Within-firm Inequality in Multi-product Firms*

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This Version: January 2017

Preliminary version. Please do not quote.

Abstract

I estimate the effect of trade liberalization on the within-firm wage inequality using French matched employer-employee data. I find that trade liberalization negatively impacts within-firm wage inequality : trade liberalization generates a fall in the number of products produced and exported by the firms. It follows, from technology variation across products, that changes in the product scope result in lower skill and wage dispersion within each firm.

Keywords: Inequality, Multi-product firms, Liberalization

JEL Codes: F14 F22 F16

*This paper has benefited from financial support from the DGEF and from the LEM-CNRS (UMR 9221). Access to the data is supported by a public grant overseen by the French National Research Agency (ANR) as part of the "Investissements d'Avenir" program (ANR - 10-EQPX-17 - CASD). I am grateful to the participants at the ETSG 2016 meeting for useful comments.

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1 Introduction

In this paper, I estimate the effect of trade liberalization on the within-firm wage inequality using French matched employer-employee data. I find that trade liberalization negatively impacts within-firm wage inequality : trade liberalization generates a fall in the number of products produced and exported by the firms. It follows, from technology variation across products, that changes in the product scope result in lower skill and wage dispersion within each firm.

The causes of inequalities, both at the aggregate and the micro levels, have received attention in the literature since a few years. This academic trend echoes a broader concern about inequalities for the civil society.

Within the trade literature, interest in trade liberalization consequences has also received renewed attention. Precisely, the consequences of trade liberalization, including its effects on inequalities, are not fully accounted for by existing literature. A vast but not-so-recent literature focused on the effects of trade liberalization on economic outcomes mainly at the aggregate level. The availability of micro data thus opens the avenue for evaluation of trade liberalization effects at the disaggregated level. Otherwise said, the access to those micro-level data allows to take firms heterogeneity seriously.

The need for the investigation of trade liberalization consequences is all the more pertinent that trade liberalization is growing and deepening as could be witnessed about the recent TAFTA discussions.

Estimating the effect of trade liberalization on within-firm wage inequality is not a trivial exercise for one main reason. Pertinent disaggregated data about both trade flows and wage inequality have only been recently made available to researchers.

The contributions of the present paper with respect to existing literature are the following. First, the documented decrease in within-firm wage inequality may constitute a new margin for gains for trade, in addition to the inter-firm selection generally emphasized in the literature. Second, I build upon Sampson (2014) that provides a theoretical framework rationalizing a trade-induced increase in skill demand and between-firm wage inequality due to positive assortative matching between skills and firm exporting performance. With respect to this article, I allow for multi-product firms, with technology variation across products to exist, and to this end, I follow Bernard et al. (2011) that investigate how multiproduct firms react to trade liberalization, taking the optimal range of products into account. This article documents the compositional product changes within firms following trade costs shocks. One result is that firms tend to drop their least successful product when trade cost decrease, inducing within-firm selection of products.

The empirical analysis is based upon French micro data from 1995 to 2009. The first dataset I use is the *Déclaration Annuelle des Données Sociales* (DADS) file. This matched administrative employer-employee dataset comes the mandatory reports by firms about their workforce each

year and is made available to researchers by the INSEE (Institut National de la Statistique et des Etudes Economiques). A single observation in this dataset consists in the worker-firm couple. For each firm-worker observation, I have information about the individual gender, age, birth region, occupation (via 2-digit CS), annual gross and net earnings, the number of workers hours and job status (full or part-time). I aggregate this data at the firm-level computing various within-firm wage dispersion measures. The second dataset I use contains trade flows data at the firm-year-country-product level from the French Customs Data. I merge this dataset with the aggregated DADS firm-level dataset using the firm identifier (firm *siren* number). This dataset allows me to identify the changes in the exported-product scope. For controls, I also use the *Bénéfices Réels Normaux* (BRN) dataset that provides balance-sheet information, such as financial indicators, at the firm-year level. Trade liberalization is measured using destination-year trade costs from Arvis et al. (2013) and I compute average trade costs at the sectoral level.

