International Trade Elasticities at the Firm Level: French Evidence *

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Abstract

We estimate international price elasticities using French exporters data on the period 2001-2010. We focus on three elasticities: the elasticity of exports to the the firm specific unit export value in euro, to the product and destination specific tariff and to the destination specific real exhange rate. In standard trade and international macroeconomics models these three elasticities should be equal. We find that this is far from being the case. We use an original data set on firm level electricity costs to instrument for unit export values. We show that the elasticity of exports is highest for (instrumented) export unit values followed by tariffs and is lowest for the real exchange rate.

Key Words: Elasticity, International Trade and Macroeconomics, Export Price, Firm exports.

JEL Codes: F14, F18, Q56.

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1 Introduction

In international trade and macroeconomic models, the elasticity of substitution between Home and Foreign varieties, the Armington elasticity, is a crucial parameter. It is one of the fundamental primitives that shape the international transmission of shocks into prices and quantities. It is also a key component for analyzing the welfare impacts of trade liberalization (see Arkolakis, Costinot & Rodriguez-Clare (2012)). A tension between the micro and macro views on this elasticity exists: the evidence suggests that the elasticity of export volumes to changes in tariffs is quite large (typically above 3 or 4) whereas the aggregate elasticity to changes in exchange rates is small (typically around one or lower). This is what Ruhl (2008) has dubbed the international elasticity puzzle, arguing that permanent shocks (trade liberalization) would translate in adjustments at the intensive and the extensive margin, while transitory shocks would lead to adjustments at the intensive margin only.

The empirical literature has mainly focused and compared the elasticity based on two international relative cost shocks: tariffs and exchange rates. Although evident at the macroeconomic level, this puzzle is also observed at the firm level Fitzgerald & Haller (2014). For example, Berman, Martin & Mayer (2012) and Amiti, Itskhoki & Konings (2015) have analyzed exchange rate shocks using firm level data and emphasized the heterogenous response of firms as larger ones exhibit lower pass-through. This is to some extent another elasticity puzzle, since in a standard model with heterogenous firms such as Melitz (2003) or Chaney (2008), the firm level export volume elasticity to a price change (the intensive margin of trade) should be the same whether this price change comes from a marginal cost shock, a tariff change or an exchange rate shock. Additional ingredients are needed to account for such difference. Arkolakis, Eaton & Kortum (2012) introduce slow adjustment on the part of consumers in response to relative price changes. They propose a model where customers shift relative demand slowly in response to relative price changes. Their model can explain why short-run and long-run aggregate responses to the same variable differ. But it cannot explain why over the same time horizon, exports respond differently to real exchange rates and tariffs.

One clear advantage of using firm level data on is that the aggregate shock (exchange rate or tariffs) can be considered exogenous to an individual firm. These two papers found that the elasticity of a firm export volumes to an exchange rate movement was below unity and around 0.5 to 0.7. The impact of those shocks on export volumes typically depend on how exporters pass them into export prices, how importers pass them into consumer prices and how finally consumers react to change in final goods prices. It also depends on the extent of strategic complementarities between firms in price setting an issue analyzed by Amiti et al. (2015). On the tariff side, Bas, Mayer & Thoenig (2015) show that aggregate and firm-level elasticities to tariffs are shaped by exporter participation and thus vary across destinations. Berthou & Fontagné (2016) estimate a mean elasticity of the product-destination firm-level exports with respect to applied tariffs at about -2.5. Using product-level information on trade flows and tariffs, Head & Ries (2001), Romalis (2007) and Caliendo and Parro (2015) estimate average elasticities of -6.88, -8.5 and -4.45 respectively. Also using industry-level data, Costinot et al. (2012) find an elasticity of -6.53. Finally, Anderson and Van Wincoop (2004) survey the evidence on the elasticity of demand for imports at the sectoral level and conclude that this elasticity is likely to be in the range of 5 to 10.

Indeed, exchange rates and tariffs shocks are common to many firms in several countries. In the eurozone case they are common to all countries of the monetary union. This complicates the interpretation of the estimated elasticity of export volumes to exchange rates. If all French and eurozone exporters to Canada are affected similarly by a depreciation of the euro, this implies that the change in export volumes to Canada of a single firm will be a mix of the relative price decrease for the firm but also of its competitors in the eurozone who will tend to produce close substitutes. This is related but different from the strategic complementarity issue in price setting as analyzed by Amiti et al. (2015). This suggests that the estimated exchange rate elasticity may be smaller (in absolute value) than the structural elasticity of substitution between home and foreign goods. This does not mean that the estimation of the exchange rate elasticity is without interest. It is actually crucial in international macroeconomic policy debates. But it cannot be interpreted as the elasticity of substitution between home and foreign goods that typically appears in monopolistic competition and international macroeconomic models. One way to take this issue into account is to control for the price index of the importing country proxied either with the effective real exchange rate or a country-year fixed effect.However, this may not fully solve the problem as the information contained in the real effective exchange rate or the country-year fixed effect is at a very aggregate level. In this paper, we take a different and complementary route from the existing literature. While the shocks addressed in the literature are about changes in tariffs and exchange rates, not firm level shocks, we argue this approach is not properly tackling the problem at stake: how quantities react to prices for a given firm selling a variety of a given product in a given market. Our strategy of identification takes a different and in a sense simpler route: it aims at directly estimating the elasticity of firm level exports to a firm level export price change. We therefore identify the international elasticity based on an individual price shock and not only on an aggregate price shock. An advantage is that given that the shock is firm level and not aggregate the change in firm level price should have no impact on the price index of the importing country. [1]

However, a difficulty to estimate the export price elasticity is that export prices and export quantities are clearly endogenous at the firm level. This problem did not occur in the case for exchange rates and tariffs that could be considered exogenous to a single firm. To overcome this difficulty we need to use a firm level time varying instrumental variable for export prices. For this we use an original French dataset that provides information on a firm specific cost shock, namely firm level electricity prices[2]. We argue below that these

[1] To proceed, we could well rely on sales and prices data on the domestic market, but such data is not available. This is where trade data is preferable: we observe all the competitors in all destination markets. What we need is a firm-specific shock impacting her price and hardly driven by her exports.

[2] An alternative for marginal cost shocks would be to use exchange rate shocks for intermediate imported inputs such as Piveteauy

electricity cost shocks are related to factors exogenous to its export performance and are likely to affect its export performance only through the firm export price. The reason is that we can identify several shocks (regulation changes, year and length of beginning of contracts, national and local tax changes, location, changes in both market and regulated prices and weather) that affect firm level electricity prices and are unlikely to the firm level export performance. We match this dataset to a data set on French export volumes and values to estimate the firm level export price elasticity. Using within-firm estimators, we take benefit of the variance and the desynchronization of firm specific prices of electricity.

Our results confirm that, when estimated at the firm level, the tariff elasticity is higher than the exchange rate elasticity. This is the standard international elasticity puzzle. We go further by showing that the export price elasticity is much larger than both the tariff and the exchange rate elasticities.

