

# Competition and pass-through on international markets: Firm-level evidence from VAT shocks \*

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## Abstract

We exploit French customs' firm-level data to study how exporters pass a change in the VAT rate of one importing country through their prices. Looking at this reaction is of interest beyond a mere fiscal incidence analysis: VAT shocks provide instruments to identifying the extent of mark-up adjustment in exporting firms' reaction to macroeconomic shocks. Indeed, and by contrast with more usual shocks, typically exchange rate fluctuations, variations in VAT rates leave the marginal cost of exporters unchanged. For a sample covering exportations to the Euro-area over the 1996-2005 period our estimates show that, on average, markups contract by 50% of the VAT hike one year after the shock, implying a pass-through to final prices of 50% of the shock as well. We furthermore exploit the individual dimension of the data to show that the extent of mark-up adjustment varies across firms and markets. More precisely it depends on the market power of an exporter, as measured by its relative market share, and competition on a given market, as measured by standard concentration indexes. These evidences are in line with a model featuring variable elasticity of demand and heterogeneous firms.

**Keywords:** Export prices, markup adjustment, market share, market concentration, extensive margin, Value-Added Tax.

**JEL classification:**

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# 1 Introduction

How do exporters pass macroeconomic shocks through their prices? The question is fundamental to understand the international transmission of business cycles, or to characterize the effects of macroeconomic policies in open economies. It has mostly been answered by looking at the reaction of international prices to exchange rate fluctuations. This so called exchange rate pass-through literature typically emphasizes small and long-lasting adjustments to these shocks<sup>1</sup> suggesting exporters smooth the shock by adjusting their markup. However, it is not clear how much of these results are driven by exchange rate peculiarities and therefore whether these conclusions extend to other macroeconomic shocks. Indeed, exchange rates fluctuate a lot and it may be optimal not to react to their transitory components. Moreover, exchange rates may affect the marginal cost of an exporter through imported inputs so that the incomplete pass-through can occur even without markup changes.

In this paper, we study whether incomplete pass-through holds for other shocks than exchange rate fluctuations and to which extent it affects and relates to imperfect competition on international markets. More precisely, we rely on a rich micro data set to look at exporter's price reaction to variations in the value-added tax (VAT) rates of the importing countries.

Focusing on the VAT rather than exchange rate bears three attractive features. First, a change in VAT rates in a foreign country affects the consumer-price of a firm but leaves its marginal cost constant. Thus incomplete pass-through can hardly be attributed to marginal cost adjustment associated with imported inputs. Second VAT-rate changes are unfrequent, exogenous policy events that are generally long-lasting (and perceived as very persistent). Any finding of incomplete pass-through thus is unlikely to be related to perceptions that the shock will die out rapidly and to transitory price rigidity issues. Finally, VAT applies in a symmetric way to imported and local goods. Thus, incomplete pass-through cannot be attributed to any distortion created by the shock in favor or against foreign suppliers and in particular non-traded local distribution services. In brief, focusing on VAT shocks allows us to derive a measure of pass-through based on the sole markup

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<sup>1</sup>In an authoritative survey, Goldberg and Knetter (1997) report a median (across studies) pass-through of 50% one year after the shock. Goldberg and Campa (2005), Goldberg and Campa (2008) and Bouakez and Rebei (2008) provide more recent evidence of incomplete pass-through.

adjustment and therefore this measure bears general implications for other types of macroeconomic shocks.

We rely on the firm-level, French customs' database that tracks volumes and prices of exported goods at the firm's level according to an 8-digit classification of goods (around 10,000 products), between 1996 and 2005. We aim at identifying how each exporter adjusted its pricing decisions, for each different good to each destination country, in reaction to VAT-rate shocks that occurred in the eleven EMU12 partner countries of France over this period. Our identification strategy is derived from the analysis of a stylized model of imperfect competition on international markets that features heterogeneous exporters and variable elasticity of demand. In this setup, the reaction of a firm's markup in response to a VAT shock depends on how its perceived demand-elasticity varies with price, which in turn depends on the impact of the shock on the number of competitors on the shocked market. Aside to the price reaction to a VAT shock at the level of a firm, the use of firm-level data precisely allows us to estimate the change in competition on the export market, as measured by entry and exit rates, hence the evolution of market shares. Subsequently, we are able to disentangle what in the price/mark-up reaction to VAT shocks comes from changes in the strength of competition and what comes from others sources in demand-curve elasticity variations. Furthermore, relying on micro data, we can investigate how prices and markup adjustments vary across firms with different market power and across different market with different degree of concentration.

We find that, at the firm level, the pass-through of VAT shocks to consumption prices is far from complete. On our sample, we get an average (across sectors) estimate for the one-year horizon pass-through of 50%. This incomplete degree of pass-through confirms the consensus view of the literature, which also reports long-lasting, incomplete adjustment of international prices to macroeconomic shocks. This result also stresses that incomplete pass-through due to may be a very general pattern of international pricing strategies rather than just related to exchange rate fluctuation features. Moreover as VAT shocks ties incomplete pass-through to markup adjustments, this finding supports models featuring variable markups.

In addition to, and in relation with, incomplete pass-through and markup adjustments, we also find that a VAT hike in a destination country modifies the conditions of competition on export markets. We show that the VAT rate lowers the entry rate and increases the exit rate of exporters,

therefore reducing the number of competitors and increasing the average market share. We also uncover that the shock raises the lowest market share on each export markets. Furthermore, we find that this increase is higher than the average increase of individual markets shares so that the relative market share of the average exporter declines. These evidence are in line with a model of heterogeneous firms<sup>2</sup> in which, due to declining markups, markets become less profitable and the less performing firms therefore stop their export activities. However, this time variation of competition has only mild effects on markup adjustment to VAT shocks. On the contrary, cross section differences in competition as measured by firms market share and market concentration imply very different reactions of markups to VAT shocks and their degree of pass-through to final prices.

Our analysis also bears important implications in terms of tax policy analysis. First, a change in the VAT rate induces a redistribution across sectors as some exporters adjust their margin more than others. Second, the incomplete VAT pass-through implies that the exporters share a part of a VAT hike burden and that the importing country experiences a terms-of-trade gain. Third, there is a fall in the number of varieties available to the consumers and a rise in the market power of the remaining foreign suppliers. All in all, and despite it is levied according to the destination principle, VAT bears important international implications.

### *Literature*

We are not aware of another work assessing the reaction of VAT shocks on international prices.<sup>3</sup> Feenstra (1989) evidences that changes in ad-valorem tariffs on imports are incompletely passed-through to consumer prices, thus suggesting a terms-of-trade effect of trade policies. Although exogenous and permanent, a tariff shock nevertheless affects domestic and foreign suppliers asymmetrically, which is not the case of VAT. Also related to our work is the research carried out by Chen et al. (2009) who rely on sectoral European data to study the impact of a sectoral opening to international trade on competition, prices, and markups in that sector.

Our econometric identification is based on a model of imperfect competition among French exporters

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<sup>2</sup>See Melitz (2003).

<sup>3</sup>This lack of literature contrasts with both domestic VAT pass-through (see e.g. for the French case) and, on the international sphere, exchange-rate pass-through.

on each foreign market. Prices are assumed to be perfectly flexible but markups can vary due to changes in the perceived elasticity of demand on each market. Incomplete pass-through thus results from optimal price discrimination on segmented markets, *i.e.* from Pricing To Market (PTM) in the spirit of Dornbusch (1987) and Krugman (1987). Relating the optimal pass-through to the strength of competition on a market also connects our paper to Froot and Klemperer (1989) and to the models with heterogenous firms, entry & exit and variable markups by Bernard *et al.* (2003) and Melitz and Ottaviano (2008). Atkeson and Burstein (2008) is a recent example of a model that features both PTM on segmented international markets due to trade costs and varying competition between heterogenous firms.

The theoretical literature points to two other important channels explaining incomplete pass-through: sticky prices in local currency (e.g. Devereux and Engel (2002)), and non-traded distribution services (e.g. Burstein *et al.* (2003), Corsetti and Dedola (2005)). Although highly relevant especially for exchange-rate pass-through, these two channels are unlikely to be important in our case, for two reasons. First, we work on yearly prices, thus at a sufficiently low frequency for price adjustments to be complete in most sectors of the economy (see Bils and Klenow (2004) for the United States and Dhyne *et al.* (2006) for the European Monetary Union). Second, our trade prices are registered free on board (FOB) at the French border, hence before transportation and local distribution costs have been charged. More crucially, VAT is levied at the final consumer's level, which includes local distribution costs, and the same rate applies to the value-added produced abroad and to that produced locally.<sup>4</sup> Therefore our results suggest that incomplete pass-through is still observed when short-run price stickiness and distribution costs are excluded from the analysis.<sup>5</sup>

Finally, our results can be compared with the very recent theoretical models and evidence of incomplete exchange-rate pass-through based on firm-level behaviors. For instance Gopinath and Rigobon (2008). Fitzgerald and Haller (2009). Berman *et al.* (2009). Auer and Chaney (2009). Mjean and Schwellnus (2009). [TO BE COMPLETED]

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<sup>4</sup>By contrast, exchange-rate shocks do not affect symmetrically local (in particular distribution) and overseas production prices. This relative price change can contribute to generating incomplete pass-through (see Corsetti and Dedola (2005)). This is a channel that we do not have when focusing on VAT rate changes.

<sup>5</sup>These two channels will then reinforce pass-through incompleteness. Goldberg and Verboven (2001), Hellerstein (2008) and Nakamura and Zerom (orth), based respectively on evidence from the car, beer and coffee sectors, show that variable markups and distribution costs are indeed the most significant components of incomplete pass-through. See also Goldberg and Campa (2008) for macroeconomic estimates of distribution margins and their implications.

The rest of the paper is organized as follows. In Section 2 we describe the imperfect-competition model on export markets and derive our pass-through identification strategy. Section 3 presents the database. We provide and discuss the empirical results in Section 4. Section 5 concludes.

