables by aggregating the information over each firm-SIREN. We then merge such variables with the FARE and Customs dataset at the firm level.

We have two sources of information regarding exporters, with different sample size and variables. The FARE dataset registers the total value of exports for all firms, with no legal obligation. Instead firms are legally bound to provide the customs institution information about their trade flows (products or destination) above a specified threshold.[3] For this reason, we define as exporters those firms declaring export sales to the custom administration, or firms declaring in the FARE dataset export sales below the binding declaration threshold.[4] In others words, the export status is taken from the Customs dataset if firms declare export revenue above the threshold, else it is associated with the information from the FARE dataset.

[3]Indeed, export sales within the European Union need to be declared only if the yearly firm export sales are above €460,000 for years 2011 and 2012, and €150,000 before 2011.

[4]Note that we also find exporters in FARE that we do not retrieve in the Customs data irrespective of the threshold.

3 Preliminary Statistics on hierarchical layers and firm diversification

Starting from the model of Caliendo and Rossi-Hansberg (2012), Caliendo et al.(2015) brought a large amount of empirical evidence on production hierarchies. Focusing on the case of French manufacturing firms over the period 2002-2007, they find support to the theoretical model by Caliendo and Rossi-Hansberg (2012): firms' important growth events are associated with an increase in their number of hierarchical layers. Following a pyramidal firm structure, growth in number of employees in the existing layers requires to strengthen the hierarchy at the firm level, e.g. by assigning new managerial positions.

Although our data are coming from the same source, we cover a more recent period. After checking that the results by Caliendo et al.(2015) are also validated in our data, we bring additional evidence regarding the organizational structure of *exporting firms*. In particular we test whether the change in trade costs associated with exporters' diversification in terms of products and destinations requires a change in the organization of their labor force.

3.1 Descriptive statistics conditional on layers

We describe below how the firms in our sample are distributed according to the structure of their hierarchical layers, by aggregating over firms' employee characteristics. The presence of a layer within a firm is defined by at least one employee with the corresponding occupation level. We observe heterogeneity across firms along two dimensions: their total number of layers (as described in Table 2) and the structure of such layers (as described in Table 3). About the former, we observe that if most firms have only a layer of "blue collars" (1-layer),[5] 7.4% have a complete set of hierarchical layers (4-layers) in our sample. Table 2 also shows that the distribution of number of layers differs for exporting firms, as more of them have 3 or 4 layers. Thus the hierarchical structure of exporting firms seems to be more complex than that of non-exporting firms.

Table 2: Observations by number of layers, 2012, Manufacturing firms

Total nb.	All firms		Exporters	
of layers	# Obs	%	# Obs	%
1-layer	53,941	50.36	5,781	17.63
2-layers	24,214	22.61	7,489	22.84
3-layers	21,042	19.64	13,301	40.57
4-layers	7,918	7.39	6,216	18.96
Total	107,115	100	32,787	100

[5]Note that in our cleaned sample all firms have at least one layer, i.e. the lowest one.

Table 3 informs us, conditional on firms' number of layers, how these are structured. Following a pyramidal model, we expect employees in 1-layered firms to fall in the lowest occupational category. Moreover, additional layers would be added in a sequential manner. Although the pyramidal structure is dominant in our sample (for example it corresponds to 57.66% of 2-layered firms and 79% of 3-layered ones), other patterns are also quite frequent. In particular, the top-layer is often not directly added over the lowest layer. This could indeed depend on the type of skills the top-management needs. The only outlier to the pyramidal structure is the last case displayed in Table 3 (layers 1;3;4). It is only found in 6.5% of the cases.

Table 3: Structure of layers, 2012, manufacturing firms (consecutive layers in bold).

Total nb. of layers	layer 1	layer 2	layer 3	layer 4	Share of cases
2 layers	X	X			**57.66%**
	X		X		21.75%
	X			X	20.59%
3 layers	X	X	X		**78.98%**
	X	X		X	14.47%
	X		X	X	6.55%

Next we describe in Table 4 how employees are distributed across the four layers, for the year 2012. It also shows that their wage relates to their hierarchical position and the export status of their employer.

We observe a pyramidal distribution of number of workers, with almost 10 times as many individuals partaining to layer 1 as they do in layer 4. Instead the hourly wage displays the opposite pattern. Thus upper layers consist of a smaller number of employees paid higher hourly wages. Note also that the wage variance is much more important in upper layers of the hierarchy. Besides differences at the mean, such ordering of wages according to layers is found at all locations of the wage distribution.