Preliminary results show that

- trade liberalization effectively generates a change in the product scope of the firms. This is consistent with Bernard et al. (2010, 2011).
- trade liberalization negatively affects the wage dispersion within a firm across time.
- When I introduce the change in the product scope in the exercise and interact it with trade liberalization, evidence is that product churning magnifies the inequality-dampening effect of trade liberalization.

The remainder of the paper is the following. The next section provides the main intuitions behind the results. I then present in section 5 the data I use and the empirical strategy. I then turn to the main results in section 6 before focusing on the aggregate implications of these results in section 7.

2 Main Mechanism

The baseline mechanism is the following. Firms export some products on each market. I assume that firms choose the optimal product set for each market independently. As in standard models, exporters face a fixed cost to incur in order to entry market j and ad valorem trade costs. Both these costs vary at the product-destination level.

When trade costs changes, following trade liberalization or some exogenous shocks at the product or destination level, firms are expected to change their exported products set. As a consequence, their workforce should also respond to changes in trade costs.

I suppose that when firms expand their exported product set, they start by selling their "core" product and then they start to sell other product that further away from their core competency. The higher the number of exported products, the farther away the last product lies in the product space with respect to the "best" product. When firms start expanding their production of different products, I assume that they employ different types of workers, in many

dimensions. The main question I ask is whether these changes in product set are associated to changes in workers' wage.

It follows, on the contrary, that if trade liberalization generates a drop in the number of exported products, then the tasks content of the exports of firms should change and so should the workforce diversity (in terms of skills). I expect that when the number of exported products goes down, then within-firm wage dispersion should go in the same direction.

3 Data

The empirical analysis is based upon French micro data from 1995 to 2009. The first dataset I use is the *Déclaration Annuelle des Données Sociales* (DADS) file. This matched administrative employer-employee dataset comes the mandatory reports by firms about their workforce each year and is made available to researchers by the INSEE (Institut National de la Statistique et des Etudes Economiques). A single observation in this dataset consists in the worker-firm couple. For each firm-worker observation, I have information about the individual gender, age, birth region, occupation (via 1 and 2-digit CS), annual gross and net earnings, the number of workers hours and job status (full or part-time). I aggregate this data at the firm-level computing various within-firm wage dispersion measures. XXX Add some info here XXX

The second dataset I use contains trade flows data at the firm-year-country-product level from the French Customs Data. I merge this dataset with the aggregated DADS firm-level dataset using the firm identifier (firm *siren* number). This dataset allows me to identify the changes in the exported-product scope. Products are defined at the CN8 (8-digit level) allowing me to investigate different magnitudes in the product scope. For instance, when any firms exported product 1xxxxxx1 and drops it to sell product 1xxxxxx2, I infer that the change in the product space is of different nature and magnitude than if she had dropped product 1xxxxxx1 to produce 6xxxxxx2. The first digit provides information about the general type of product the firms sells and produces. I can thus identify the magnitude of product set churning from changes in the exports of product defined at different levels of disaggregation (1-digit, 2-digit, etc).

For controls, I also use the *Bénéfices Réels Normaux* (BRN) dataset that provides balance-sheet information, such as financial indicators, at the firm-year level.

To measure trade costs shocks, I exploit the trade dataset and construct firm-year-specific exogenous trade shocks. Following Hummels et al. (2014), I measure trade shocks as fluctuations in world demand conditions and changes in transport costs for the products that a firm exports. World import demand WID_{cpt} is measured as the total imports of product p to country j in period t from the rest of the world. Products p are defined at the HS-6 digit level.