## 2 Optimal pass-through of VAT rate changes to export prices

### 2.1 Exporters' optimal prices

Consider a firm  $f$  selling goods  $k = 1, \dots, K$  on several destination markets  $l = 1, \dots, L$ . Let  $\tau_l$  be the VAT rate on destination market  $l$ ,  $Q_{fkl}$  the quantity of good  $k$  sold by firm  $f$  on market  $l$ ,  $\tilde{P}_{fkl}(Q)$  the (inverse) demand function for product  $k$  on market  $l$  and  $C_{fk}(\cdot)$  the variable production cost (including the VAT of the production country). The optimal price can be written as a markup over marginal cost,  $MC_{fk}$ , namely

$$\frac{\tilde{P}_{fkl}}{1 + \tau_l} \left( 1 - \frac{1}{\epsilon_{fkl}} \right) = MC_{fk} \quad (1)$$

where  $MC_{fk} \equiv \frac{\partial C_{fk}}{\partial Q_{fkl}}$  and  $\epsilon_{fkl} \equiv \frac{\partial \tilde{P}_{fkl}}{\partial Q_{fkl}} \frac{Q_{fkl}}{\tilde{P}_{fkl}}$  the price-demand elasticity for good  $k$  produced by firm  $f$  and sold on market  $l$ , that we assume strictly greater than 1. It is important to remark that, in contrast with the final price of the goods, the cost of production is not a function of the VAT rate abroad. As a consequence, VAT rate changes abroad affect the marginal product but not the marginal cost of a domestic exporter.

For notational convenience, let us index by  $i \equiv \{f, k, l\}$  a good of type  $k$  produced by firm  $f$  and sold on market  $l$ , and let  $P_i \equiv \frac{\tilde{P}_i}{1 + \tau_l}$  denote the corresponding optimal price net of VAT. As shown in equation (1), this optimal price is the product of a markup over marginal cost. In our model, the markup is specific to each unit  $i$  because the price-elasticity of demand depends on the target market, on the firm and on the type of good. Let us denote by  $\mu_i \equiv \left( \frac{\epsilon_i}{\epsilon_i - 1} \right)$  this markup. By contrast, the marginal cost is specific to a firm and to a particular type of good but does not vary across destinations. Using the log transformation, the optimal net price can be split into two terms, namely:

$$\log P_i = \log \mu_i + \log MC_{fk}$$

Note that the fact that the marginal cost  $MC_{fk}$  does not depend on the destination market means

that transport and distribution costs are excluded from the exporter's cost function. Hence, our model describes the optimal price of an exporter at the border of his own country, i.e. before tariffs, transportation and distribution costs are charged. However our specification does not preclude a good  $k$  produced by firm  $f$  being sold at a different price on different locations  $l$ . Those deviations from the law of one price can be initiated by differences across destinations in the elasticity of demand addressed to that firm/product. These differences in demand elasticities may indirectly derive from differences in transportation and distribution costs: a more costly distribution in one destination may reduce local demand for a given export price, hence reduce the demand elasticity. However, since VAT affects domestic and foreign-sourced value-added in the same way, distribution costs should be neutral regarding VAT pass-through.<sup>6</sup>

Our elasticity of demand is a general, unspecified function of the sector  $k$  specific elasticity of demand in country  $l$ ,  $\epsilon_{kl}$ , the relative market share of firm  $f$  on the market for good  $k$  in country  $l$ ,  $s_i \equiv \tilde{s}_i/\underline{s}_{kl}$ , with  $\tilde{s}_i \equiv P_i Q_i / \sum_{j \in (k,l)} P_j Q_j$ , firm's  $i$  market share, and  $\underline{s}_{kl}$  the smallest share on the market for good  $k$  in country  $l$ . We also assume that it depends on a set of firms' characteristics  $Z_f$ :

$$\epsilon_i \equiv \epsilon(\epsilon_{kl}, s_i, Z_f) \quad (2)$$

with  $\frac{\partial \epsilon_i}{\partial \epsilon_{kl}} > 0$  and  $\frac{\partial \epsilon_i}{\partial s_i} < 0$ . We also normalize  $\epsilon(\epsilon_{kl}, \bar{s}_{kl}, \bar{Z}_{f \in (k,l)}) = \epsilon_{kl}$ , with  $\bar{s}_{kl}$  the average relative share on market  $(k, l)$  and  $\bar{Z}_{f \in (k,l)}$  the average of firms characteristics across firms that operate on the market for good  $k$  on location  $l$ .

Along the lines of recent models of imperfect competition with heterogenous firms, we postulate that the relative market share of a firm is determined by

$$s_i = \frac{s(\theta_i, \underline{\theta}_{kl})}{s(\underline{\theta}_{kl}, \underline{\theta}_{kl})}, \quad \tilde{s}_i \equiv s(\theta_i, \underline{\theta}_{kl}) \quad (3)$$

where  $\theta_i$  is a parameter, typically productivity, that varies across firms and determines the market share of a given firm  $f$  on a market  $(k, l)$  and where  $\underline{\theta}_{kl}$  denotes the value of that parameter for the less profitable firm on market  $(k, l)$ . We make the assumption that the relative market share of a firm increases with the parameter  $\theta_i$  (productivity say)  $\frac{\partial s_i}{\partial \theta_i} > 0$ . By contrast, we leave the effect of

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<sup>6</sup>This is contrast with one strand of the recent literature on exchange-rate pass-through, where local distribution costs invoiced in the destination currency affect the amount of pass-through, see Corsetti and Dedola (2005) and Berman et al. (2009).

an increase in the cut-off value of productivity,  $\underline{\theta}_{kl}$ , on the relative market share of the remaining firms as undetermined:  $\frac{\partial s_i}{\partial \underline{\theta}_{kl}} \geq 0$ . Indeed, this depend on the market share variation of firms above the cut-off parameter values,  $\frac{\partial \tilde{s}_i}{\partial \underline{\theta}_{kl}} > 0$  compared to the market share reaction of the smallest firm on the market,  $\frac{\partial s_{kl}}{\partial \underline{\theta}_{kl}} > 0$ .

Equations (1), (2) and (3) describe a model of price setting under imperfect competition. This general description embeds several recent ones featuring firms heterogeneity and variable markups.<sup>7</sup>

## 2.2 Mark-up adjustments to VAT rate changes

A change in the VAT rate abroad has no direct effect on the marginal cost of an exporter. However, it could have an indirect one since, by changing the marginal revenue therefore profit, it will modify the scale of production of a firm. We discard this effect by assuming a constant marginal cost with respect to the quantities produced for a given destination country,  $\partial MC(y_{fk})/\partial y_{fkl} = 0$ .<sup>8</sup>

Under this assumption, the VAT rate change induces a variation in the optimal net price that equals the mere variation in the optimal mark-up, that is, differentiating equation (1)

$$\sigma(P_i) = \sigma(\mu_i) = \frac{-\sigma_{\epsilon_i}}{\epsilon_i - 1} \quad (4)$$

where  $\sigma_{\epsilon_i} = \frac{d\epsilon_i}{dP_i} \frac{P_i}{\epsilon_i}$  is the price elasticity of the demand elasticity, also sometimes called the *super-elasticity* of demand,  $\sigma(\mu_i)$  is the elasticity of the markup with respect to VAT, and  $\sigma(P_i) = \frac{dP_i}{d(1+\tau_l)} \frac{(1+\tau_l)}{P_i}$  is the elasticity of the net price with respect to VAT. This equation shows that, following an increase in VAT in the destination country, an exporter will find optimal to reduce its net price, hence its markup, if it faces a price-elasticity of demand that is an increasing function of the price level,  $\sigma_{\epsilon_i} > 0$ . By contrast, if its price-elasticity is constant,  $\sigma_{\epsilon_i} = 0$ , the exporter will not implement any net-price adjustment, hence no markup adjustment. Finally, the exporter will increase its markup if the price-elasticity is a decreasing function of the price level,  $\sigma_{\epsilon_i} < 0$ .

It is also interesting to study the consequences of these markup adjustments in terms of gross prices, *i.e.* how the tax increase is borne by the final consumers. By definition of the gross price,

<sup>7</sup>See Melitz & Ottaviano (2008) and Atkeson & Burstein (2009) for two recent examples.

<sup>8</sup>This amounts to consider either that firms have a constant marginal cost of production,  $\partial MC(y_{fk})/\partial y_{fk} = 0$ , or that the variation in a firm's production for a given destination country has no scale effect on the total production of that firm,  $\partial y_{fk}/\partial y_{fkl} = 0$ .

( $\tilde{P}_i = (1 + \tau_i)P_i$ ), its elasticity to the VAT rate is simply

$$\sigma(\tilde{P}_i) = 1 + \sigma(P_i) = 1 - \frac{\sigma_{\epsilon_i}}{\epsilon_i - 1} \quad (5)$$

This equality states that  $\sigma(\tilde{P}_i) = 1$ , *i.e.* the pass-through is complete, whenever the price elasticity of demand is constant  $\sigma_{\epsilon_i} = 0$ . In that case, an increase in the VAT rate will result in a one-for-one increase in the final price and VAT hike burden is fully passed on to the consumers. By contrast, the pass-through is incomplete,  $\sigma(\tilde{P}_i) < 1$  when  $\sigma_{\epsilon_i} > 0$ . In that case, both the final consumers and the exporters of the goods bear the cost of the tax. There is no pass-through at all when the elasticity of the demand elasticity is equal to the markup denominator, *i.e.*  $\sigma_{\epsilon_i} = \epsilon_i - 1$ . In that case the firm adjusts its markup in order to fully compensate for the rise in VAT rate:  $\sigma(\tilde{P}_i) = 0$ .<sup>9</sup>

It is worth emphasizing again that the above analysis holds for a shock that affects the optimal markup *while leaving the marginal cost constant*. When this condition is not satisfied, the total elasticity of the exporter's price to a shock will also include a term involving the marginal cost reaction to the shock. This is typically the case for exchange rate variations since at least some exporters rely on imported inputs.<sup>10</sup> Let  $P_i$  be the exporter's price in domestic currency and  $\tilde{P}_i$  the foreign-currency price of the exporter, the total elasticity of the exporter's price to the exchange rate is  $\sigma(P_i) = \sigma(\mu_i) + \sigma(MC_i)$ . The second term is likely to be negative due to the negative impact of an exchange-rate appreciation on imported input costs,  $\sigma(MC_i) \leq 0$ . Hence the pass-through to the final price will be due to markup adjustments,  $\sigma(\mu_i)$ , will be overrated.

### 2.3 Effects of VAT rate changes on competition

When firms are heterogeneous, the markup variations induced by the VAT shock will also imply a change in the extend of entry and exit on export markets. For example, in the case where an increase in the VAT rate leads to a contraction of markups,  $\sigma(\mu_i) < 0$ , the profitability of the market will be reduced. This will increase the minimum productivity level a firm has to satisfy in order to be profitable on a given market  $(k, l)$ ,  $\underline{\theta}_{kl}$ . Assuming the distribution of productivity across (existing and potential entrants) exporters is not affected by the shock, the exporters that

<sup>9</sup>Note that the model does not preclude situations where either  $\sigma(\tilde{P}_i) > 1$ , when super-elasticity of demand is negative,  $\sigma_{\epsilon_i} < 0$ , or  $\sigma(\tilde{P}_i) < 0$ , when the super-elasticity of demand is (relatively) high,  $\sigma_{\epsilon_i} > \epsilon_i - 1$ .