By cutting our sample of individuals across exporting and non-exporting firms, we find that irrespective of the layer, employees in exporting firms are paid higher wages. This is first evidence of the wage export premium which will be further investigated in section 3.3.

Figure 1 shows the kernel density distribution of hourly wages per layer. It provides a straightforward image of two facts. First, the higher the layer, the higher the wages. Second, the higher the layer, the more dispersed the distribution of wages in the layer is. Note that the distribution of wages in layer 4 is bimodal. Further tests show that this is explained by firm size: the first mode is associated to the wages of very small firms' owners (i.e. below 10 employees); the second mode to top-management in larger firms.

Table 4: Number of employees and average hourly wage in each layer, 2012, Manufacturing firms

	Layer 1 Blue Collar-clerks	Layer 2 Supervisors	Layer 3 Senior Staff	Layer 4 CEO-directors
Mean	14.6	11.5	35.5	48.8
–exp.	15.5	21.5	35.9	58.7
–non exp	12.1	17.5	29.3	33.6
Stand. dev.	8.32	69.3	47.1	95.6
p5	8.6	11.5	18.6	9.7
p25	11.4	16.2	26.6	27.7
p50	13.6	19.6	31.5	40.3
p75	16.6	24.2	38.6	56.1
p99	33.3	45.9	64.5	181.7
Obs. All	2,024,669	637,177	498,195	24,028
Obs. Exporters	1,457,184	558,618	466,672	14,487

Notes: Sample 1 with all employees. Wage figures are given in 2012 euros.