These findings relate our paper to an emerging literature on firm level elasticities. Bas et al. (2015) cannot observe firm-level tariffs but bypass this problem by comparing two different sets of firms (French and Chinese) confronted to different tariffs on the same destinations. Fitzgerald & Haller (2014) confirm the difference between firm level trade elasticity to exchange rate and tariff, but do not provide an elasticity related to firm-specific shocks. In contrast, Amiti et al. (2015) estimate the price response to a firm specific cost shock (proxied with changes in the unit values of the imported intermediate inputs) but do not analyze the response of exports to these cost shocks.

There are several ways to interpret our results. One is that the effect of aggregate shocks (exchange rate and tariff), that are common (although maybe not identical) to all French exporters, on the price index in the importing country is large and not fully captured by the aggregate price index or by the country-time fixed effect. Another interpretation is that strategic complementarities in prices are more important for common aggregate shocks than for idiosyncratic cost shocks. Yet another interpretation is that these shocks transmit differently to final consumers. For example it may be that exchange rate shocks may be perceived as temporary and that due to local price stickiness consumer prices react less to exchange rate shocks than to exporter price shocks.

The remaining of the paper is structured as follows. We present our empirical strategy and the data in Section 1. We show our first stage regression results, the impact of firm level electricity cost shocks on export prices, and compare these results with exchange rate and tariff shocks in Section 2. In Section 3, we estimate the elastictity of substitution between Home and Foreign varieties.

& Smagghue (2015) and Loecker & Biesebroeck (2016). Ganapati, Shapiro & Walker (2016) also use electricity cost shocks as instruments for marginal cost shocks. Their aim is to estimate the pass-through of those shocks into domestic prices. A major difference with our paper is that they use the interaction between national fuel prices for electricity generation and 5-year lagged electricity generation shares at the state level. We use firm level data for electricity prices.

2 Data and descriptive evidence

2.1 Data

In this paper we use three confidential firm level datasets: (i) *Douanes* database on French firms exports, (ii) $Ficus/Fare$ on French firms balance sheet information and (iii) $EACEI$ data on energy consumption and purchase of French firms .[3] Then macro level control variables come from standard sources (World Bank, CEPII and Penn World Table).

The *Douanes* database is provided by French customs for the period 1995-2010 and gives us information on import and export flows of French firms by destination country, product (HS6 classification) and year. This database contains all trade flows by firm-product-destination that are above 1000 euros for extra EU trade and 200 euros for intra-EU trade, so it can be considered an exhaustive sample of all French exporting firms. Based on export values and volumes we computed the Trade Unit Values for a specific firm-product-destination-year cell (here used as proxy for the export price). The potential amount of observations is thus very large: there are almost 100,000 exporting firms per year and 200 destination markets. For this reason, and considering that our main explanatory variables do not vary with the product dimension, we collapse the French customs data at firm-destination-year level. So the resulting TUV is the weighted average across products of a given firm-destination-year cell.[4] The exported volume for the firm-destination-year is the sum across HS-6 codes.

However, the weighted average of TUV can suffer the composition bias (due to the aggregation of several products within a firm-destination-year cell). So, as robustness check, we retain the product dimension of the dataset by restraining the analysis to the core product exported by the firm in a given market. For each firm-destination we keep the HS-6 code that represents the maximum (average across years) exported value for the firm-destination. So we basically select a specific HS-6 product for each firm-destination and use the core product of the firm to compute TUV and export volume. Doing so, TUV values do not suffer the composition bias.

Table 1 reports the share of total French exports by destination in our sample for a set of top-10 export markets. The relative ranking of destinations changes marginally over the period 1996-2010; but it is interesting to notice the growing importance of China and USA and the reduction in the export share towards some historical EU trade partners (Germany, Italy and Netherlands).

The second firm level (confidential) database is $Ficus/Fare$ which contains balance sheet information for the universe of French firms. From this database we retain the turnover and the employment level of each French firm used as control variables in the main regressions. From $Ficus/Fare$ we also keep the labor cost and the purchase of intermediate inputs and raw materials used to compute the share of electricity over the total

[3] All firm level confidential dataset have been used at the CEPII

[4] We used the exported quantity as weight.

Table 1: Shares of exports by destination (top-10)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BEL	8	8	8	7	7	7	8	9	8	8	7	7	7	8	8
CHE	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
CHN	1	1	1	1	1	1	1	1	2	2	2	2	3	3	3
DEU	21	19	19	19	18	18	17	17	18	18	17	19	18	16	17
ESP	6	8	9	10	9	8	10	8	9	10	9	9	7	7	6
GBR	10	11	10	10	10	9	10	10	9	9	8	8	7	7	6
ITA	9	9	9	9	9	8	9	8	8	8	8	7	6	7	6
NLD	5	5	5	5	4	4	3	4	4	4	3	3	3	3	3
POL	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
USA	7	7	7	7	8	9	8	8	7	7	8	7	9	9	9

Notes: statistics on the sample of firms used in the baseline estimations.

Source: Authors' calculations on EACEI and Douane dataset.

cost share reported in table 2.

The information on firm level electricity price (here used as instrumental variable for the export price) is provided by the *EACEI* database on energy purchase and consumption by French firms in the period 1996-2010. For each plant-year combination we have information about the usage of different types of energy such as electricity, carbon, coke and gas. For consistency with the French custom data, the *EACEI* database has been aggregated at firm level by summing electricity bill and consumption across plants within the same firm[5] The price of electricity has been computed as the ratio between electricity bill (in €) and purchased quantity of electricity (in kwh). The final electricity price for the firm is thus expressed in €/kwh.

Finally we merge firm level data with macro dataset: (i) OECD.stat for the GDP of destination countries, (ii) CEPII MacMap data for tariffs and (iii) Penn World Table for nominal exchange rates and consumer price indexes (used to calculate the real exchange rate). The MacMap database on tariffs records ad-valorem *applied* tariff for each country pair-sector (HS-4 digit) observed in four years: 2001, 2004, 2007 and 2010 (see *Assessing Applied Protection across the World* (2008) for more details on MacMap).[6] Since French exporters do not face tariff in EU, we simply set to zero intra-EU tariffs. As described above, for our baseline regressions we use a firm-destination-year specific dataset. So we follow Fitzgerald & Haller (2014) and use the weighted average tariff faced by a firm into a given destination-year (average across exported products).[7] In the robustness check estimations, when we keep the core product of each firm, we use (core) product specific tariff.

[5] We use the French firm identifier *siren*, which is the key variable for the merge with the Custom database.