<sup>10</sup>[Mention the attempts to control for marginal costs + their criticisms; see (Goldberg & Knetter)].

are the less profitable will be swept out of export markets and some firms that are not operating on this export market will be deterred to enter.

Let  $\text{ex}_{kl} = \frac{n_{kl}^{\text{ex}}}{N_{kl}}$  be the exit rate on the export market  $(k, l)$ , *i.e.* the fraction of firms leaving the market,  $n_{kl}^{\text{ex}}$ , over the whole population of exporters on that market,  $N_{kl}$ . Similarly, let  $\text{en}_{kl} = \frac{n_{kl}^{\text{en}}}{N_{kl}}$  be the entry rate on market  $(k, l)$ , *i.e.* the fraction of new-competitors,  $n_{kl}^{\text{en}}$ , over the whole population of exporters on that market,  $N_{kl}$ . For markets where  $\sigma(\mu_i) < 0$ , raising the VAT rate will lead to lower entry rate and higher exit rate on export markets, namely

$$\frac{d\text{ex}_{klt}}{d\log(1 + \tau_{lt})} > 0, \quad \frac{d\text{en}_{klt}}{d\log(1 + \tau_{lt})} < 0. \quad (6)$$

Another consequence of change in the profitability on a given market  $(k, l)$  is that the cut-off point,  $\underline{\theta}_{kl}$  in the distribution of firms' productivity,  $\theta_i$ , that ensures that every exporters on a market are profitable will also be modified. In the case of a profitability loss, due to a fall in markup, only the more productive exporters survive the increase in the VAT rate. Under our specification of the relative market share,  $s_i$ , given in equation (3), the VAT shock leads to

$$\frac{d\log s_i}{d\log(1 + \tau)} = \left( \frac{\partial \log \tilde{s}_i}{\partial \underline{\theta}_{kl}} - \frac{\partial \log \underline{s}_{kl}}{\partial \underline{\theta}_{kl}} \right) \frac{\partial \underline{\theta}_{kl}}{\partial \log(1 + \tau)} \quad (7)$$

where we assume that firm's  $i$  productivity,  $\theta_i$ , is not affected by the shock,  $\frac{\partial \theta_i}{\partial \log(1 + \tau)} = 0$ . The expression underlines that the relative market share of the exporters can increase or decrease after the shock. This depends on whether the remaining firms increase their market share more than the increase necessary in order to stay profitable on that market, in which case  $\frac{\partial \log \tilde{s}_i}{\partial \underline{\theta}_{kl}} > \frac{\partial \log \underline{s}_{kl}}{\partial \underline{\theta}_{kl}}$ , or not.

This expected variation of the relative market share after the hike in the VAT rate calls for further decomposing the optimal markup adjustment induced by this variation. Totally differentiating exporter's  $i$  the elasticity function,  $\epsilon_i = \epsilon(\epsilon_{kl}, s_i, Z_f)$  given by equation (2) and postulating that firm's specific determinants of that elasticity,  $Z_f$ , stay unchanged after the change in VAT so that  $\frac{\partial \log Z_f}{\partial \log(1 + \tau)} = 0$ , one gets

$$\sigma_{\epsilon_i} \equiv \frac{d\log \epsilon_i}{d\log(1 + \tau)} = \underbrace{\left( \frac{\partial \epsilon_i \epsilon_{kl}}{\partial \epsilon_{kl} \epsilon_i} \right) \frac{\partial \log \epsilon_{kl}}{\partial \log(1 + \tau)}}_{\text{Demand}} + \underbrace{\left( \frac{\partial \epsilon_i s_i}{\partial s_i \epsilon_i} \right) \frac{\partial \log s_i}{\partial \log(1 + \tau)}}_{\text{Competition}}$$

The change in the elasticity of demand in reaction to the increase in VAT can be split into two terms: (i) a demand driven term stemming from variation in the sector-specific elasticity of demand in a given country  $\epsilon_{kl}$ , and (ii) a competition driven term associated with shifts in the relative market share.

Interestingly, the two terms can have opposite effects on the *super-elasticity of demand*. This comes from two properties of the model. First of all the demand elasticity and market share functions specified respectively in equations (2) and (3) imply  $\left(\frac{\partial \epsilon_i \epsilon_{kl}}{\partial \epsilon_{kl} \epsilon_i}\right) > 0$  and  $\left(\frac{\partial \epsilon_i s_i}{\partial s_i \epsilon_i}\right) < 0$ . Second of all, the reaction of the relative market share to a VAT shock is undetermined as shown in equation (7).

VAT hike in one destination tends to raise the VAT-included prices of all exported goods to that destination. Assume that the demand for export is “regular” in the sense that this increase in the export prices increases the elasticity of demand, so that  $\frac{\partial \log \epsilon_{kl}}{\partial \log(1+\tau)} > 0$ . This will involve a drop in export markets profitability,  $\frac{\partial \theta_{kl}}{\partial \log(1+\tau)} > 0$ . Following equation (7), this can increase decrease the relative market share of the remaining exporters  $\frac{\partial \log s_i}{\partial \log(1+\tau)} > 0$ . Theoretically, this decrease in competition after the shock can be large enough to completely offset the initial increase in the elasticity of demand after the VAT shock and induce a fall in this elasticity instead.

Inserting this decomposition of the *super-elasticity* of demand,  $\sigma_{\epsilon_i}$ , into equation (4) leads to an optimal markup — therefore net price — reaction to a VAT-rate change equal to

$$\sigma(\mu_i) = \sigma(P_i) = \frac{-1}{\epsilon_i - 1} \left[ \left( \frac{\partial \epsilon_i \epsilon_{kl}}{\partial \epsilon_{kl} \epsilon_i} \right) \frac{\partial \log \epsilon_{kl}}{\partial \log(1 + \tau)} + \left( \frac{\partial \epsilon_i s_i}{\partial s_i \epsilon_i} \right) \frac{\partial \log s_i}{\partial \log(1 + \tau)} \right] \quad (8)$$

The higher the elasticity rises and the relative market share drops in the wake of the increase in VAT rate increase, the larger the markup decreases.

In the next section we present an empirical strategy that aims at estimating the total pass-through coefficient, the reaction of competition and the impact of competition on markup adjustments.

### 3 Econometric modeling

#### 3.1 Estimating pass-through coefficients

Remarking that by definition  $\sigma(P_i) = \frac{d \log P_i}{d \log(1 + \tau_i)}$ , equation (4) can be re-written in log-linear form as:

$$d \log P_i = \frac{-\sigma_{\epsilon_i}}{\epsilon_i - 1} d \log(1 + \tau_i) \quad (9)$$

Let  $p_i \equiv \log P_i$  and assume that the price for product  $i$  is observed at successive dates  $t = 1, \dots, T$ .

Equation (9) translates into the following empirical counterpart:

$$\Delta p_{it} = -\sigma_{\epsilon_i} \left( \frac{1}{\epsilon_i - 1} \right) \Delta \log(1 + \tau_{it}) + \Delta e_{it} \quad (10)$$

where  $\Delta e_{it}$  controls for variations in (log) demand and marginal costs that are unrelated to changes in the VAT rate.

We assume the following, general decomposition for  $\Delta e_{it}$ :

$$\Delta e_{it} = \alpha_i + \theta_t + \gamma' \Omega_{it} + u_{it}, \quad \mathbb{E} \{ u_{it} | \theta_t, X_{it} \} = 0 \quad (11)$$

where  $\Omega_{it}$  represents macroeconomic factors specific to the destination market  $l$ , to the industry sector  $k$  and the firm  $f$  that will affect demand for imports of good  $i$  (lagged variables being potentially part of them).

We assume that VAT-rate changes are exogenous so that:

$$\mathbb{E} \{ \Delta u_{it} | \theta_t, \Omega_{it}, \Delta \log(1 + \tau_{it}) \} = \mathbb{E} \{ \Delta u_{it} | \theta_t, \Omega_{it} \} = 0$$

The exogeneity assumption is justified by the fact that VAT-rate changes are exogenous political decisions. However it may be the case that the assumption fails to hold if firms have production technologies with increasing returns. Then, a change in aggregate demand induced by a change in VAT will modify the scale of production and therefore affect the marginal cost. To the extent that exports to a specific country (where the VAT rate has been changed) represents a limited fraction of total output, this increasing-return argument does not appear compelling, though. We control for the size of production of each good in each firm through introducing unit- $i$  fixed effects.

Finally, we assume that the elasticity of the demand elasticity is homogenous across unit goods  $i \equiv \{f, k, l\}$ :

$$\sigma_{\epsilon_i} = \sigma \quad \forall i \quad (12)$$

This homogeneity assumption only applies to the *super-elasticity* of demand and does not constraint the markup adjustment to VAT rate changes (hence the degree of pass-through of such shocks to final prices) to be homogenous across firms or across products. On the contrary, the specification implies an heterogenous reaction of markup adjustment to VAT changes across firms and products given by  $\frac{-\sigma}{\epsilon_i - 1}$ . Everything else being constant, the markup reaction decreases with the elasticity of demand. When the elasticity goes to infinity, that is when competition is fierce, there will be no markup adjustment (and the shock will be completely pass through the final price).