Figure 1: Wage distribution per layer, 2012

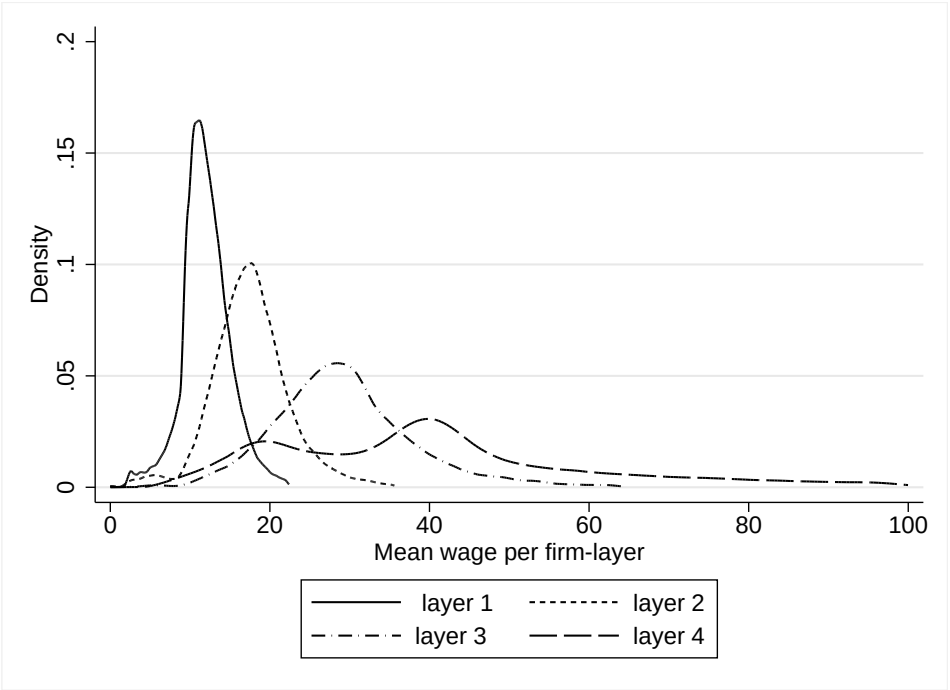


Figure 2: Share of employees in each layer conditional on export status, 2012

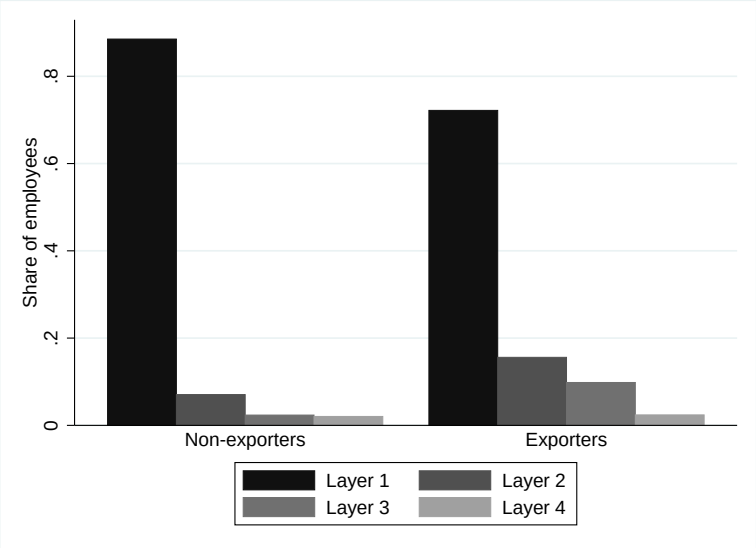


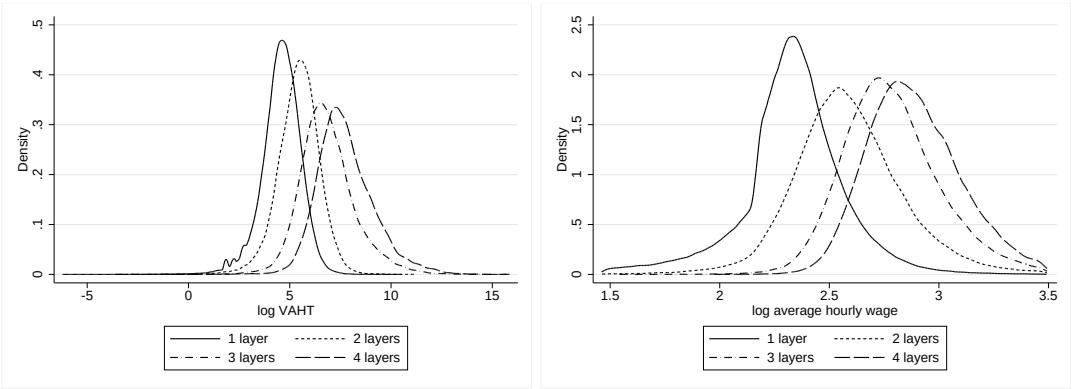
Figure 2 provides additional evidence that firms'export status is associated with a diverging hierarchical structure, as suggested by Tables 2 and 4. Indeed, our preliminary evidence could well be explained by the size premium of exporting: exporting firms are larger and therefore, automatically, have a higher number of layers. Instead, we find that the share of number of employees per layer is more concentrated in the case of non-exporting firms. Exporting firms have a lower number of production workers and clerks and instead a higher share of middle-management. Thus the supervision rate (that is, the staff-to-worker ratio) is higher in exporting firms.

Table 5 displays firm characteristics conditional on their number of layers. Not surprisingly, firms with a higher number of layers are larger (in terms of number of employees and value added). They also have a higher probability to export, and conditional on exporting, to have a higher export intensity. Relatedly, and given the known size-wage and export wage premia, we also find a positive correlation between the number of layers and mean hourly wage. Figure 3 complements such information by providing the distribution of value added and hourly wage by firm number of layers. Our descriptive results are thus in line with those of Caliendo et al. (2015).

Table 5: Mean characteristics of firms by number of layers, 2009-2012, manufacturing firms.

Total nb. of layers	Nb. employees	Value added	Exp. propensity	Exp. intensity	Hourly wage
1-layer	5.43	144.96	0.11	0.15	10.49
2-layers	11.00	360.12	0.29	0.15	13.85
3-layers	66.35	3679.17	0.60	0.21	16.82
4-layers	147.46	9653.89	0.76	0.26	18.64

Figure 3: Distribution of value added (left) and mean hourly wage (right) per number of layers, 2012, manufacturing firms.



3.2 Number of products, destinations and layers

In a next step, we measure more precisely the diversification intensity of exporters, with the aim of linking the cost of diversification to firms' labor organization. By using export data coming from the French customs (referring to our sample 2), we compute the total number of products (defined at the 8-digit level) a firm exports and the total number of destinations it ships to. The number of products per firm ranges from 1 to 1679, with 50% of exporters shipping less than 3 products and 95% less than 32. The number of destination per firm ranges from 1 to 166, with 50% of exporters shipping to less than 3 destinations and 95% less than 26 destinations. We also group the destinations by geographical area.[6] The number of areas per firm ranges from 1 to 8, with 50% of exporters shipping to less than 2 areas and 95% less than 6 areas.