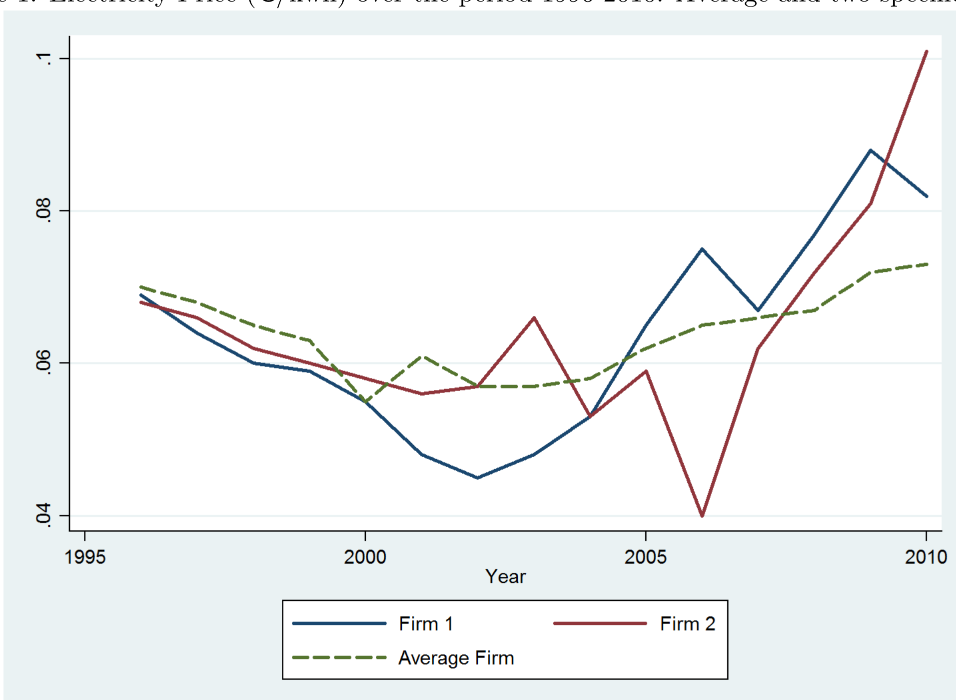
[6] We use tariff in 2001 for the years preceding 2001. Tariffs in 2001 were also used for the period 2001-2003. Then tariffs in 2004 have been used for the period 2004-2007. Finally, tariffs in 2007 were used for tariffs in the period 2007-2010.

[7] We follow Berthou & Fontagné (2016) and use the product share over total exports as a weight.

2.2 Firm level electricity prices

Contrary to the common perception, there is a firm specific component in the price of electricity paid by firms. Although the average electricity price in our dataset (reported in Table 2) is in line with the publicly available prices for the manufacturing sector, we observe in our dataset that there is variance across and within firm over time and that annual variations are not synchronized. In figure 1 we show the average price of electricity paid by French firms between 1996 and 2010, and the price paid by two anonymous firms having their mean price and standard deviation similar to the mean and the standard deviation of the sample. The presence of firm-specific shocks is clear.

Figure 1: Electricity Price (€/kwh) over the period 1996-2010. Average and two specific firms.



Note: dashed line refers to the average firm, obtained by collapsing the dataset by year. Firm 1 and 2 are specific (anonymous) firms having mean and std dev electricity price similar to sample mean and std dev. Source: Authors EACEI dataset.

We now explain what is behind the firm specific components of electricity prices in the French manufacturing sector. We will argue that the specificities of the French electricity market enable us to use firm level electricity prices as an instrument for export prices. Note that our regressions will include firm fixed effects so that any time invariant characteristic of the firm electricity price will be controlled for and that the source of variation we will use is across years for a given firm. A characteristic of the French electricity market is that many contracts co-exist with both regulated and market driven prices. Regulated prices are offered only by EDF (the main historical operator) and unregulated prices are offered by all operators to all firms (Alterna, Direct Energie, EDF, Enercoop, GDF Suez, Poweo...). Firms can also have several contracts with several producers.

Another characteristic is that many firms had to renegotiate long-term contracts that ended during the period. These long term contracts allowed firms to have low and stable prices and their expiration means that firms may experience an increase in price in different years depending on the year the contract was initially signed and its length. Importantly for us there has also been many changes in regulations during the period 2001-2010. Under the pressure of the European Commission the market has been partially deregulated and opened with an increasing role of both imports and exports. Large firms were the first to be able to opt out from regulated prices in 2000 and this possibility was open progressively to all firms in the 2000s. However, on the same period many different tariffs co-existed and were affected by several changes. For example, in 2006 there was a large increase in electricity prices for firms that had opted (in the preceding years) for contracts with deregulated market prices. The government decided in 2007 to allow those firms to go back to a transitory regulated tariff (TarTAM tariff) calculated on the basis of the regulated tariff (increased depending on the firm by 10%, 20% or 23%). Not all firms chose to do so as it depended on the difference between the firm specific previous contracted price and the (firm specific) TarTAM (transitory regulated tariff). This choice depended itself on the date the previous contract was signed. This possibility was then stopped in particular because it was deemed to be a sectoral subsidy by the European Commission and this meant another change in price. There are also different regulated tariffs for firms. The Blue tariff (small electricity users) allows a fixed price (for a year) with possibility to have lower prices during the night. Yellow and Green tariffs (intermediate and large electricity users) may also benefit from a fixed price with lower average prices during the year if they accept to pay higher prices possibly on a maximum 22 days in the year (very cold days in winter when household demand is high). Depending on the location of the firm in France these price increases may differ. Also, some firms benefit from low prices because they are close to hydroelectric facilities. Finally, the electricity price also depends on several taxes especially the so-called TURPE (to pay for distribution and transport in particular) since 2000 which was created after the European Commission obliged France to separate the production and the distribution of electricity. The tax is itself quite complex, firm specific (in particular it is reduced if the firm has experienced a power outage of more than 6 hours in the year) and changes every year. It can constitute up to 40% of the final electricity cost. Another tax (CSPE) also varies every year at the firm level. Finally there are additional taxes at the city and department level that can vary both across locations and years.

This description of the electricity market in France shows that electricity prices vary at the firm level for reasons that are both endogenous to the firm activity (in particular its average electricity use) and more importantly exogenous to the firm export activity (regulation changes, year and length of beginning of contract, tax changes both at the national and local levels, location, changes in both market and regulated tariffs, weather). We will take into account some of the impact of firm characteristics on electricity prices by including a firm fixed effect as well as time varying measures of its activity (employment or turnover). Using firm specific electricity price changes as an instrument for export prices in the regression to estimate the price elasticity of exports is also valid because we believe that electricity price changes at the firm level affect export volumes only through their effect on export prices (the exclusion restriction).

We will analyze how electricity prices affect export prices, our first stage in our estimation. In the appendix, we illustrate the mechanism through a very simple theoretical framework where firms use several inputs (energy, labor, capital and intermediates) which are imperfect substitutes. We show that in a standard monopolistic competition framework where a firm i minimizes costs, the paththrough of a firm level electricity cost shock p_{ei} to export prices p_i is given by:

$$\frac{dp_i}{dp_{ei}}\frac{p_{ei}}{p_i} = \frac{p_{ei}e_i}{p_{ei}e_i + \sum_{m=1}^{M} p_m x_{mi}} \tag{1}$$

where M is the number of inputs (other than electricity) and $p_m x_{mi}$ the expenditures on those inputs. Hence, the passthrough of electricity cost shocks to export prices is simply the share of electricity costs in the total costs of the firm. In our data set which is restricted to the manufacturing sector this ratio is around 2.7% (see table 2) so we should expect that in our first stage regressions the pass-through of a firm level electricity price shock to export prices is around the same number.

Table 2: In-sample descriptive statistics

	Mean	Std Dev	Min	Max	Std Dev Between	Std Dev Within
Electricity Price (€/kwh)	0.064	0.016	0.033	0.139	0.016	0.009
Elctricity cost share	0.027	0.059	0.000	0.999	0.059	0.043

The share of electricity over the total cost share (as reported in table 2) is the share of the electricity bill over the total production costs of the firms available in the Ficus/Fare dataset (i.e. labor cost, purchase of intermediate inputs, raw materials and electricity). Table 3 reports the summary statistics for the sample of firms we use in our baseline regressions, so the number of firms and the other statistics reported in the table refer to a sample of exporting firms for which we also have balance sheet and electricity bill data. The average size of the firm over the period 1996-2010 is quite big (but this is not surprising since we have exporting firms only). There is also some variation in the electricity cost share over time: from 1.9% in 2005 up to 3.6% in 2002 (the average over the period is 2.7%).