Letting  $\Delta\tau_{it}^\epsilon \equiv \left(\frac{1}{\epsilon_i - 1}\right) \Delta \log(1 + \tau_{it})$ , be a VAT rate changed divided by the elasticity of substitution an exporter is facing on a given market, so that the greater the elasticity, the smaller the impact on markup for a given level of *super-elasticity*. This normalization of the shock is intuitive: for markets with a high demand elasticity, the markup is low, and therefore the potential markup adjustment, in comparison with a market where this elasticity is low. The normalization therefore converts the VAT-shock to market specific relative VAT shocks, so that the different markup adjustments be comparable across markets with different elasticity. Using equations (11) and (12), one can rewrite equation (10) into the following (fixed effect) panel data model:

$$\Delta p_{it} = \alpha_i + \theta_t - \sigma \Delta\tau_{it}^\epsilon + \gamma' \Omega_{it} + u_{it}, \quad E\{u_{it} | \theta_t, \Delta\tau_{it}^\epsilon, \Omega_{it}\} = 0$$

$i = 1, \dots, n, t = 1, \dots, T$ . However the empirical estimation of this model needs to cope with the fact that the regressor  $\Delta\tau_{it}^\epsilon$  requires the knowledge of goods  $i$  elasticity of demand  $\epsilon_i$  in order to be observed. We deem estimating elasticities of substitution at such a disaggregated product/location level would be flawed by too much estimation imprecision. We therefore prefer to tackle this issue by approximating  $\epsilon_i$  with consistent sectoral/country elasticity estimates  $\hat{\epsilon}_{sl}$  that would be close to  $\epsilon_{sl}$  when estimated on a large sample. We consequently approximate  $\Delta\tau_{it}^\epsilon$  by:

$$\Delta\tau_{slt}^\epsilon \equiv \left(\frac{1}{\hat{\epsilon}_{sl} - 1}\right) \Delta \log(1 + \tau_{it}),$$

and work with the following empirical model of export prices:

$$\Delta p_{it} = \alpha_i + \theta_t - \sigma \Delta\tau_{slt}^\epsilon + \gamma' \Omega_{it} + \tilde{u}_{it}, \quad E\{\tilde{u}_{it} | \theta_t, \Delta\tau_{slt}^\epsilon, \Omega_{it}\} = 0. \quad (13)$$

Estimation of equation (13) returns an estimate for  $\sigma$ . Relying on equations (4) and (5), we can recover sectoral/country estimates of, respectively, optimal markup adjustments and pass-through coefficients using the formulas:

$$\widehat{\sigma}(\mu_{sl}) = -\frac{\widehat{\sigma}}{\widehat{\epsilon}_{sl} - 1}, \quad \widehat{\sigma}(\widetilde{P}_{sl}) = 1 - \frac{\widehat{\sigma}}{\widehat{\epsilon}_{sl} - 1} \quad (14)$$

[Explain why we don't estimate  $\sigma_{kl}/(\epsilon_{kl} - 1)$ : we need cross section variation in  $\Delta\tau_{slt}^\epsilon$ , since  $\Delta(1 + \tau_{lt})$  behaves as a time/country specific dummy and therefore would capture every effects on export prices specific to country  $l$  and date  $t$ . Introduce heterogeneity, see next subsection.]

### 3.2 Estimating changes in competition

When firms are heterogeneous, the markup variations induced by the VAT shock will also imply a change in the extend of entry and exit on export markets. In the case where an increase in the VAT rate leads to a contraction of markups,  $\sigma(\mu_i) < 0$ , the entry rates will decrease and the exit rates will increase.

These theoretical predictions of equation (6) can be assessed empirically by looking at a regression of the entry and exit rates,  $\text{en}_{klt}$  and  $\text{ex}_{klt}$  on the VAT shocks, normalized with the market specific elasticity of substitution,  $\Delta\tau_{slt}^\epsilon$ , controlling for other potential determinants,  $\Omega_{klt}$ . One has to tackle the specificity that, by definition, entry and exit rates take their values over the  $[0, 1]$  interval. We take this constraint into account by transforming the regressors of interest respectively into  $\log[r(\text{en}_{klt})] = \log[\text{en}_{klt}/(1 - \text{en}_{klt})]$  and  $\log[r(\text{ex}_{klt})] = \log[\text{ex}_{klt}/(1 - \text{ex}_{klt})]$  and regress them on  $\Delta\tau_{slt}^\epsilon$  and a set of control variables  $\Xi_{klt}$ , allowing for market  $(k, l)$  fixed effects and time dummies, namely

$$\begin{aligned} \log[r(\text{en}_{klt})] &= c_{kl}^n + m_t^n - b_n \Delta\tau_{slt}^\epsilon + g_n' \Xi_{klt} + v_{klt}^n \\ \log[r(\text{ex}_{klt})] &= c_{kl}^x + m_t^x - b_x \Delta\tau_{slt}^\epsilon + g_x' \Xi_{klt} + v_{klt}^x \end{aligned} \quad (15)$$

Another prediction of model is given by equation (7): relative market share will be affected by the variation in the VAT rate due to markup adjustments,  $\sigma(\mu_i)$ , and the resulting changes in the level of productivity necessary to participate on exports markets,  $\theta_{kl}$ . We can investigate empirically this prediction by regressing the log relative market share  $\log s_{it} = \log\left(\frac{\widetilde{s}_{it}}{\underline{s}_{klt}}\right)$  on the normalized

VAT rate shock  $\Delta\tau_{slt}^\epsilon$  and a set of controls  $\Omega_{it}$ , allowing for individual product  $i$  fixed effects and time dummies.

$$\log s_{it} = c_i^s + m_t^s - b_s \Delta\tau_{slt}^\epsilon + g_s' \Omega_{it} + v_{it}^s \quad (16)$$

While the theoretical prediction is ambiguous for the relative market share, the smallest market share on a given export market,  $\underline{s}_{klt}$  decreases when markups contract after the VAT rate hike,  $\sigma(\mu_i) < 0$ . This prediction can be tested separately by regressing the following transformation of the minimum market share  $\log[r(\underline{s}_{klt})] = \log[\underline{s}_{klt}/(1 - \underline{s}_{klt})]$ , since the market share is also a fraction, on the normalized VAT rate shock  $\Delta\tau_{slt}^\epsilon$  and a set of controls  $\Xi_{klt}$ , allowing for individual product  $i$  fixed effects and time dummies.

$$\log[r(\underline{s}_{klt})] = c_i + m_t - b \Delta\tau_{slt}^\epsilon + g' \Xi_{klt} + v_{klt} \quad (17)$$

### 3.3 Estimating markup reactions taking competition changes into account

It can be interesting to investigate to what extent the variation in competition contribute to the markup adjustment and the incomplete pass-through. This can be done by estimating the following empirical counterpart of equation (8):

$$\Delta p_{it} = -\kappa_i \left( \frac{1}{\epsilon_i - 1} \right) \Delta \log(1 + \tau_{lt}) + \phi_i \Delta \log s_{it} + \Delta e_{it}$$

with  $\kappa_i \equiv \left( \frac{\partial \epsilon_i \epsilon_{kl}}{\partial \epsilon_{kl} \epsilon_i} \right) \frac{\partial \log \epsilon_{kl}}{\partial \log(1 + \tau_{lt})}$  and  $\phi_i \equiv - \left( \frac{\partial \epsilon_i s_i}{\partial s_i \epsilon_i} \right) \frac{1}{\epsilon_i - 1}$ , and where  $\Delta e_{it}$  still represents variations in (log) demand and marginal costs for unit good  $i$  that are not related to VAT-rate changes and for which we can postulate the same general decomposition as given in equation (11). We also constraint the parameters  $\kappa_i$  and  $\phi_i$  to be homogeneous across goods items  $i$ :  $\kappa_i = \kappa$  and  $\phi_i = \phi \forall i$ . As previously, we approximate the unobserved unit good  $i$  demand elasticity by sectoral/country estimates  $\widehat{\epsilon}_{sl}$  and construct the variable  $\Delta\tau_{slt}^\epsilon$  to finally consider the following empirical model:

$$\Delta p_{it} = \alpha_i + \theta_t - \kappa \Delta\tau_{slt}^\epsilon + \phi \Delta \log s_{it} + \gamma' \Omega_{it} + \tilde{u}_{it}, \quad \text{E} \{ \tilde{u}_{it} | \theta_t, \Delta\tau_{slt}^\epsilon, \Omega_{it} \} = 0. \quad (18)$$

A difficulty is then to address the endogeneity of the market share in that equation. Indeed, the market share and the price on a market are jointly determined so that  $\text{E} \{ \tilde{u}_{it} | \Delta \log s_{it} \} \neq 0$  and the parameter  $\phi$  cannot be estimated by simply adding  $\Delta \log s_{it}$  to the price-variation regression.

To infer the contribution of market share to incomplete pass-through, and to disentangle this effect from a pure demand reaction, we rely on the predetermination of the past market share  $s_{it-1}, s_{it-2}, \dots$  so that

$$E\{\tilde{u}_{it} | \log s_{it-1}, \Delta \log s_{it-1} \dots\} = 0.$$

This assumption implies that one can use past values of the market share as instruments for  $\Delta \log s_{it}$  in equation (18).

### 3.4 Dealing with firms' heterogeneity

A first type of heterogeneity that is natural to consider is related to the possibility of entry and exit on a given export market discussed in the previous subsection. At the time of the shock, the markup adjustment renders some firms unprofitable so that they will exit the market at the end of this period. It is therefore of interest to see whether the markup adjustment of the whole population of exporters, which result from the combination of the extensive and intensive margins, differs from the behavior of the firms that survive after the shock, which gives the mere intensive margin. This distinction can be implemented by estimating equation (13) for the surviving exporters only.

Looking at equation (8), the markup reaction is potentially a function of the type of firm and market considered. One can relax the assumption that the reaction of the endogenous variables to the normalized VAT-rate change is homogenous across the units (a given firm on a given market,  $i$  or a given market  $kl$ ) of the panel regressions that are considered above. We can introduce a degree of heterogeneity in the previous panel regressions of the subsections above by estimating them for different subsets of the whole sample. More precisely we group the total population of exporters into quartiles according to two classification criteria: the market power of a firm on a given market, as measured by the share on a given market,  $s_i$ , and the concentration of the a given export market as measured by the usual Herfindahl index,  $H_{kl} = \sum_{i \in (k,l)} \tilde{s}_i$ . This two criteria can also be combined.

## 4 Data

The dataset provided by the French customs administration contains annual exports by country of destination at the firm and product level for the period 1996-2005.<sup>11</sup> Contrasting with many other sources of firm-level information, the French customs data are (almost) exhaustive.<sup>12</sup> Each observation is identified by a firm identifier  $f$ , a product identifier at the 8-digit level of disaggregation  $k$ , an export destination  $l$  and a time period  $t$ . Unit values are computed as ratios of value over volume, the latter being expressed as the physical weight of the product in kilograms. These unit values are used as proxies for FOB export prices at the unit good  $i$  level:  $P_{fkl} \equiv P_{it}$ . Note that using weights instead of physical units to calculate unit values may result in a less precise proxy for prices. However, this measurement error will not lead to the classical attenuation bias in our empirical analysis since this measurement error affects the dependent variable and is not related to exogenous shifts in VAT rates, although it may reduce the precision of our estimates. Another critique that is commonly addressed to the use of unit values is that they hide quality differences across goods (see Kravis and Lipsey (1974)). However, our estimation procedure at least partly handles this issue by including fixed effects that are specific to each unit  $i$ , i.e. specific to a good  $k$  produced by a firm  $f$  and sold in a destination market  $l$ . This corrects for constant vertical differentiation across products, firms and countries.