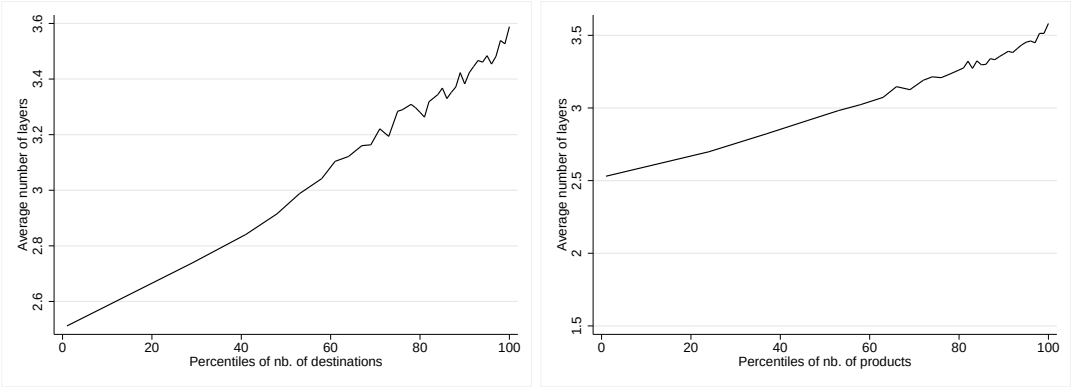
To complement the information about the number of destinations and products, we compute a Herfindahl-Hirschmann Index (HHI) at the level of the firm to appreciate the reality of the product or destination diversity in terms of exported value. For instance, a firm that exports toward two destinations such as it splits its export value in two equal shares is more destination-diversified than a firm which exports 98% of its sales in a destination A and 2% in destination B. Identically, a firm that exports two different products in equal shares is more product-diversified than a firm which export 98% of its total export in the first product and only 2% of its export in the second product. The higher the HHI, the lower the diversification (either in terms of product or destination). By construction, the HHI ranges between 0 and 1. We then cross the information on product and destination numbers with the information on the number of layers. We expect that a larger number of products or of destinations is positively correlated with a demand in complex management. It follows that we should find a positive correlation between the number of layers and the number of products/destinations. In other words, a more diversified exporting firm should have a higher number of layers.

After ranking firms per percentile of number of products and destinations, we compute the average number of layers in each group of firms. Figure 4 plots the average number of layers per percentile of number of destinations (left) and number of products (right). It illustrates the clear positive relationship among exporters between the number of layers and the degree of diversification.

Table 6 confirms that a firm with a more complex organization exports more products and ships to more different destinations. As expected, all indicators of diversification are positively correlated with the number of layers. Moreover, the HHI in terms of products or destinations both decrease with the number of layers (recalling that a high HHI value is a signal of weak diversification). This evidence confirms our intuition that a more

[6]Geographical areas are: Europe, Africa, Asia, North-America, Central and South America, Middle-East, Oceania and Others.

Figure 4: Average number of layers per percentile of destinations and of products



diversified firm – which really splits its production and shipment over several products and destinations in equal weights – needs a higher number of layers.

Table 6: Average firms export diversification indicators by number of layers

	Mean Value of:				
# Layers	# Prod.	# Dest.	# Area.	HHI prod.	HHI dest.
1-layer	3.08	2.66	1.55	0.76	0.81
2-layers	4.37	3.94	1.81	0.72	0.74
3-layers	11.63	10.99	2.81	0.63	0.56
4-layers	17.97	16.13	3.43	0.59	0.47

Notes: Manufacturing firms, sample 2, 2009-2012.

Table 7 shows that the average number of layers increases with the quartiles. By looking more precisely at what drives such differences, we compute the share of firms with a layer $i = 2, ..., 4$ in each quartile. We find that the difference is mostly explained by an increase in the second and third layers.

Using the same groupings of firms per quartile of products and destinations, Figure 5 represents the share of employees in each layer within each firm. Both in terms of destination (Fig. 5, left) or products (Fig. 5, right), the share of employees in layer 1 decreases with the quartile, while the shares in layers 2 and 3 increase with the quartiles. Interestingly, the share of employees in layer 4 decreases with the quartile going from 2.6% in quartile 1 for products and 2.7% for destinations to 1.2% and 1.9% respectively in quartile 4. This result suggests that the diversification process impliesa more pyramidal structure. The share of employees in each layer is more unequal when firms have more products and more destinations.