For the individual-firm level, the measure for world import demand for firm i's products at time t is then computed as the weighted average of import demand for product p at all export

destination countries j

$$FID_{it} = \sum_{p} \sum_{j} s_{ijp} WID_{cpt} \tag{1}$$

where the product-destination weights s_{ijp} denote the importance of selling product p to a given country c relative to total export activities of firm i.

For robustness checks, trade liberalization is also measured using destination-year trade costs from Arvis et al. (2013) and I compute average trade costs at the sectoral level.

4 Exporters, Products and Categories

Before turning to the consequences of the product churning on wages distribution, I document how firms behave with respect to the different products they export.

Products and Categories I first provide in Table 1 some descriptive statistics about the number of products, defined at the 6-digit level, and the number of 2-digit categories to which each product belongs to, in the export dataset. A striking feature is the median number of product is far lower than the average, suggesting that the distribution of products across firms is highly heterogeneous, emphasizing the role of some exporter superstars selling a lot of products. This is of particular importance since these export superstars that sell many product are also the ones that shape the aggregate outcomes, and in particular wage inequality.

Table 1: Descriptives Statistics: Products and Categories

Variable	Mean	St. Dev.	Q1	Med.	Q3
# Products (HS6)	18.81	109.92	1	3	10
# Categories (HS2)	2.58	3.62	1	1	3

In table 2, for each number of products exported (over all its destinations), I report the observed mean number of 2-digit categories in the second column. An increase in the number of products is associated to an increase in the number of categories, but the increase is far from being linear. The increase in the number of categories is growing at a slow rate along the number of products.

In column 3, I report the observed probability that all 6-digit products fall into different 2-digit categories, in the third column, in percentage. In particular, among all French firms that sell exactly two HS6 products, these two products are from two HS2 categories for one third of them.

to be completed.

Categories To go further than the cross-firm evidence in Table 2, I estimate the following equation:

$$\text{Categories}_{it} = \alpha \text{Product}_{it} + \lambda_i + \lambda_t + \varepsilon_{it} \tag{2}$$

Table 2: Products and Categories: cross-firm evidence

# Products	# Categories	# Products = # Categories
1	1	100
2	1.347	34.69
3	1.612	13.37
4	1.823	5.32
5	2.009	2.34
6	2.177	0.98
7	2.319	0.45
8	2.477	0.21
9	2.602	0.1

in which Categories_{it} denotes the number of 2-digit categories in the firm-year exported products, and Product_{it} denotes the number of 6-digit products firm-year exports. λ_i and λ_t are respectively firm- and year fixed effect to account for unobserved heterogeneity. Results are presented in table 3 in column 1.

I find that the estimated coefficient between the number of categories and of product is significantly different from 0, suggesting that an increase in the number of products is associated to an increase in the number of categories. New products belong to other categories than former categories.

Table 3: Products and Categories: reduced-form evidence

	(1)	(2)
	est1	est2
Product_{it}	0.425^a	
	(0.000)	
Product_{ijt}		0.501^a
		(0.000)
Observations	1704869	8708360
R^2	0.877	0.874

Standard errors in parentheses
^{c} p<0.1, ^{b} p<0.05, ^{a} p<0.01

In the same vein, I also estimate:

$$\text{Categories}_{ijt} = \alpha \text{Product}_{ijt} + \lambda_{ij} + \lambda_t + \varepsilon_{it} \tag{3}$$

in which the variables are now defined at the firm-year-destination level. Including the λ_{ij} (firm-country) fixed effects allows to use variation across time in the number of products. Results are presented in column (2) of table 3. The estimated coefficient is significantly positive, supporting that a change in the number of exported products across time for a given firm and destination is associated to a larger number of categories.

I infer from this correlation that products changes are associated to changes in the categories

Core products and other products

5 Estimation

I estimate the following baseline equation :

$$Ineq_{it} = \alpha FID_{it} + \beta C_{it} + \lambda_i + \gamma_t + \varepsilon_{it} \tag{4}$$

in which $Ineq_{it}$ is the within-firm i inequality measured as the standard deviation of gross wages and where FID_{it} is the world import demand faced by firm i. The parameter of interest is thus α. I include some firm-year controls C_{it} and a set of firm fixed effect (λ_i) and a set of year fixed effects (γ_t).