The French customs' database tracks the same firm over the whole 1996-2005 period. We can therefore observe whether a firm  $f$  enters or exits a market  $k, l$  at a specific date  $t$  and calculate entry and exit rates that will shed line on the evolution of the number of competitors following a VAT shock.<sup>13</sup> We define the entry rate  $en_{klt}$  as the percentage of firms that were not present on market  $(k, l)$  at date  $t - 1$  but entered at  $t$ , i.e. the year during which the shock occurs. In turn, the exit rate  $ex_{klt}$  is defined as the percentage of firms that were present in market  $(k, l)$  at date  $t$

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<sup>11</sup>This database has been already used by Eaton and Kramarz (2004), Berthou and Fontagné (2008), Mjean and Schwellnus (2009), Berman et al. (2009). The sample covers 1995-2005, but due to a change in the nomenclature of products in 1996, year 1995 has been dropped here. To circumvent changes in declaration thresholds over time, we also dropped firms that declared *total* exports to the European Union of less than EUR 100,000.

<sup>12</sup>Below a threshold of 1,000 euro, firms do not have to declare their exports. Below a threshold of 150,000 euro, firms exporting only to the EU do not have to declare their export volumes. These two thresholds are very low, so in practice the dataset includes most French exporters.

<sup>13</sup>Although French exporters also face competitors from other countries as well as local competitors, competition among French exporters selling the same good  $k$  may be the harshest since their products are more likely to be close substitutes. As a matter of fact, our database does not include any information on local and foreign, non-French competition. See Auer & Chaney (2009) for related arguments.

but absent in  $t + 1$ , so that they exit the market after the shock.

In our study, we restrict the database to exports that are shipped to the set of 11 countries (other than France) that were in the euro area in 2001.<sup>14</sup> In addition to the free movement of goods and services (no border tariffs, no export/import quotas), this subset of countries presents the advantage to have been almost preserved from intra-area exchange-rate fluctuations between 1995 and 1999, and totally preserved from 1999 onwards. Selecting this sample allows us to get rid to this major source of international price variations. However, as argued above, export prices may react not only to local VAT-rate changes, but more generally to any macroeconomic shock. We control for these variations by introducing time dummies, which capture for the shocks that are common to all euro area Member states, and country-specific macroeconomic factors namely real GDP growth and inflation rates (from Eurostat), plus real GDP per capita (from Penn World tables).

We also restricted our analysis to final consumption goods since the tax is supported by the final consumer and because it can be argued that exporters on intermediate goods should be unaffected by VAT changes in target countries since VAT is generally recovered by the importing firm. Note however that, in fact, to the extent that intermediate inputs and final goods produced by the importer are being applied the same VAT rate (generally the standard rate), changes in VAT can have the same impact on price strategies of firms selling either intermediate or final goods: both types will have to face the same percentage change in final demand. However, this reaction is less direct and involve chain margin adjustments that may be complex. Moreover some intermediate inputs may be applied different VAT rates compared to final goods they allow the importer to produce. These could therefore blur the price reaction of exporters of intermediate goods to a change in the VAT rate.

Sectoral price-elasticities of demand are recovered from Broda and Weinstein (2006). We obtain 1523 observations for 9 countries. On average we have roughly 170 sectors per country classified at the 3-digit level. As shown in Figure 1, the distribution of these elasticities over our sample is quite concentrated around 3-4. Table 1 further shows that countries have comparable average, median, min and max sectoral price elasticities of demand.<sup>15</sup>

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<sup>14</sup>The euro area was launched in 1999 with 10 countries plus France. Greece joined in 2001.

<sup>15</sup>The highest elasticity of the sample is 1560 but only 26 observations are greater than 30. Dropping them, as is done in Figure 1, modifies significantly average and median elasticities. For instance, the average falls from 7.02 to

Table 2 provides some descriptive statistics for our sample of French exporters, together with price elasticities of demand corresponding to firm sectors, taken from Broda and Weinstein (2006).<sup>16</sup> The table shows that the median French exporter sells a specific good to three different euro-area destinations (excluding Belgium) where it competes with 42 other French exporters and faces a price elasticity of demand of 3.3. The median French exporter sells 24 different goods to worldwide. The minimum number of goods sold to each market is one. This confirms the quasi-exhaustiveness of our data set which includes small firms exporting a single good. The maximum number of goods sold is 1762. The median elasticity of demand is 3.3, implying a median markup of 1.4 - a relatively large figure compared to usual macroeconomic references (see, i.e., Rotemberg and Woodford (1992)). Note however that the distribution is skewed to the right: the average elasticity is 4.8, implying a markup of 1.25.

Finally, VAT rates are taken from European-Commission (2009). As shown in Table 3, standard VAT rates were changed eight times over the 1996-2005 period. Only one change was a cut (Ireland in 2001, a measure that was reversed the following year). In all other cases, the standard rate was raised, most of the time by one percentage point. As for reduced rates, our sample covers three changes, all being upward.<sup>17</sup> These various changes in VAT rates were matched with our firm-level export data by identifying the product categories concerned by the changes.<sup>18</sup> As apparent in Table 3, most VAT changes happened at the beginning of the year. However, in some cases, VAT rates changed at mid-year or even in the fall. Since our export data is yearly, we could not exploit the monthly information on VAT rates. In order not to multiply VAT-rate events, we chose not to interpolate the rates. Hence, any change in VAT occurring during year T was assumed to apply during the whole year.

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4.44.

<sup>16</sup>Here, again, the 26 elasticities greater than 30 have been dropped. We also excluded Belgium as a destination because of the unavailability of demand elasticities for this country.

<sup>17</sup>We did not account for eight very small, successive changes in the Irish super-reduced rate for we could not match these super-reduced rates with the exact NC8 products.

<sup>18</sup>The car industry was handled the same way as the other sectors since the origin-principle only applies to imports carried out by individuals whereas most imports are made by intermediaries and are applied a destination principle.

## 5 Results

### 5.1 Markup adjustment and incomplete pass-through to international prices

We estimate equation (13) using the Arellano-Bond procedure as our controls include a lagged value of the endogenous variable. The results are displayed in Columns (1) of Table (4). We postpone the discussion of columns (2) & (3) to the Section 5.3 below.

The result in Column (1) of Table (4) show that a rise in the VAT rate of a destination country induces a fall in the producer price to that country. The coefficient ( $\hat{\sigma}$ ) associated with the VAT shock regressor ( $\Delta\tau slt^\epsilon$ ) is an estimate for the the elasticity of the demand elasticity. So the results show that in the wake of a VAT hike in a destination country French exporters face a rise in the elasticity of demand in this market due to the induced increase in prices in this destination country. This increase in the elasticity of demand command them to reduce their markup.

The estimation allow us to recover the markup adjustment,  $\hat{\sigma}(\mu_{sl})$ , as well as the pass-through to the price charged to the final buyer,  $\hat{\sigma}(\tilde{P}_{sl})$ , that are induced by a 1% increase in a destination country VAT rate. For that one simply need to interact the super-elasticity coefficient estimate ( $\hat{\sigma}$ ) with sectoral price elasticities of demand ( $\hat{\epsilon}_{sl}$ ) using equation (5). Table (1) reports that the average elasticity is equal to 4.76 for our sample of final consumption goods, so we obtain an average markup adjustment equal to  $\hat{\sigma}(\mu_{sl}) = -(1.89/3.76) \simeq 50\%$  and a pass-through to final prices equal to  $\hat{\sigma}(\tilde{P}_{sl}) = 1 - \hat{\sigma}(\mu_{sl}) \simeq 50\%$ . This result is greater than the results usually reported in the pass-through literature using micro data, which is typically much lower than 50% [ADD REFERENCES]. This is in line with the fact that we focus on exogenous, permanent, symmetric shocks that moreover leave the marginal cost constant. Still, and strikingly since we tame the incomplete pass-through mechanism, the extent of incomplete pass-through to that particular type of shocks is sizeable.

[Broda-Weinstein work on HS3. Data are NC8. Higher aggregation means lower elasticities,  $\epsilon_{sl} < \epsilon_i$ . This does not bias our results but just re-normalize the super-elasticity estimate]

[Say estimation uncertainty does not affect distribution of  $\hat{\sigma}$ . However, it affects the distribution of estimates  $\hat{\sigma}(\mu_{sl})$ ,  $\hat{\sigma}(\tilde{P}_{sl})$ . The distribution will involve the standard errors of each Broda-Weinstein

estimates,  $\widehat{\epsilon}_{sl}$ . Unfortunately, we don't have that information. We can however derive the explicit expression for the variance of each  $\widehat{\sigma}(\mu_{sl})$  as a function of the variance of  $\widehat{\epsilon}_{sl}$ . It shows that the contribution of this unreported estimation uncertainty should be small as it is divided by a factor  $(\widehat{\epsilon}_{sl} - 1)^4$ .]

Finally some effect among our control variables are also worth mentioning. French exporters react to higher growth in the destination country,  $y_{lt}$  by raising their prices. More surprising is the result that inflation in the destination,  $\pi_{lt}$  country has no effect on the prices of French exportation to that country. This might reflect the fact that import prices account for a small share of total CPI inflation in the destination country. Keeping everything else constant, exporters increase their price by a lower amount in less-wealthy (as measured by real GDP per capita,  $y_{lt}^c$ ) destination countries. Additionally, firms exporting goods to a larger number of countries,  $n_{ft}^l$ , tend to increase their prices to a greater extend. These firms are probably bigger than the average one and therefore able to reap more market power on their markets. Likewise, the number of product  $n_{ft}^l$  exported by a firm has a positive effect on price changes.

As we underline in the next subsections, the exporters' population reacts to the VAT shock. This reaction of competition affects the optimal pass-through of each remaining exporter.

## 5.2 The reaction of entry, exit & competition

Table (5) reports the estimation results for the effect of VAT shocks on entry and exit rates on a given  $(k, l)$  market. Table (6) provides the estimated reaction of the average market share,  $\bar{s}_{klt}$ , the minimum market share  $\underline{s}_{klt}$  and the relative market share of a firm on a specific market,  $s_{it}$ . Except for the latter, the regressions are on average values of the variables for a given  $(k, l)$  market. Again, we use the Arellano-Bond estimation procedure as our controls include a lagged value of the endogenous variable.

As predicted by theory, Table (5) shows that the drop in market profitability associated that the VAT shock increases the exit rate and decreases the entry rate in about the same proportion. As a consequence, a rise in VAT in the target country reduces competition among French exporters. These results are qualitatively comparable with Berman et al. (2009) who find a significant impact of an exchange-rate depreciation on the entry probability, based on the same data set.