Table 7: Quartiles of number of products and hierarchical structure

		Share of:		
	# layers	layer 2	layer 3	layer 4
Q1 # products	2.59	0.70	0.59	0.30
Q2 # products	2.86	0.80	0.71	0.35
Q3 # products	3.08	0.88	0.82	0.38
Q4 # products	3.36	0.95	0.93	0.47
Q1 # destinations	2.51	0.68	0.55	0.28
Q2 # destinations	2.81	0.78	0.69	0.34
Q3 # destinations	3.11	0.89	0.84	0.39
Q4 # destinations	3.39	0.96	0.95	0.48

Notes: Manufacturing firms, sample 2, 2009-2012.

Figure 5: Share of employees in each layer per quartile of destinations and per quartile of products

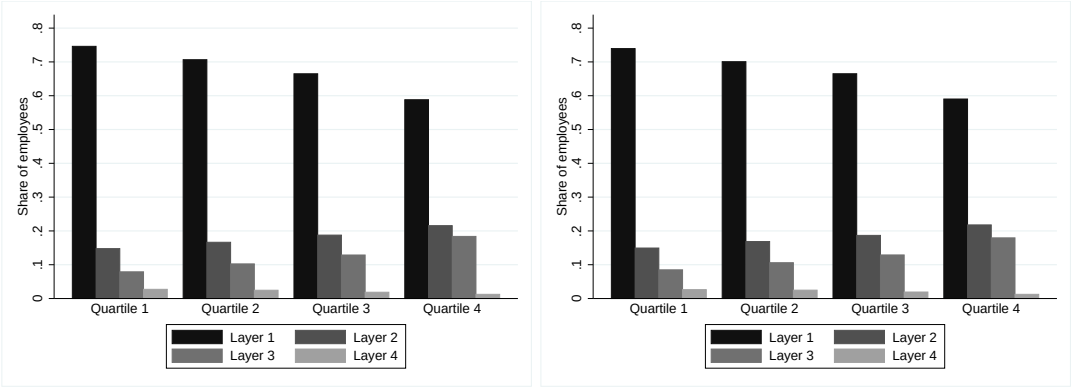
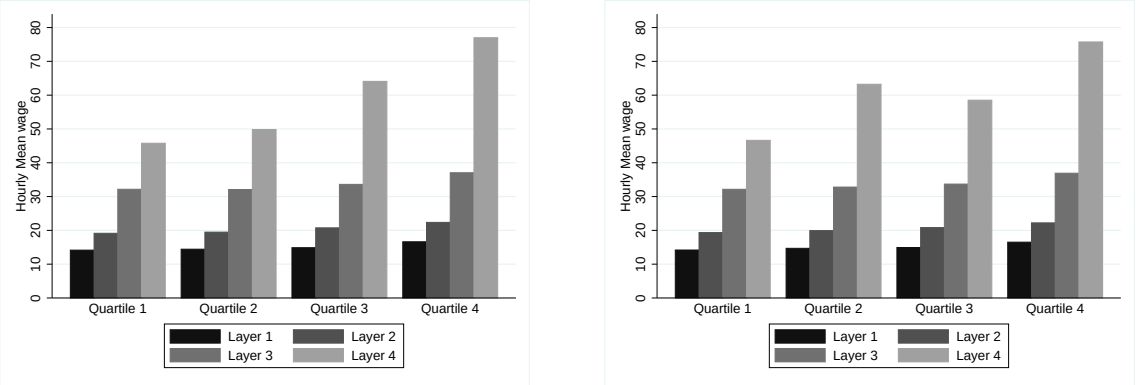


Figure 6: Average hourly wage in each layer per quartile of destination (left) and per quartile of products (right)



Notes: Manufacturing firms, 2012, All wages of exporting firms.