3 Empirical Strategy

Our empirical strategy proceeds in two steps. First, we estimate the elasticity of export volumes to prices by using an instrumental variable approach to solve the endogeneity problem of prices i.e. Trade Unit Values (TUV). Then, we analyze the international elasticity puzzle in our data set by including in the same regression export price (instrumented), real exchange rate and firm specific tariffs.

Table 3: In-sample summary statistics

Year	N. Firms	Employees	Elec. Price	Elec. Share
1996	9000	227	0.070	0.029
1997	9492	217	0.068	0.029
1998	9746	215	0.065	0.028
1999	9702	213	0.063	0.028
2000	5561	289	0.055	0.020
2001	8744	223	0.061	0.025
2002	5895	344	0.057	0.036
2003	5715	353	0.058	0.036
2004	6054	316	0.059	0.035
2005	4613	241	0.062	0.019
2006	6198	205	0.065	0.020
2007	6464	201	0.067	0.022
2008	5413	223	0.068	0.021
2009	5437	194	0.073	0.033
2010	5721	183	0.075	0.025

Notes: statistics on the sample of firms used in the baseline estimations.
Source: Authors' calculations on EACEI and Douane dataset.

3.0.1 Export Volumes Elasticity to Export Price

To estimate the elasticity of export volumes to price we use an instrumental variable aimed at solving the endogeneity of export price with respect the exported quantity. The second stage regression has the following econometric specification:

$$ln(exp_{i,j,t}) = \theta_{ij} + \theta_t + \beta_1 ln\left(TUV_{i,j,t}\right) + \beta_2\left(X_{i,t}\right) + \varepsilon_{i,j,t} \quad (2)$$

while the first stage regression is the following:

$$ln(TUV_{i,j,t}) = \theta_{ij} + \theta_t + \gamma_1 ln\left(ElectricityPrice_{i,t}\right) + \gamma_2\left(X_{i,t}\right) + \eta_{i,j,t} \quad (3)$$

where subscripts i,j, and t stand respectively for firm, destination market and year. The dependent variable is the log of the exported volumes (in Kg) by firm i in a specific country j and year t. The main explanatory variable here is the log of the export price (i.e. trade unit value) - $ln(TUV_{i,j,t})$- so we expect a negative coefficient for β_1. As explained in the data section we use two main regression samples: (i) exported aggregate volumes and average TUV across products within firm-destination-year (*baseline*), (ii) exported volumes of the HS-6 specific core product of the firm for a given destination and TUV (*core product estimation*).

Our preferred estimation includes firm-by-destination (θ_{ij}) and year (θ_t) fixed effects - in both first and second stage regressions.[8] These two sets of fixed effects properly control for any time shock (common to all destinations) and for any firm-destination specific characteristics affecting the export volumes of French firms (average size and productivity of the firm, quality of exported products, managerial capability, relative comparative advantage between France and the destination country j, the preference of a given firm for a specific destination). However, the econometric specification in (2) does not control for the multilateral price resistance term in destination countries (Anderson & van Wincoop (2003) and Head & Mayer (2014)). So we add a set of country-year specific variables Z_{jt} including GDP (in ln) and effective reals exchange rate as a proxy for the multilateral price resistance term. Then, as a robustness check, we modify the set of fixed effects in equation (2) by including firm (θ_i) and destination-year (θ_{jt}) fixed effects. Destination-year fixed effects control for any destination specific macroeconomic cycle and for the multilateral resistance to trade. The set of control variable X_{it} includes firm-year controls as turnover (in ln) and employment (in ln) with the aim of controlling for the time varying performance of the firm.

Table 4 shows the results of the simplest IV regression where the first stage results are shown at the bottom of the table. Electricity price has always positive and significant coefficient, showing the relevance of the electricity price in explaining the within variation of export price. The F-stat is always above 10. Note in particular that the first stage estimates of the impact of electricity cost shocks on export prices are very stable as they vary between 0.045 and 0.050[9]. As discussed before, a simple model predicts that this elasticity should be close to the share of electricity costs in total costs. The average observed share in our sample is around 3% so not very different. It may be a bit larger because electricty prices may be correlated with other energy costs that also affect export prices.

Table 4 provides a first estimate of the export price elasticity that varies between -2.9 and -5.5[10]. In the specification reported in column 1 of table 4 firm fixed effects and destination year fixed effects are included but there are no controls for the time varying activity of the firm. These are added in specifications 2 and 3. Then, in specifications 4,5 and 6, the firm fixed effect and the destination year fixed effects are replaced by a firm-destination fixed effect and a year fixed effect. The elasticity in this case is a bit higher in absolute value between -4 and -5.

In Table 5, we perform several robustness checks on the sample. First, we restrict the sample to the core product of the firm (for each firm we keep the product line having the maximum average exports over the period 1996-2010). This responds to a potential aggregation bias concern when firms export more than one product to a given destination. In this case, changes in prices and quantities may reflect changes in the product mix instead of real price changes. To eliminate this problem, we restrict the sample to a set of observations for which

[8] We use high-dimensional instrumental variable estimations procedure developed in Bahar (2014) - **ivreg2hdfe** in Stata.

[9] The full first stage regression results are shown in the appendix in table A3

[10] We report the OLS estimation in the appendix in table A2. Not surprisingly the demand elasticity is lower in absolute value when we do not instrument the export price. An obvious reason is that in this case price movements are affected by demand shocks to the firm

Table 4: Baseline 2SLS regressions on full dataset.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)		
TUV (ln)	-4,203***	-2,918***	-3,916***	-5,544***	-3,944***	-5,131***
	(0,729)	(0,514)	(0,671)	(0,982)	(0,699)	(0,900)
Turnover (ln)		0,299***			0,361***	
		(0,010)			(0,014)	
Employment (ln)			0,159***			0,205***
			(0,012)			(0,015)
GDP (ln)				0,784***	1,029***	0,831***
				(0,167)	(0,119)	(0,153)
Effective RER (ln)				-0,067***	-0,073***	-0,067***
				(0,017)	(0,012)	(0,016)
Firm FE	yes	yes	yes	no	no	no
Destination-Year FE	yes	yes	yes	no	no	no
Firm-Destination FE	no	no	no	yes	yes	yes
Year FE	no	no	no	yes	yes	yes
First Stage						
Electricity Price	0,049***	0,049***	0,050***	0,046***	0,046***	0,046***
Turnover (ln)		0,001			-0,002	
Employment (ln)			0,002			-0,001
F-stat	23,25	22,94	23,47	22,83	21,88	22,67
Observations	1630856	1626667	1630856	1488954	1485547	1488954

Standard errors are clustered within firm-year in all estimations.