This fall in the number of competitors is also to be seen in the reaction of the average market share,  $\bar{s}_{klt}$ , on market  $(k, l)$  since by definition the average market share verifies  $\bar{s}_{klt} = 1/N_{klt}$ . Column (1) in Table (6) shows that indeed this average market share increases in the wake of a positive VAT shock.

In a world with symmetric firms, the reduction in the number of competitors increases the market share of the remaining firms but leaves their relative market share, and therefore their perceived elasticity of demand, (*i.e.* their market power), constant. This is not anymore the case when firms are heterogenous. Indeed, the VAT hike will decrease the number of competitors therefore increase the market share of the remaining ones, but it will also increase the lower market share for which exporting on a given market is profitable. So the variation in the market power of a firm as measured by the change in its relative market share can decrease or increase after the increase in the VAT rate. Column (2) in Table (6) show that indeed raising the VAT rate increases the minimum market share of export market participants,  $\underline{s}_{klt}$ . Column (3) in the same Table shows that the relative market share,  $s_{it}$ , on the contrary decreases. Thus, on average, the market share of the remaining exporters increases by less than the minimum market share ensuring profitability, so that the market power of these remaining exporters decreases after the VAT shock.

In the following, we explore how the competition channel, *i.e.* the fact that a VAT-rate increase reshape the competition among surviving firms, interacts with markup adjustment and the degree of pass-through of the VAT shocks to final prices.

### 5.3 Change in competition, markup adjustment & incomplete pass-through

The change in the population of exporters calls for two extensions of our first markup adjustment reported in Section 4.1. First, measuring to what extent the reaction of the firms that do not exit markets one year after the shock differs from the reaction of firms that do exit. Second estimating the contribution of this change in competition in the markup adjustment, according to equation (8) of our theoretical setup.

To answer the first question, we re-estimate our basic regression (13), again resorting on the Arellano & Bond method, but for the population of product items  $i$  that are still present after the shock, *i.e.* removing from the estimation sample the units  $i$  that disappear one period after the shock.

The results are reported in Column (2) of Table (4). They show that the markup adjustment, and therefore incomplete pass-through, results are robust to removing those firm-product-country items  $i$  that do not survive the VAT shock. The effect of a VAT hike on exporters' optimal price is significantly negative with an implied average markup adjustment of  $\hat{\sigma}(\mu_{sl}) = -2.14/3.76 \simeq 57\%$  implying an average pass-through to final prices of  $\hat{\sigma}(\tilde{P}_{sl}) = 43\%$ . The markup adjustment is thus somewhat higher than, but close to, the reaction of the whole population of exporters (50%). The difference in the two super-elasticity of demand estimates,  $\hat{\sigma}$ , is not significant, which confirms that the two figures are close in comparison to the estimation uncertainty.

To answer the second question we estimate the panel equation (18) that disentangle between a pure demand-elasticity channel (controlling for a given market share) and a competition channel (controlling for the product-country specific elasticity of demand) in the net-price reaction to a VAT shock. On top of dealing with the issue of the lagged endogenous variable in a panel data, implementing the Arellano and Bond procedure allows us to tackle the endogeneity of the relative log market share,  $s_i$ . Under our assumption of predetermination of the market share change  $\Delta \log s_{it}$  it can be instrumented, as done in this procedure, by the combination of the lagged variations  $\Delta \log s_{it-1}$ ,  $\Delta \log s_{it-2}$ ,  $\Delta^2 \log s_{it-1}$ ,  $\dots$ . Likewise, we postulate the average market share variation,  $\Delta \log \bar{s}_{klt}$ , is predetermined and instrument it accordingly with a combination of its own past values.

Column (3) in Table (4) reports the estimation results, for the population of exporters that survive to the shock. Both instrumented variations in individual relative and average market shares have a significant positive impact on export prices. Controlling for this variation in market shares lowers the pure demand impact of VAT shocks on net prices: for a given market share, exporters' markups fall by a smaller extent following a VAT hike than when market share is not controlled for. Indeed, our results in Table (6) showed that the relative market share of the exporter falls after the shocks calling for a reduction of the markup due to lower market power. However, while significant, these effects of changing competition on markup adjustment are small. The coefficient associated with the VAT shock variable, *i.e.* the pure effect of the variation in demand elasticity according to equation (18), is not significantly different from the estimated super elasticity of Column (2), that is without controlling for market share variations. Put it differently, the pure demand elasticity implies an average markup adjustment of  $\hat{\sigma}(\mu_{sl}) = -1.91/3.76 \simeq 53\%$  very close to the total 57%

obtained without controlling for variations in competition.

[Broda-Weinstein postulate no entry-exit when estimating  $\epsilon_{sl}$ . We do rather and therefore should have time variations in  $\epsilon_{sl}$ . We view average figure  $\epsilon_{sl}$  as a good approximation of the elasticity level around which we identify the effects of the VAT shock.]

All in all these results show that the crucial role of changes in the elasticity of demand to account for the average markup adjustment and incomplete pass-through. They also point out that the average reaction of surviving exporters is almost similar to the average reaction of the whole population. The low average pass-through over the whole population of exporters does not result from a composition effect of these exporters, the ones that exit being the ones that pass-through the most, and the ones that survive being the ones that can adjust their markup up the most

In the next section, we show that these average figure estimates conceal heterogenous reaction across different types of exporters. We focus on two characteristics: the market share of the firm and the degree of concentration of the market on which they operate, measured by the standard Herfindahl index.

#### 5.4 The heterogenous reaction of exporters

We investigate the heterogenous reaction of firms in several dimensions. First, we split the whole population of exporters into four quartiles of relative market shares. We denote  $Q_4^s$  the indicator variables selecting firms belonging to the fourth quartile of relative market shares, namely the exporters in the top 25% relative market-shares. Similarly  $Q_3^s$ ,  $Q_2^s$  and  $Q_1^s$  are indicator variables selecting firms in the third, second and first quartiles of relative market shares. Second we also split the whole sample into four quartiles of market concentration measured by the usual Herfindahl index,  $H_{klt} = \sum_{i \in (k,l)} \tilde{s}_{it}$ . We can also interact these two criteria and distinguish, for instance, the behavior of relatively big firms in concentrated markets from the one of relatively big firms in competitive markets.

Table (7) describes the heterogeneous markup reaction of exporters. Column (1) recalls, as a reference estimate, the result obtained when estimating equation (18) for the whole population of firms that stay even one year after the shock. The pure demand elasticity variation is then equal to

$\hat{\kappa} = 1.99$ . Column (2) consider the possibility of a different reaction to the VAT rate change for the different quartiles of the relative market share. This is done by including the VAT shock multiplied by each quartile dummy,  $\tau_{it}^{\epsilon} \times Q_4^s$ ,  $\tau_{it}^{\epsilon} \times Q_3^s$ ,  $\dots$ , as regressors in the estimation of equation (18). The results show that markup adjustment varies with the relative share of the exporters. The firms that adjust the most their markup to the shock are the one with the smallest relative market shares, with a demand elasticity variation of  $\hat{\kappa} = 7.99$ . Firms with a higher relative market exhibit much smaller markup adjustments, the effect being even non-significant for the second and third quartiles, and significant for the top market share quartile, with a demand elasticity variation of  $\hat{\kappa} = 1.65$ . The result therefore show that this markup adjustment due to changes in pure demand elasticity is a non monotonic function of the markets share.

We then undertake the same decomposition of the reaction to the VAT shock among exporters with different relative market share on four different sub-samples selected according to their market concentration degree. More precisely columns (3) to (6) provide the results for firms belonging to each of the market concentration quartiles, going from the most concentrated markets to the least concentrated ones. Again the heterogeneity of the reaction is striking. Whatsoever the market concentration, firms with the lower market share are the one that lower their markup the most. For most market concentration quartile the adjustment is a non-monotonic function of the market share. The two extreme market concentration quartiles are particularly worth being compared. For highly concentrated markets, firms with a high relative market share react to the VAT shock by increasing their producer price therefore their markup ( $\hat{\kappa} = -3.71$ ). On these high concentrated markets, firms with a low market share have a stronger lowering of their markup compared with the average low relative market share firms ( $\hat{\kappa} = 9.165$ ). By contrast, for low concentration markets, firms with a high market share also lower their markup, and to a greater extent than the average reaction ( $\hat{\kappa} = 3.84$ ). Firms with a low market share have a stronger lowering of their markup ( $\hat{\kappa} = 5.23$ ), this adjustment being now smaller compared with the average low relative market share firms. Exporters have thus much more heterogenous reaction on high concentration markets than on low concentration ones. These results also hint to a negative relationship between the average markup adjustment to a shock and the extent of heterogeneity. Averaging out the reaction across different relative market share quartiles gives a result of .11 for high concentration markets and of -3.31 low concentration ones. The standard deviation of the reactions across market share

quartiles are respectively equal to 6.25 and 1.88.

All in all, the results show that the performance of a firm, measured by its relative market share, influence its markup adjustment in the wake of the VAT hike. Low performing firms are the ones reduce their markup and therefore do not report the rise in VAT to their final price. By contrast, high performing firms can adjust less in terms of markup, and even sometimes increase their markup, that is rise their final price more than the VAT.<sup>19</sup> This suggests a distorting effect of the VAT rate increase: firms that increase their markup are the ones that have the bigger market share and operate on highly concentrated market, so that they maybe the ones that already have large markups.

## 6 Conclusion

In this paper, we confront firm-level data on French exports to VAT-rate shocks in EMU countries to identify the extent of pass-through that is directly related to the adjustment of markups due to changes in the price-elasticity of demand in the destination country. Our baseline result is that, exporters adjust their markup so that VAT-rate changes are incompletely passed on export prices. For the average exporter in our sample, the markup adjustment is found to be 50%. The pass-through coefficient is thus also equal to 50%. This figure is higher than those generally found for exchange-rate pass-through on micro data. This is not surprising since we concentrate on VAT shocks which identify markup changes only since they do not to affect marginal costs and are deemed to be almost permanent.

The individual dimension of the data set allows to measure the impact of changes in VAT rate on competition, through exit and entry and market shares of exporters. An increase in the VAT rate of the destination country decreases the number of French competitors therefore raising the average market share for the exporters that remain. It also increase the smallest market share of the exporters that participate on each markets. On average, the individual share exporter relative to the minimum market share falls. This change over time in competition contributes little on

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<sup>19</sup>By contrast Berman et al. (2009) show that more productive (single product) firms react by adjusting their mark-up more than the average firm. Our results underline the importance of other characteristics in optimal markup reaction that maybe not systematically related to productivity.

the markup adjustment. However, the cross-section differences in competition as measured by firm market share and market concentration index are important determinants of the heterogeneous reaction of firms to the VAT shock.