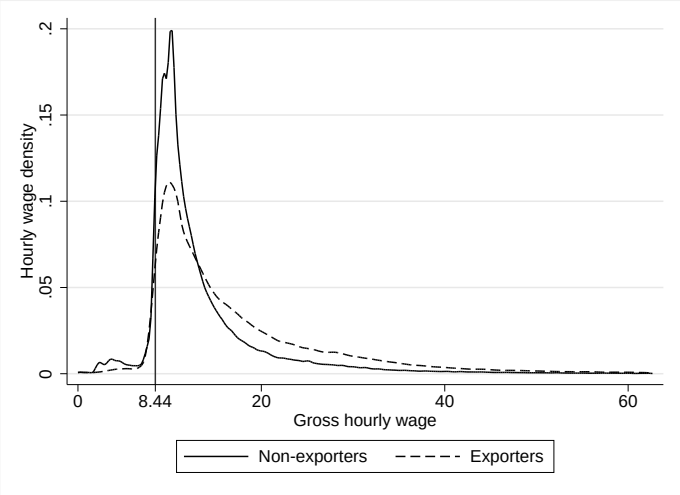
Besides differences in the employment structure shown above, we evaluate differences in wages per layer. We can expect that a more diversified firm will raise its average wage as shown by the literature on wage and productivity export premium . But will the firm do so at all levels of the hierarchical structure, or, as implied by the theoretical framework of Caliendo and Rossi-Hansberg (2012), do we observe differences in wages per layer? Figure 6 reveals that a higher diversification in terms of products and destinations is associated with a higher hourly wage, but only in the case of the highest layer (i.e. layer 4). In other layers, the hourly wage rise with the quartile is less sharp. Note also that it is even less clear for product quartiles than it appears for destinations.

3.3 Wage premium and layers

In Figure 7, we compare the distribution of gross hourly wages in exporting and non-exporting firms. A vertical line indicates the regulated minimum hourly gross wage at 9.31€. We observe that both the distribution mode and the variance are very different between exporters and non exporters. More wages are located close to the minum wage in the non exporters group of employees. By testing for the equality of wage distributions in the two groups using the Kolmogorov-Smirnov (KS) and Wilcoxon-Mann-Whitney (WMW) tests, we find that wages for non-exporting firms are significantly lower than for exporting ones, with a p-value of 0. This result remains strongly significant at the 2-digit sector level, as well as within quartiles of the firm-size distribution. We can therefore conclude that the distribution of wages of exporting firms dominates that of non-exporting ones in our sample.

In a second step, we want to test for the existence of a firm-level wage premium at different percentiles of *firms'* wage distributions. According to the hypothesis that there

Figure 7: Wage distribution conditional on export status



are increasing returns to skills in exporting firms, we expect the wage premium to be larger at higher percentiles of the wage distribution.

Table 8 presents the results of t-tests of equality of means and Wilcoxon-Mann-Whitney tests for equality of distributions at firms' 10th, 25th, 50th, 75th and 90th percentiles of their wage distribution. If the difference is strongly significant in all cases, note that the gap in the mean value of the percentile across the two groups of firms (i.e. the size of the wage premium) increases with the percentile. At the 10th percentile, the wage premium represents 14.5% of the wage in non-exporting firms, and steadily increases to reach 59% at the 90th percentile.

Table 8: Wage premium at different percentiles of the wage distribution, 2012, all firms

Percentile in firm	Mean hourly wage		t test	WMW test	% wage
wage distribution	Non-exporters	Exporters	(p. val.)	(p. val.)	premium
10th	11.268	12.818	0.000	0.000	13.76
25th	12.073	14.252	0.000	0.000	18.05
Median	13.715	16.908	0.000	0.000	23.25
75th	15.958	21.119	0.000	0.000	32.34
90th	18.103	26.538	0.000	0.000	46.59

Table 9: Wage premium at different percentiles of the wage distribution, 2012, manufacturing firms

Percentile in firm	Mean hourly wage		t test	WMW test	% wage
wage distribution	Non-exporters	Exporters	(p. val.)	(p. val.)	premium
10th	9.517	11.561	0.000	0.000	21.47
25th	10.553	13.012	0.000	0.000	23.30
Median	12.292	15.264	0.000	0.000	24.18
75th	14.455	19.226	0.000	0.000	33.01
90th	16.756	25.393	0.000	0.000	51.55

A simple econometric exercise which allows us to control for 2-digit sectoral effects presented in Table **??** shows a positive and very significant coefficient of the export dummy variable *Exp*, which is found at all percentiles of wages, with or without controlling for the hourly labour productivity. Again, mirroring the simple test from Table 8, we find that the magnitude of the wage premium increases in the percentile of the wage distribution.

In column (4), we add the number of layers to the export dummy, the size and the labor productivity. In column (5), we switch the number of layers with the share of employees in layer 4. Information on the number of layers or on the share of employees in layer 4 do not capture all the export wage premium. Nevertheless, variables relative to layers explain a great share of a change in hourly wage whichever the decile of the wage distribution.