More details on the first stage results are reported in table A3

*** $p < 0,01; **p < 0,05; *p < 0,1$.

the firm exports only one product over our time frame which we take as the core product. Second, we restrict the sample to firms exporting to a given destination over the entire period. This is the simplest way to deal with the selection bias (entry/exit dynamics of the firm) - see Fitzgerald & Haller (2014). Results reported in columns 1-3 in Table 5 show an estimated elasticity a bit higher (in absolute value) than that obtained on the full sample (when we do not restrict to the core product). The F-stat of the first stage regressions decrease and are slightly lower than 10. This suggests a moderate weak instrument issue that might be due to the reduced number of observations in presence of clustered standard errors. Then, in columns 4-6 in Table 5, we report a further robustness check by using the core product of the firm for a sub-sample of firms exporting at least five year over the period 1996-2010. This robustness check aims at reducing the problem of churning without sticking on pure continuous exporting firms. Again, the estimated elasticities are a bit higher in the range of -4.6 to -6.6 (with a reassuring joint F-stat above the rule of thumbs of 10).

Finally, we run the regressions for the entire sample in first difference estimations in columns 7-9 in Table 5. In this case, our estimation of the export price elasticity is not over a change in price relative to its average over the period for a given destination but relative to the previous year for a given destination. It is reassuring that the (instrumented) export price elasticity remains very similar (between -5 and -6). In this case, while the first stage coefficient remains statistically significant, the F-stat is definitely lower suggesting a weak instrument problem.

All in all, from this first set of evidence we can conclude that our estimate of the firm level export price elasticity is precisely estimated and relatively high at around -5.

Table 5: Baseline 2SLS regressions. Robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)		
TUV (ln)	-5,231***	-4,062***	-5,296***	-6,504***	-4,576***	-5,991***	-5,905**	-5,034**	-5,176**
	(1,678)	(1,244)	(1,667)	(1,537)	(1,028)	(1,426)	(2,725)	(2,341)	(2,282)
Turnover (ln)		0,428***			0,428***			0,180***	
		(0,037)			(0,021)			(0,016)	
Employment (ln)			0,201***			0,196***			0,109***
			(0,027)			(0,023)			(0,020)
Sample	Core product and balanced database			Core product, exporting			First difference estimations		
Sample				more than 5 year					
Firm FE	yes	yes	yes	yes	yes	yes	no	no	no
Destination-Year FE	yes	yes	yes	yes	yes	yes	no	no	no
Year FE	no	no	no	no	no	no	yes	yes	yes
First Stage									
Electricity Price	0,043***	0,045***	0,043***	0,042***	0,044***	0,042***	0,015*	0,015*	0,015*
Turnover (ln)		0,023***			0,010***			0,002	
Employment (ln)			-0,002			-0.004			0,006*
F-stat	8,75	9,71	8,75	14,67	15,81	14,26	3,45	3,35	3,76
Observations	173827	173524	173827	643564	642477	643567	1007989	1005010	1007989

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

3.0.2 Export Volumes Elasticity to Price, Tariff and Real Exchange Rate

In this section we keep the core trade elasticity estimated in this paper (i.e. the elasticity to the firm specific export price) and we confront it with two other trade elasticities often estimated in the existing literature: (i) the elasticity to tariff and (iii) real exchange rate. The previous literature highlighted the presence of the so called International Elasticity puzzle as trade volumes react more elastically to tariffs than to real exchange rate movements. We add to such puzzle the elasticity to the firm export price (here properly estimated with an IV approach). As a preliminary to our micro-level estimations of export volume elasticities, we provide aggregate OLS estimations in order to confirm in our data the presence of the International Elasticity Puzzle. We follow Fitzgerald & Haller (2014) and aggregate our dataset at sector-destination-year to estimate the effect of tariff and real exchange rate on both export volumes and revenues. All variables are taken in log and we include destination and sector-year fixed effects in all the estimations. Results, reported in table 6 strongly confirm the presence of International elasticity Puzzle. The estimated coefficients on tariff range between -1 and -1.23, while coefficients on real exchange rate are between 0.57 and 0.72. French exporters react more elastically to tariffs that to real exchange movements. Then in a last specification (see columns 3 and 6) we include the (log of) export price which will be our crucial variable in what follows. Coefficients on TUV have the expected sign with an elasticity of -0.48 on export volumes. However, as describe above, coefficient on TUV is biased (endogeneity) and deserves proper Instrumental Variable estimations (which is at the core of this paper).

Table 6: Aggregated regressions.

	Dep Var: Export Volumes (ln)			Dep Var: Export Revenues (ln)		
	(1)	(2)	(3)	(4)	(5)	(6)
RER (ln)	0,649***	0,725***	0,786***	0,574***	0,639***	0,634***
	(0,063)	(0,070)	(0,067)	(0,051)	(0,056)	(0,056)
Ln(tariff+1)	-1,132***	-1,040***	-1,185***	-1,233***	-1,112***	-1,098***
	(0,169)	(0,168)	(0,162)	(0,137)	(0,136)	(0,136)
GDP (ln)		1,034***	1,168***		1,119***	1,106***
		(0,077)	(0,075)		(0,068)	(0,063)
Effective RER (ln)		0,107***	0,111***		0,107***	0,107***
		(0,028)	(0,028)		(0,023)	(0,023)
TUV			-0,486***			0,046***
			(0,009)			(0,007)
Destination FE	yes	yes	yes	yes	yes	
Sector-Year FE	yes	yes	yes	yes	yes	
Observations	40557	39974	39974	40557	39974	39974
R-squared	0,796	0,798	0,812	0,810	0,813	0,813

Robust standard errors. *** $p < 0,01; **p < 0,05; *p < 0,1$.

Now we focus again on micro-level estimations and augment the standard international elasticity puzzle by including the price elasticity of export volumes. Namely, our estimation is the same as in equation (2) but we include destination-year specific tariffs ($ln(tariff_{jt} + 1)$) and bilateral real exchange rate (RER_{jt}) as follows:

$$ln(exp_{i,j,t}) = \theta_{ij} + \theta_t + \beta_1 ln\,(TUV_{i,j,t}) + \beta_2\,(RER_{j,t}) + \beta_3 ln\,(tariff_{j,t} + 1) + \beta_4\,(X_{i,t}) + \beta_4\,(Z_{j,t}) + \varepsilon_{i,j,t} \quad (4)$$

All variables have the same meaning as before. In equation (4) we can only include firm-destination (θ_{ij}) and year (θ_t) fixed effect since destination-year fixed effects would be perfectly collinear with tariffs and real exchange rates. We then include a set of destination-year specific control variables Z_{jt} containing: (i) the GDP (in log) of destination countries to control for import demand and (ii) Real Effective Exchange Rate to control for the degree of competition in the destination country and the price index of the importing country. The results are shown in table 7. In the first stage regression, the tariffs and the real exchange rates have the expected sign on export prices: part of a euro appreciation and of a tariff increase is absorbed by exporters in the markups. Interestingly, only a small part of the exchange rate changes are absorbed (less than 3 percent) whereas for tariffs exporters react to a 1 percent increase by a 0.35 percent decrease in export price. This suggests that the low elasticity of export volumes to exchange rate shocks that we will find is not due to the fact that export prices expressed in the foreign currency do not change. However, we do not observe import prices or consumer prices at destination.