From a fiscal policy point of view, our results imply that the import price index will not react one-for-one to the VAT-rate hike in the country that conduct it. Hence, part of the VAT burden will be shifted to foreign import suppliers. However, the reduction in competition among foreign suppliers may bear negative effects on local competition, distorting markups in favor of the less competitive sectors. They will also reduce the range of varieties available. On the whole, VAT-rate changes cannot be considered as a purely-domestic policy issue, although it is raised on a destination principle.

## References

- Atkeson, A. and Burstein, A. (2008). Pricing-to-market, trade costs, and international relative prices. *American Economic Review*, 98(5):1998–2031.
- Auer, R. and Chaney, T. (2009). Exchange rate pass-through in a competitive model of pricing-to-market. *Journal of Money, Credit and Banking*, 41(1):151–175.
- Berman, N., Martin, P., and Mayer, T. (2009). How do different exporters react to exchange rate changes? Theory, empirics and aggregate implications. working paper 7493, CEPR.
- Berthou, A. and Fontagné, L. (2008). The Euro effects on the firm and product-level trade margins: Evidence from France. Working paper 2008-21, CEPII.
- Bils, M. and Klenow, P. (2004). Some evidence on the importance of sticky prices. *Journal of Political Economy*.
- Bouakez, H. and Rebei, N. (2008). As the exchange rate pass-through really declined? evidence from canada. *Journal of International Economics*, 75:245–67.
- Broda, C. and Weinstein, D. (2006). Globalization and the gains from variety. *The Quarterly Journal of Economics*, 121(2):541–585.
- Burstein, A., Neves, J., and Rebelo, S. (2003). Distribution costs and real exchange rate dynamics. *Journal of Monetary Economics*.
- Carbonnier, C. (2007). Who pays commodity taxes? Evidence from French reform, 1987-1999. Technical Report 5-6, PSE.
- Chen, N., Imbs, J., and Scott, A. (2009). The dynamics of trade and competition. *Journal of International Economics*.
- Corsetti, G. and Dedola, L. (2005). A macroeconomic model of international price discrimination. *Journal of International Economics*, 67:129–155.
- Devereux, M. and Engel, C. (2002). Exchange rate volatility, exchange rate pass-through, and exchange rate disconnect. *Journal of Monetary Economics*.

- Dhyne, E., Alvarez, L., Le Bihan, H., Veronese, G., Dias, D., Hoffman, J., Jonker, N., Lnnemann, P., Rumler, F., and Vilmunen, J. (2006). Price changes in the euro area and the united states. some facts from individual consumer price data. *The Journal of Economic Perspectives*, 20:171–192.
- Dornbusch, R. (1987). Exchange rates and prices. *American Economic Review*, 77:93–106.
- Eaton, J., K. S. and Kramarz, F. (2004). Dissecting trade: Firms, industries, and export destinations. *American Economic Review, Papers and Proceedings*, 93:150–154.
- European-Commission (2009). Vat rates applied in the member states of the european community. Technical Report DOC/2412/2008, Taxation and Customs Union, Brussels.
- Feenstra, R. (1989). Symmetric pass-through of tariffs and exchange rates under imperfect competition. *Journal of International Economics*, 27:25–45.
- Fitzgerald, D. and Haller, S. (2009). Pricing-to-market: Evidence from producer prices. Working paper, Stanford.
- Froot, K. and Klemperer, P. (1989). Exchange rate pass-through when market share matters. *American Economic Review*, 79:637–654.
- Goldberg, L. and Campa, J. (2005). Exchange rate pass-through into import prices. *Review of Economics and Statistics*.
- Goldberg, L. and Campa, J. (2008). The insensitivity of the cpi to exchange rates: Distribution margin, imported inputs and trade exposure. *Review of Economics and Statistics (forth.)*.
- Goldberg, P. and Knetter, M. (1997). Goods prices and exchange rates: What have we learned? *Journal of Economic Literature*, 35:1243–72.
- Goldberg, P. and Verboven, F. (2001). The evolution of price dispersion in the European car market. *Review of Economic Studies*, 68:811–48.
- Gopinath, G. and Rigobon, R. (2008). Sticky borders. *Quarterly Journal of Economics*, 123(2).
- Hellerstein, R. (2008). Who bears the cost of a change in the exchange rate? pass-through accounting for the case of beer. *Journal of International Economics (forth.)*, 76(1):14–32.

- Imbs, J., Mumtaz, H., Ravn, M., and Rey, H. (2005). PPP Strikes Back: Aggregation and the Real Exchange Rate. *The Quarterly Journal of Economics*, 120(1):1–43.
- Kravis, I. and Lipsey, R. (1974). International trade prices and price proxies. In Ruggles, N., editor, *The role of the computer in economic and social research in latin america*, pages 253–66. Columbia University Press.
- Krugman, P. (1987). Pricing to market when the exchange rate changes. In Arndt, S. and Richardson, J., editors, *Real-financial linkages among open economies*. MIT Press, Cambridge, Mass.
- Melitz, M. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6):1695–1725.
- Melitz, M. and Ottaviano, G. (2008). Market size, trade, and productivity. *Review of Economic Studies*, 75:295–316.
- Mjean, I. and Schwellnus, C. (2009). Price convergence in the European union: Within firms or composition of firms. *Journal of International Economics*.
- Nakamura, E. and Zerom, D. (Forth.). Accounting for incomplete exchange rate pass-through. *Review of Economic Studies*.
- Rotemberg, J. and Woodford, M. (1992). Oligopolistic pricing and the effects of aggregate demand on economic activity. *Journal of Political Economy*, 100:1153–1207.

Table 1: Sectoral elasticities by country

	AT	FI	GE	GR	IE	IT	NL	PO	SP
Mean	5.265	3.563	5.029	3.568	5.217	4.695	4.471	4.413	3.751
Median	4.073	3.062	3.902	2.626	3.795	3.720	3.229	3.390	2.785
Max	28.798	25.032	25.032	25.03	29.806	25.032	25.032	25.032	25.032
Min	1.359	1.275	1.278	1.129	1.058	1.34	1.077	1.283	1.210
Std Dev	4.293	2.444	4.301	3.578	4.573	3.677	4.623	3.583	3.483

*Source:* Broda & Weinstein (2006) and authors' calculations.

Table 2: Descriptive statistics on the firm-level sample

	ELAS	GOOD	DEST	COMP	MASHA
Mean	4.76	71.11	8.31	81.6	.081
Median	3.29	24	6	42	.004
Max	29.80	1762	143	1320	1
Min	1.08	1	1	1	.000

*Notes:* Sample: 1995-2005 period, final consumption goods, EMU12 destination countries excluding Belgium & Luxembourg; ELAS = price-elasticity of demand (from Broda & Weinstein, 2006, dropping the 26 elasticities exceeding 30) for sector  $s$  in which good  $k$  is classified; GOOD = number of goods shipped by a firm to a given country  $l$ ; DEST = number of destinations served by a firm for a good  $k$ ; COMP = number of French competitors on a specific market (good  $k$  & country  $l$ ); MASHA = market share of a firm  $f$  on a specific market (good  $k$  & country  $l$ ).

Figure 1: Distribution of sectoral elasticities

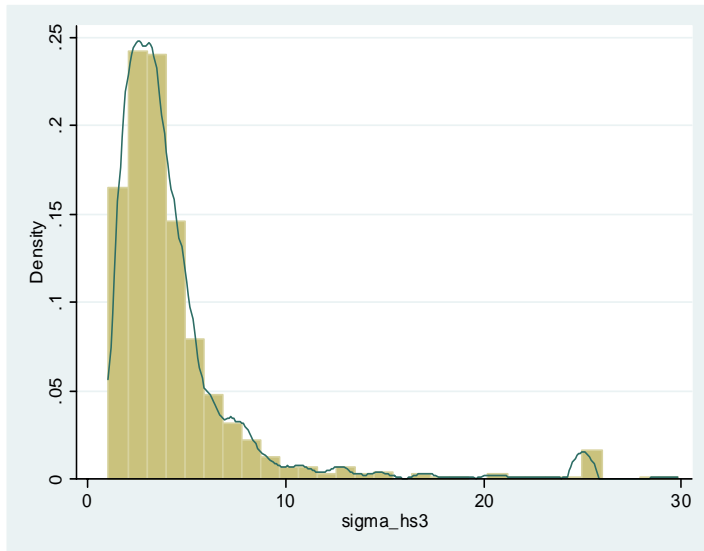


Table 3: VAT rate changes between 1996 and 2005 – Euro-area

Countries	Standard rates		Reduced rates	
	Nb. of changes	Dates of changes	Nb. of changes	Dates of changes
Austria	0		0	
Finland	0		1	1 Jul 1998
Germany	1	1 Apr 1998	0	
Greece	1	1 Apr 2005	1	1 Apr 2005
Ireland	2	1 Jan 2001 and 1 Mar 2002	1	1 Jan 2003
Italy	1	1 Oct 1997	0	
Luxembourg	0		0	
Netherlands	1	1 Jan 2001	0	
Portugal	4	5 Jun 2002 and 1 Jul 2005	1	
Spain	0		0	

*Source:* European Commission (2008).