Table 10: Wage premium OLS regressions, 2009-2012, Manufacturing firms

Dep var: log hourly wage	(1)	(2)	(3)	(4)	(5)
10th percentile					
Exporter	0.144***	0.148***	0.161***	0.101***	0.135***
log Labour prod		0.142***		0.136***	0.150***
log Nb. employees			-0.014***	-0.047***	0.012***
Nb. of layers				0.127***	
Empl. in layer 4					0.544***
25th percentile					
Exporter	0.143***	0.145***	0.095***	0.053***	0.075***
log Labour prod		0.085***		0.102***	0.112***
log Nb. employees			0.055***	0.019***	0.059***
Nb. of layers				0.085***	
Empl. in layer 4					0.477***
50th percentile					
Exporter	0.132***	0.133***	0.066***	0.03***	0.049***
log Labour prod		0.049***		0.069***	0.082***
log Nb. employees			0.081***	0.032***	0.072***
Nb. of layers				0.079***	
Empl. in layer 4					0.787***
75th percentile					
Exporter	0.179***	0.178***	0.082***	0.032***	0.065***
log Labour prod		0.028***		0.054***	0.074***
log Nb. employees			0.149***	0.032***	0.098***
Nb. of layers				0.134***	
Empl. in layer 4					1.351***
90th percentile					
Exporter	0.284***	0.283***	0.106***	0.034***	0.088***
log Labour prod		-0.002***		0.045***	0.075***
log Nb. employees			0.141***	0.064***	0.167***
Nb. of layers				0.214***	
Empl. in layer 4					1.699***
Nb obs.	461,288	450,651	450,651	450,651	450,651

4 Explaining changes in the number of hierarchical layers

Going beyond cross-sectional differences as shown in the previous section, we are interested in evaluating whether we see change in the organization of the labour force when firms add destinations and products (thus, increasing their export diversification). To do so, we need to understand what drives the dynamics of firms' number of layers. We expect that part of the explanation lies in firms' decision to expand their export portfolio.

Table 11 (top panel) shows the yearly transition probability matrices for all exporting firms (for which we have information in the customs data, that is, our sample 2). More precisely, we compute, conditional on a firm's number of layers in year t, the probability that it has 1,2,3 or 4 layers in year $t+1$. As could be expected, most firms do not change their organizational structure over time, as evidenced by the numbers on the diagonal of this matrix. For example, 79.25% of 1-layer firms still have one layer in the following year. A second observation is that among firms that change their organizational structure, most of them do so one layer at a time (see the right cells adjacent to the diagonal).

We then compute same transition matrices for different subsamples of firms, so as to detect a particular pattern among firms increasing their number of destinations or products. The middle and bottom blocks of Table 11 report the difference in the cell values between those firms increasing their diversification, and those which don't. More precisely, our control group consists of firms which do not change their number of products or destinations. We find that our group of interest, the firms expanding their export portfolio, have a higher probability to add hierarchical layers, and a lower probability to remove them. Indeed, the difference with respect to the control group is positive in the case of the values on the upper triangle of the matrix, and negative in the lower triangle.

Table 11: Yearly transition probability matrices – 2009-2012, manufacturing firms, customs data.

All firms

	Nb of layers in t+1			
	1 layer	2 layers	3 layers	4 layers
Nb of layers in t				
1 layer	79.25	18.34	2.25	0.16
2 layers	10.05	70.93	17.96	1.07
3 layers	0.65	7.90	82.82	8.63
4 layers	0.29	1.15	18.87	79.69

Firms adding destinations - same nb of destinations

	Nb of layers in t+1			
	1 layer	2 layers	3 layers	4 layers
Nb of layers in t				
1 layer	-7.85	5.71	1.89	0.26
2 layers	-3.80	-0.72	4.10	0.42
3 layers	-0.57	-6.01	4.26	2.32
4 layers	-0.99	-2.65	-4.18	7.81

Firms adding products - same nb of products

	Nb of layers in t+1			
	1 layer	2 layers	3 layers	4 layers
Nb of layers in t				
1 layer	-7.20	5.18	1.81	0.21
2 layers	-1.92	-2.91	4.48	0.35
3 layers	-0.51	-5.87	2.99	3.39
4 layers	-0.14	-1.11	-6.57	7.82

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