Table 7 first shows that the inclusion of tariffs and real exchange rates does not alter the estimates of the instrumented export price elasticity that remains between -5 and -6. The export price elasticities are (in absolute value) systematically much larger than the elasticity for the tariff which itself is larger that the elasticity for the real exchange rate. This last result is the international elasticity puzzle. The tariff elasticity is around -1.9 and the exchange rate elasticity is around -0.6. These results are a bit lower (in absolute value) but of a similar magnitude as those found by Fitzgerald & Haller (2014). The results are robust to using the core-product on a balanced panel as shown in table 8 as well as using data only up to 2007 (see table 9) therefore excluding crisis years. The results are also robust when we use the core product sample with firms exporting more than 5 years (see table A4) and when we run regressions in first difference as shown in table A5 in appendix. The estimated coefficients are very similar but the relatively low F-stat suggest a weak instrument problem in this specification.

Following a recent literature (see Amiti et al. (2015))that has emphasized the importance of strategic complementarities in international pricing, we now control for export unit values of French competitors in the same sector. The concern could be that in the first stage regression, the electricity cost shock that generates the export price increase could also lead close competitors to increase their own price. In turn, this may alter the impact of the firm exprt price increase on its export sales. We would expect this strategic complementarity to therefore reduce the absolute value of the estimate of the elasticity of exports we are after. Given that we have the information on unit values of French exporters in the destination at stake in the same sector we control for these prices in both the first and second stages of the regression. The results are in Table 11. The results are intuitive as the competitors price are positively correlated with the firm export price. Competitors prices also have a positive impact on export sales. However the estimated elasticity is almost not affected.

A last empirical concern is the selection bias in the export status if firms select endogenously in different destinations (firm-level zeros). In heterogeneous firm trade models, only high-productive firms are able to serve far and more costly (complicated) markets. In our framework, higher tariff observations will be associated with high-productive firms. Similarly, firms able to reach relatively more competitive destinations (having low real exchange rate) are the most productive. To partially address this problem, we follow Fitzgerald & Haller (2014) and Mulligan & Rubinstein (2008) and run a last set of robustness checks using a subsample of firms with sufficiently high number of destinations (more than 11 destinations, corresponding to the 25th percentile of the distribution). Results, reported in table 10 confirm what described above.

Table 7: 2SLS regressions on full dataset.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV (ln)	-5,498***	-5,556***	-5,588***	-5,586***	-5,171***
	(0,0983)	(0,982)	(0,992)	(0,994)	(0,911)
RER (ln)			0,552***	0,673***	0,659***
			(0,035)	(0,044)	(0,040)
Ln(tariff+1)			-1,927***	-1,908***	-1,771***
			(0,367)	(0,365)	(0,175)
Effective RER (ln)				0,125***	0,121***
				(0,021)	(0,019)
Employment (ln)					0,205***
					(0,015)
GDP (ln)		0,772***	0,594***	0,568***	0,624***
		(0,167)	(0,189)	(0,191)	(0,175)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,046***	0,046***	0,046***	0,046***	0,046***
RER (in log)			0,017***	0,026***	0,026***
Ln(tariff+1)			-0,350***	-0,348***	-0,348***
F-stat	22,40	22,94	22,75	22,63	22,47
Observations	1496270	1496270	1496270	1488954	1488954

Standard errors are clustered within firm-year in all estimations.

More details on the first stage results are reported in table A6

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 8: 2SLS regressions on core-product balanced panel.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV (ln)	-5,081***	-5,490***	-5,419***	-5,418***	-5,498***
	(1,774)	(1,856)	(1,813)	(1,810)	(1,803)
RER (ln)			0,953***	1,055***	1,060***
			(0,206)	(0,205)	(0,205)
Ln(tariff+1)			-0,696***	-0,679***	-0,689***
			(0,175)	(0,177)	(0,177)
Effective RER (ln)				0,132***	0,130***
				(0,049)	(0,050)
Employment (ln)					0,194***
					(0,028)
GDP (ln)		1,310***	1,197***	1,157***	1,120***
		(0,167)	(0,176)	(0,174)	(0,173)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,040***	0,041***	0,041***	0,041***	0,041***
RER (in log)			0,106***	0,105***	0,106***
Ln(tariff+1)			0,012	0,012	0,012
F-stat	7,6	7,9	8,13	8,13	8,13
Observations	172947	172947	172947	172918	172918

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 9: 2SLS regressions using full data up to 2007.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV	-5,444***	-5,526***	-5,524***	-5,555***	-5,260***
	(1,127)	(1,130)	(1,130)	(1,144)	(1,070)
RER (in log)			0,645***	0,803***	0,790***
			(0,043)	(0,058)	(0,054)
Ln(tariff+1)			-2,119***	-2,117***	-2,000***
			(0,485)	(0,488)	(0,457)
Effective RER (log)				0,154***	0,151***
				(0,026)	(0,024)
Ln employment					0,175***
					(0,016)
GDP (log)		1,056***	0,905***	0,862***	0,897***
		(0,151)	(0,171)	(0,176)	(0,165)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,044***	0,044***	0,044***	0,044***	0,044***
RER (in log)			0,022***	0,035***	0,035***
Ln(tariff+1)			-0,411***	-0,409***	-0,409***
F-stat	16,87	17,19	17,16	16,55	16,87
Observations	1221409	1221409	1221409	1218470	1218470

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 10: 2SLS regressions using firms exporting to a large number of destination. Selection bias solution.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV	-7.461***	-7.511***	-7.575***	-7.331***	-6.989***
	(2.396)	(2.394)	(2.421)	(2.268)	(2.173)
RER (ln)			1.039***	1.115***	1.085***
			(0.189)	(0.189)	(0.181)
Ln(tariff+1)			-0.290	-0.288	-0.303*
			(0.183)	(0.177)	(0.169)
Effective RER (ln)				0.095***	0.092***
				(0.031)	(0.029)
Employment (ln)					0.161***
					(0.025)
GDP (ln)		0.761***	0.591*	0.605**	0.363***
		(0.288)	(0.312)	(0.294)	(0.281)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0.029***	0.029***	0.029***	0.030***	0,029***
RER (in log)			0.076***	0.080***	0,080***
Ln(tariff+1)			0.036	0.037	0,032
F-stat					
Observations	768292	768292	768292	764623	764623

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

4 Robustness checks: strategic complementarity

Table 11: Baseline 2SLS regressions on full dataset.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)		
TUV (ln)	-4,234***	-2,923***	-3,940***	-5,593***	-3,985***	-5,180***
	(0,748)	(0,525)	(0,687)	(0,998)	(0,712)	(0,916)
Turnover (ln)		0,300***			0,362***	
		(0,010)			(0,014)	
Employment (ln)			0,161***			0,205***
			(0,012)			(0,015)
GDP (ln)				0,800***	1,044***	0,846***
				(0,168)	(0,121)	(0,154)
Effective RER (ln)				-0,067***	-0,073***	-0,067***
				(0,017)	(0,012)	(0,016)
TUV competitors (ln)	0,090**	0,020	0,074**	0,054***	0,025*	0,046**
	(0,041)	(0,028)	(0,037)	(0,020)	(0,014)	(0,019)
Firm FE	yes	yes	yes	no	no	no
Destination-Year FE	yes	yes	yes	no	no	no
Firm-Destination FE	no	no	no	yes	yes	yes
Year FE	no	no	no	yes	yes	yes
First Stage						
Electricity Price	0,049***	0,049***	0,049***	0,046***	0,046***	0,046***
Turnover (ln)		0,003			-0,002	
Employment (ln)			0,002			-0,002
TUV competitors (ln)	0,053***	0,053***	0,053***	0,017***	0,017***	0,017***
F-stat	22,53	22,14	22,69	22,67	21,68	22,47
Observations	1619200	1615030	1619200	1479885	1476489	1479885

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01$; ** $p < 0,05$; * $p < 0,1$.