Table 4: Markup adjustment

VARIABLES	(1) $\Delta p_{it}$	(2) $\Delta p_{it}$	(3) $\Delta p_{it}$
VAT SHOCKS			
$\Delta \tau_{slt}^\epsilon$	-1.824*** (0.385)	-2.138*** (0.503)	-1.989*** (0.498)
CONTROLS			
$\Delta p_{it-1}$	-0.254*** (0.002)	-0.240*** (0.003)	-0.242*** (0.003)
$\log s_{it-1}$	-0.070*** (0.001)	-0.067*** (0.001)	0.025*** (0.002)
$\log \underline{s}_{klt-1}$	-0.003*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
$\log \bar{s}_{klt-1}$	0.032*** (0.002)	0.031*** (0.003)	-0.009*** (0.003)
$\Delta \log s_{it}$			0.043*** (0.002)
$\Delta \log \bar{s}_{klt}$			0.072*** (0.001)
$y_{lt}$	0.528*** (0.143)	0.648*** (0.162)	0.656*** (0.160)
$\pi_{lt}$	-0.138 (0.181)	-0.118 (0.201)	-0.176 (0.199)
$y_{it}^c$	0.006*** (0.001)	0.004*** (0.001)	-0.003*** (0.001)
$n_{ft}^l$	0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)
$n_{kt}^l$	0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)
:			
Observations	648680	465035	465035
Number of id	181092	134135	134135

Notes:  $\Delta p_{it}$ : log price variation for firm  $f$ , product  $k$  and destination  $l$ ;  $\Delta \tau_{slt}^\epsilon$ : VAT-rate variation in the destination country, normalized by sector-demand elasticity in that destination  $(\widehat{\epsilon}_{sl} - 1)^{-1} \Delta \log(1 + \tau_{lt})$ ; controls for destination country  $l$ :  $y_{lt}$ , real GDP growth rate,  $\pi_{lt}$ , consumer price inflation;  $y_{it}^c$ , log of real GDP per capita; controls for firm  $f$ :  $n_{ft}^l$ , number of destination countries;  $n_{ft}^k$ , number of exported products; controls for market  $(k, l)$ :  $\bar{s}_{klt}$ , average market share among French exporters in the specific country  $l$  for the specific product  $k$ ;  $\underline{s}_{klt}$ , minimum market share on market  $(k, l)$ ; controls for firm  $f$  on market  $(k, l)$ :  $s_{it}$ , market share of exporter  $f$  on market  $(k, l)$  relative to the minimum market share on that market; all regressions include individual fixed effects and time dummies and are estimated using the Arellano & Bond procedure; numbers in brackets are robust std errors of estimates; \*\*\*, \*\*, \* indicates significance at the 1, 5 and 10% levels respectively.

Table 5: Entry and exit rates

	(1)	(2)
	$\log[r(\text{en}_{klt})]$	$\log[r(\text{ex}_{klt})]$
VAT SHOCKS		
$\Delta\tau_{slt}^\epsilon$	-3.797*** (1.420)	3.506*** (1.255)
CONTROLS		
$\log[r(\text{ex}_{klt-1})]$	0.053*** (0.006)	
$\log[r(\text{ex}_{klt-1})]$		0.063*** (0.006)
$s_{klt-1}$	0.138*** (0.004)	0.010*** (0.004)
$y_{lt}$	-0.237 (0.379)	0.252 (0.410)
$\pi_{lt}$	0.725 (0.462)	0.472 (0.487)
$y_{lt}^c$	-0.209* (0.120)	0.025 (0.128)
$n_{ft}^l$	-0.041*** (0.003)	-0.058*** (0.003)
$n_{ft}^k$	-0.002*** (0.000)	-0.001*** (0.000)
:		
Observations	89749	87036
Number of id	14679	14467

Notes:  $\text{en}_{klt}$ : entry rate on market  $(k, l)$ ;  $\text{ex}_{klt}$ : exit rate on market  $(k, l)$   $\Delta\tau_{slt}^\epsilon$ : VAT-rate variation in the destination country, normalized by sector-demand elasticity in that destination  $(\hat{\epsilon}_{sl} - 1)^{-1} \Delta \log(1 + \tau_{lt})$ ; controls for destination country  $l$ :  $y_{lt}$ , real GDP growth rate,  $\pi_{lt}$ , consumer price inflation;  $y_{lt}^c$ , log of real GDP per capita; controls for firm  $f$ :  $n_{ft}^l$ , number of destination countries;  $n_{ft}^k$ , number of exported products; controls for market  $(k, l)$ :  $\bar{s}_{klt}$ , average market share among French exporters in the specific country  $l$  for the specific product  $k$ ;  $\underline{s}_{klt}$ , minimum market share on market  $(k, l)$ ; all regressions include individual fixed effects and time dummies; columns (1) to (4) are estimated using a within procedure; columns (5) and (6) are estimated using the Arellano & Bond procedure; numbers in brackets are robust std errors of estimates; \*\*\*, \*\*, \* indicates significance at the 1, 5 and 10% levels respectively.

Table 6: Market share and VAT-rate shocks

	(1)	(2)	(3)
	$\log[r(\bar{s}_{klt})]$	$\log[r(\underline{s}_{klt})]$	$\log s_{it}$
VAT SHOCKS			
$\Delta\tau_{slt}^e$	2.204*** (0.613)	6.415** (2.915)	-3.155*** (0.880)
CONTROLS			
$\log \bar{s}_{klt-1}$	0.123*** (0.008)		
$\log \underline{s}_{klt-1}$		0.124*** (0.008)	
$\log s_{it-1}$			0.131*** (0.002)
$y_{lt}$	0.656*** (0.188)	2.069** (0.886)	-1.890**** (0.314)
$\pi_{lt}$	0.492** (0.225)	2.175** (1.102)	1.617*** (0.374)
$y_{lt}^c$	-0.756*** (0.069)	-1.761*** (0.271)	0.859*** (0.116)
$n_{ft}^l$	0.085*** (0.002)	0.268*** (0.008)	0.130*** (0.002)
$n_{ft}^k$	0.002*** (0.000)	-0.002*** (0.001)	0.015*** (0.000)
$\vdots$			
Observations	108610	108610	914705
Number of id	16345	16345	255915

Notes:  $\bar{s}_{klt}$ : average market share in terms of revenues on market  $(k, l)$ ;  $\underline{s}_{klt}$ : lowest market share in terms of revenues on market  $(k, l)$ ;  $s_{it}$ : market share of firm  $f$  on market  $(k, l)$  relative to minimum market share;  $r(x) = \exp(x)[1 - \exp(x)]^{-1}$ ;  $\Delta\tau_{slt}^e$ : VAT-rate variation in the destination country, normalized by sector-demand elasticity in that destination  $(\hat{e}_{sl} - 1)^{-1} \Delta \log(1 + \tau_{lt})$ ; controls for destination country  $l$ :  $y_{lt}$ , real GDP growth rate,  $\pi_{lt}$ , consumer price inflation;  $y_{lt}^c$ , log of real GDP per capita; controls for firm  $f$ :  $n_{ft}^l$ , number of destination countries;  $n_{ft}^k$ , number of exported products; controls for market  $(k, l)$ :  $\bar{s}_{klt}$ , average market share among French exporters in the specific country  $l$  for the specific product  $k$ ;  $\underline{s}_{klt}$ , minimum market share on market  $(k, l)$ ; controls for firm  $f$  on market  $(k, l)$ :  $s_{it}$ , market share of exporter  $f$  on market  $(k, l)$  relative to the minimum market share on that market;; all regressions include individual fixed effects and time dummies and are estimated using the Arellano & Bond procedure; numbers in brackets are robust std errors of estimates; \*\*\*, \*\*, \* indicates significance at the 1, 5 and 10% levels respectively.

Table 7: Heterogeneous pass-through across sub-groups of exporters

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta p_{it}$	$\Delta p_{it}$	$\Delta p_{it}$	$\Delta p_{it}$	$\Delta p_{it}$	$\Delta p_{it}$
VAT SHOCKS						
$\Delta \tau_{slt}^{\epsilon}$	-1.985*** (0.500)					
$\Delta \tau_{slt}^{\epsilon} \times Q_4^s$		-1.165* (0.629)	3.712** (1.707)	-0.163 (1.346)	-1.214 (1.202)	-3.844*** (1.042)
$\Delta \tau_{slt}^{\epsilon} \times Q_3^s$		-0.758 (0.821)	1.918 (2.384)	1.206 (1.875)	-3.839** (1.559)	-0.741 (1.300)
$\Delta \tau_{slt}^{\epsilon} \times Q_2^s$		-1.119 (0.984)	3.991 (2.903)	-0.606 (2.255)	-0.655 (1.854)	-3.446** (1.528)
$\Delta \tau_{slt}^{\epsilon} \times Q_1^s$		-7.992*** (2.123)	-9.165* (4.883)	-13.607*** (4.255)	-4.903 (3.249)	-5.228** (2.656)
CONTROLS						
$\Delta p_{it-1}$	-0.241*** (0.003)	-0.241*** (0.003)	-0.246*** (0.006)	-0.241*** (0.006)	-0.237*** (0.006)	-0.240*** (0.005)
$\log s_{it-1}$	-0.017*** (0.001)	-0.017*** (0.001)	-0.014*** (0.003)	-0.017*** (0.003)	-0.018*** (0.003)	-0.015*** (0.003)
$\log \underline{s}_{klt-1}$	-0.061*** (0.002)	-0.061*** (0.002)	-0.036*** (0.003)	-0.059*** (0.003)	-0.076*** (0.004)	-0.067*** (0.003)
$\log \bar{s}_{klt-1}$	0.106*** (0.004)	0.105*** (0.004)	0.061*** (0.007)	0.102*** (0.008)	0.129*** (0.010)	0.117*** (0.013)
$\Delta \log s_{it}$	0.039*** (0.001)	0.039*** (0.001)	0.024*** (0.002)	0.035*** (0.002)	0.047*** (0.002)	0.046*** (0.002)
$\Delta \log \bar{s}_{klt}$	0.052*** (0.002)	0.052*** (0.002)	0.035*** (0.004)	0.043*** (0.005)	0.056*** (0.006)	0.067*** (0.008)
$\vdots$						
Observations	465035	465035	95806	108402	114343	143071
Number of id	134135	134135	29439	32160	33385	38251

Notes:  $\Delta p_{it}$ : log price variation for firm  $f$ , product  $k$  and destination  $l$ ;  $\Delta \tau_{slt}^{\epsilon}$ : VAT-rate variation in the destination country, normalized by sector-demand elasticity in that destination  $(\hat{\epsilon}_{sl} - 1)^{-1} \Delta \log(1 + \tau_{it})$ ;  $Q_1^s$  to  $Q_4^s$ : dummies identifying which quartiles of relative market share (from lowest to highest) firms belong to; controls for destination country  $l$ :  $y_{lt}$ , real GDP growth rate,  $\pi_{lt}$ , consumer price inflation;  $y_{it}^c$ , log of real GDP per capita; controls for firm  $f$ :  $n_{ft}^l$ , number of destination countries;  $n_{ft}^k$ , number of exported products; controls for market  $(k, l)$ :  $\bar{s}_{klt}$ , average market share among French exporters in the specific country  $l$  for the specific product  $k$ ;  $\underline{s}_{klt}$ , minimum market share on market  $(k, l)$ ; controls for firm  $f$  on market  $(k, l)$ :  $s_{it}$ , market share of exporter  $f$  on market  $(k, l)$  relative to the minimum market share on that market; all regressions include individual fixed effects and time dummies and are estimated using the Arellano & Bond procedure; numbers in brackets are robust std errors of estimates; \*\*\*, \*\*, \* indicates significance at the 1, 5 and 10% levels respectively.