I then investigate the effect of product churning on the previous relationship. I thus estimate the following equation as an augmented version of the baseline estimation:

$$Ineq_{it} = \alpha FID_{it} + \beta C_{it} + \delta \text{Churning}_{it} + \mu(FID_{it} \times \text{Churning}_{it}) + \lambda_i + \gamma_t + \varepsilon_{it} \tag{5}$$

in which Churning_{it} measures the change in the product set at the firm level.

Expected relations Following the mechanisms I presented above, I expect that α to be negative. This would be consistent with the idea of a trade liberalization leading to lower within-firm inequalities.

I also expect

6 Results

Table 4 presents the estimated baseline results. I find that the foreign import demand is negatively related to the within-firm standard deviation of wages at the firm level. The higher are trade shocks, the lower are the inequalities within each firm. This result is robust to the inclusion of other firm-level control variables. In particular, I control for capital intensity and the total assets of the firms. Those variable are included as firm size proxies. I also control for the average wage at the firm-level. (refe XXX)

In column (2), I include the product churning (defined at the 6-digit level). Precisely, I consider product as defined at the 6-digit level and compute the number of new products as well as the number of dropped products. I thus define product churning as the sum of new and dropped products. In column (3) I focus on the interactive term between foreign import demand and this product churning. I estimate that the unconditional effect of product churning is positive on within-firm inequality. I interpret this as an additional firm size effet. However, the interactive term between import demand and product churning is estimated to be negative.

Table 4: Baseline estimation

Dependent variable	Standard deviation of gross wages				
	(1)	(2)	(3)	(4)	(5)
FID	-0.010^a	-0.011^a	-0.010^a	-0.011^a	-0.011
	0.000	0.009	0.009	0.009	0.059
Capital intensity	0.056^a	0.054^a	0.055^a	0.054^a	0.054^a
	0.000	0.004	0.004	0.004	0.004
Assets	-0.012^a	-0.116^a	-0.116^a	-0.115^a	-0.115^a
	0.000	0.007	0.007	0.007	0.007
Mean Wage	-0.234^a	-0.234^a	-0.234^a	-0.232^a	-0.232^a
	0.002	0.002	0.002	0.002	0.002
6-digit churning		0.090^a	0.103^a		
		0.009	0.009		
FID × 6-digit churning			-0.020^a		
			0.003		
3-digit churning				0.103^a	0.112^a
				0.023	0.023
FID × 3-digit churning					-0.060^a
					0.001
Observations	515924	515924	515924	515924	515924
Firm FE			Yes		
Year FE			Yes		

Note: This table presents the estimation results from the OLS estimation. Robust standard errors clustered by year are shown in parentheses. ^{a} and ^{b} respectively denote significance at the 1% and 5% levels.

I interpret this result as follows: foreign import demand has a negative effect on within-firm inequality all the more that the product churning is large. Product churning is estimated to magnify the negative impact of changes in trade conditions on inequality.

I reproduce the same type of estimations in column (4) and (5), now focusing on 3-digit product churning. I investigate the effect of changes in product set in which the products are defined with a 3-digit identifier. This naturally tends to reduce the number of new and dropped products at the firm-level since we look at more aggregate product data. The counterpart of this choice is that the now defined 3-digit product churning is supposed to incorporate larger changes in the firm production process. The probability to identify large changes in the product space is augmented with this measure.

I obtain qualitatively similar results with this level of disagregation. The estimated elasticities are however (significantly) larger when product are defined at the 3-digit level. The negative impact of foreign demand is amplified by the change in product set.

6.1 Robustness checks

XXXX Include robustness checks here XXX.

7 Aggregate implications

8 Conclusion

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