Table 12: Baseline 2SLS regressions. Robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)		
TUV (ln)	-5,249***	-4,086***	-5,320***	-5,640***	-4,673***	-6,116***
	(1,706)	(1,267)	(1,696)	(1,620)	(1,085)	(1,504)
Turnover (ln)		0,427***			0,428***	
		(0,037)			(0,022)	
Employment (ln)			0,202***			0,196***
			(0,027)			(0,024)
TUV competitors (ln)	0,099**	0,066*	0,099**	0,139***	0,075**	0,122**
	(0,048)	(0,034)	(0,048)	(0,051)	(0,034)	(0,047)
Sample	Core product and balanced database			Core product, exporting		
Sample				more than 5 year		
Firm FE	yes	yes	yes	yes	yes	yes
Destination-Year FE	yes	yes	yes	yes	yes	yes
Year FE	no	no	no	no	no	no
First Stage						
Electricity Price	0,042***	0,045***	0,042***	0,041***	0,043***	0,040***
Turnover (ln)		0,023***			0,001***	
Employment (ln)			-0,002			-0,004
TUV competitors (ln)	0,025***	0,024***	0,025***	0,030***	0,030***	0,030***
F-stat	8,54	9,46	8,54	13,80	14,84	13,93
Observations	173494	173191	173494	638637	637560	638637

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01$; $** p < 0,05$; $*p < 0,1$.

Table 13: 2SLS regressions on full dataset.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV	-5,522***	-5,614***	-5,646***	-5,633***	-5,219***
	(1,002)	(1,002)	(1,012)	(1,010)	(0,927)
RER (ln)			0,547***	0,668***	0,655***
			(0,036)	(0,044)	(0,041)
Ln(tariff+1)			-1,945***	-1,928***	-1,790***
			(0,375)	(0,374)	(0,343)
Effective RER (ln)				0,125***	0,121***
				(0,022)	(0,015)
Employment (ln)					0,205***
					(0,015)
GDP (ln)		0,786***	0,605***	0,579***	0,635***
		(0,169)	(0,191)	(0,193)	(0,177)
TUV competitors (ln)	0,047**	0,053***	0,055***	0,054***	0,046**
	(0,021)	(0,020)	(0,020)	(0,020)	(0,019)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,045***	0,046***	0,046***	0,046***	0,046***
RER (in log)			0,016**	0,025***	0,025***
Ln(tariff+1)			-0,350***	-0,350***	-0,350***
TUV competitors (ln)	0,017***	0,017***	0,017***	0,017***	0,017***
F-stat	22,11	22,66	22,48	22,47	22,29
Observations	1486900	1486900	1486900	1479885	1479885

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 14: 2SLS regressions on core-product balanced panel.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV	-4,985***	-5,390***	-5,319***	-5,314***	-5,398***
	(1,700)	(1,779)	(1,737)	(1,735)	(1,728)
RER (ln)			0,946***	1,049***	1,055***
			(0,199)	(0,202)	(0,201)
Ln(tariff+1)			-0,715***	-0,698***	-0,707***
			(0,173)	(0,173)	(0,176)
Effective RER (ln)				0,134***	0,133***
				(0,048)	(0,049)
Employment (ln)					0,193***
					(0,027)
GDP (ln)		1,321***	1,206***	1,168***	1,129***
		(0,164)	(0,172)	(0,171)	(0,170)
TUV competitors (ln)	0,021	0,037*	0,036*	0,038*	0,037*
	(0,021)	(0,021)	(0,021)	(0,021)	(0,021)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,041***	0,041***	0,041***	0,041***	0,041***
RER (in log)			0,106***	0,106***	0,108***
Ln(tariff+1)			0,012	0,012	0,012
TUV competitors (ln)	0,007**	0,007**	0,007**	0,007**	0,007**
F-stat	8,00	8,33	8,53	8,52	8,53
Observations	172610	172610	172610	172593	172593

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

5 Concluding remarks

The main contribution of this paper is to offer an estimation of the elasticity of substitution between home and foreign goods at the firm level. Our preferred estimate is around -5 and our estimation strategy allows us to identify it as the structural elasticity that many international trade and international macroeconomics models use. The second contribution is to show that this structural elasticity is higher in absolute vale than both the exchange rate and the tariff elasticities. The estimates that we obtain for these two are not very different from some other papers (cite...). The interpretation of why this is so ... We have estimated an "average" firm elasticity. There is evidence (cite...) that the exchange rate elasticity is different across firms depending on their size and productivity. We leave this issue for future research.

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A Appendix

A.1 Theory

Firms have several inputs, among them electricity, labor, capital and intermediates in the production function of the different varieties of final goods they produce. These inputs are imperfect substitutes and we will assume that this elasticity is low: $\rho < 1$. There are M inputs other than energy in the production function. The production function of firm i with productivity φ is given by:

$$y_i(\varphi) = \varphi \left[\alpha_{ei} e_i^{(\rho-1)/\rho} + \sum_{m=1}^{M} \alpha_{mi} x_{mi}^{(\rho-1)/\rho} \right]^{\rho/(\rho-1)} \tag{5}$$

with α_{ei} a parameter that describes how energy dependent the firm is, e_i the quantity of energy employed and x_{mi} the use of other inputs by the firm. $\alpha_{ei} + \sum_{m=1}^{M} \alpha_{mi} = 1$. The relative demand for energy and and any other input is given by: $\frac{e_i}{x_{mi}} = \left(\frac{\alpha_{ei} p_m}{\alpha_{mi} p_{ei}} \right)^{\rho}$ with p_m the price of input m which we assume common to all firms and p_{ei} the firm-specific energy price.

Hence, production of firm i can be rewritten as:

$$y_i(\varphi) = \varphi e_i \alpha_i^{e\rho/(\rho-1)} \left[1 + \sum_{m=1}^{M} \frac{p_m x_{mi}}{p_{ei} e_i} \right]^{\rho/(\rho-1)} \tag{6}$$

So that total costs of firm i is:

$$C_i(\varphi) = \frac{p_{ei}}{\varphi} \alpha_{ei}^{-\rho/(\rho-1)} y_i(\varphi) \left[1 + \sum_{m=1}^{M} \frac{p_m x_{mi}}{p_{ei} e_i} \right]^{1/(1-\rho)} \tag{7}$$

With monopolistic competition on the demand side with σ the elasticity of substitution between varieties, the producer price $p_i(\varphi)$ expressed in Home currency (euros in our case)of firm/variety φ exporting to country i is the usual mark-up over marginal cost. It is given by:

$$p_i(\varphi) = \frac{\sigma}{\sigma - 1} \frac{p_{ei}}{\varphi} \alpha_i^{-\rho/(\rho-1)} \left[1 + \sum_{m=1}^{M} \frac{p_m x_{mi}}{p_{ei} e_i} \right]^{1/(1-\rho)} \tag{8}$$

In the data, we do not observe the parameter α_i. However we will observe total costs of the firm and its energy expenditures: $p_{ei} e_i$.

The elasticity of the producer price to the energy price is given by:

$$\frac{dp_i}{dp_{ei}} \frac{p_{ei}}{p_i} = \frac{p_{ei} e_i}{p_{ei} e_i + \sum_{m=1}^{M} p_m x_{mi}} \tag{9}$$

which is the observed ratio of energy expenditures to total costs if we assume that firms minimize costs.

A.2 Tables

Table A1: In-sample descriptive statistics

	Observations	Mean	Std Dev	Min	Max
Electricity Price (€/kwh)	1630856	0,062	0,015	0,033	0,139
Exported Quantity (ln)	1630856	8,378	3,187	-0,693	20,702
TUV (ln)	1630856	2,608	1,813	-1,66	8,005
Employment (ln)	1630856	5,372	1,068	0,693	8,869
Turnover (ln)	1630856	10,407	1,471	-1,881	17,23
Ln (tariff+1)	1630856	0,042	0,084	0	2,397
RER (ln)	1630856	0,106	0,191	-2,005	1,162
GDP (ln)	1630856	26,05	1,925	18,3	30,24
Effective RER (ln)	1630856	1,179	1,967	-2,09	9,499

Table A2: OLS regressions on full dataset.

	Dep Var: Export Volumes (ln)			Dep Var: Export Volumes (ln)		
	(1)	(2)	(3)	(4)	(5)	(6)
TUV (ln)	-1,268***	-1,268***	-1,268***	-1,143***	-1,143***	-1,143***
	(0,003)	(0,003)	(0,003)	(0,004)	(0,002)	(0,002)
Turnover (ln)		0,298***			0,373***	
		(0,009)			(0,012)	
Employment (ln)			0,153***			0,215***
			(0,007)			(0,008)
GDP (ln)				1,477***	1,472***	1,457***
				(0,037)	(0,026)	(0,027)
Effective RER (ln)				-0,081***	-0,082***	-0,080***
				(0,008)	(0,008)	(0,008)
Firm FE	yes	yes	yes	no	no	no
Destination-Year FE	yes	yes	yes	no	no	no
Firm-Destination FE	no	no	no	yes	yes	yes
Year FE	no	no	no	yes	yes	yes
Observations	1633037	1628826	1366037	1624300	1620118	1624300
R-squared	0,650	0,652	0,621	0,879	0,880	0,873

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; ** p < 0,05; *p < 0,1$.

Table A3: First stage regression results on full dataset.

	Dep Var: TUV (ln)			Dep Var: TUV (ln)		
	(1)	(2)	(3)	(4)	(5)	(6)
Electricity Price (ln)	0,046***	0,049***	0,050***	0,046***	0,046***	0,046***
	(0,011)	(0,010)	(0,010)	(0,010)	(0,011)	(0,011)
Turnover (ln)		0,001			-0,002	
		(0,003)			(0,003)	
Employment (ln)			0,002			-0,001
			(0,004)			(0,004)
GDP (ln)				-0,157***	-0,158***	-0,157***
				(0,013)	(0,013)	(0,013)
Effective RER (ln)				0,003	0,003	0,003
				(0,004)	(0,004)	(0,004)
Firm FE	yes	yes	yes	no	no	no
Destination-Year FE	yes	yes	yes	no	no	no
Firm-Destination FE	no	no	no	yes	yes	yes
Year FE	no	no	no	yes	yes	yes
Observations	1630856	1626667	1630856	1488954	1485547	1488954
R-squared	0,770	0,770	0,770	0,883	0,883	0,883
F-stat	23,25	22,94	23,47	22,83	21,88	22,67

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table A4: 2SLS regressions on core-product. Firms exporting more than 5 years into a given country

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV	-7,510***	-7,649***	-7,635***	-7,620***	-6,933***
	(2,144)	(2,148)	(2,137)	(2,126)	(1,969)
RER (ln)			1,122***	1,122***	1,159***
			(0,184)	(0,190)	(0,176)
Ln(tariff+1)			-0,194	-0,180	-0,219
			(0,212)	(0,212)	(0,194)
Effective RER (ln)				0,115***	0,112***
				(0,036)	(0,033)
Employment (ln)					0,209***
					(0,029)
GDP (ln)		0,896***	0,750***	0,720***	0,788***
		(0,256)	(0,269)	(0,269)	(0,248)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,035***	0,036***	0,036***	0,036***	0,035***
RER (in log)			0,083***	0,085***	0,085***
Ln(tariff+1)			0,053*	0,053*	0,053*
F-stat	10,29	10,63	10,70	10,72	10,21
Observations	590043	590043	590043	589870	589970

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table A5: 2SLS regressions in first differences.

	Dep Var: Export Volumes (ln)				
	(1)	(2)	(3)	(4)	(5)
TUV (ln)	-5,905**	-5,981**	-5,974**	-6,063**	-5,306**
	(2,735)	(2,759)	(2,753)	(2,882)	(2,380)
RER (ln)			0,600***	0,587***	0,552***
			(0,125)	(0,144)	(0,306)
Ln(tariff+1)			-2,374*	-2,413*	-2,070*
			(1,269)	(1,325)	(1,100)
Effective RER (ln)				-0,023	-0,026
				(0,038)	(0,032)
Employment (ln)					0,111***
					(0,021)
GDP (ln)		1,538***	1,168***	1,155***	1,239***
		(0,275)	(0,351)	(0,365)	(0,306)
Year FE	yes	yes	yes	yes	yes
First Stage					
Electricity Price	0,015*	0,015*	0,015*	0,015*	0,015*
RER (in log)			0,041***	0,045***	0,045***
Ln(tariff+1)			-0,453***	-0,452***	-0,452***
F-stat	3,45	3,47	3,5	3,3	3,6
Observations	1007989	1007989	1007989	1003361	1003361

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.

Table A6: First stage regression results on full dataset.

	Dep Var: TUV (ln)				
	(1)	(2)	(3)	(4)	(5)
Electricity Price (ln)	0,046***	0,046***	0,046***	0,046***	0,046***
	(0,010)	(0,010)	(0,010)	(0,010)	(0,010)
RER (ln)			0,170**	0,026***	0,026***
			(0,007)	(0,008)	(0,008)
Ln(tariff+1)			-0,350***	-0,348***	-0,348***
			(0,029)	(0,029)	(0,029)
Effective RER (ln)				0,009*	0,009*
				(0,004)	(0,004)
Employment (ln)					-0,002
					(0,004)
GDP (ln)		-0,157***	-0,179***	-0,187***	-0,181***
		(0,013)	(0,013)	(0,013)	(0,004)
Firm-Destination FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
Observations	1496270	1496270	1496270	1488954	1488954
R-squared	0,883	0,883	0,883	0,883	0,883
F-stat	22,40	22,94	22,75	22,63	22,47

Standard errors are clustered within firm-year in all estimations.

*** $p < 0,01; **p < 0,05; *p < 0,1$.