# The Valuation Effects of Trade

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**Abstract**

This paper estimates the cash flow effects of currency mismatches generated by foreign-priced operations of French manufacturers. The value of transactions invoiced in foreign currencies is twice as sensitive to exchange rates as the value of transactions invoiced in the domestic currency. I aggregate foreign-priced operations to the firm level to build a shift-share measure of invoice currency mismatch. This measure outperforms any trade-weighted effective exchange rate index at explaining cash flows of trading firms. Large firms absorb valuation shocks in their balance sheet and small exporters partially hedge their dollar-priced exports with dollar-priced imports. Investment and payroll of small domestic-oriented firms are sensitive to invoice currency valuations. These results show how trade value sensitivities to currency fluctuations can coexist with the evidence of disconnect between exchange rates and real macroeconomic fundamentals.

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# 1 Introduction

The international policy sphere is dominated by the notion that countries can gain trade advantages by weakening their currencies. In line with this view, conventional economic theories assume that all goods are priced in the producer currency and that a depreciation makes them cheaper than foreign goods. Yet, in practice, depreciations rarely generate the expected market share responses. Recent studies suggest this is because most world trade is settled in dollars, rather than in the producer currency.[1] Widespread dollar pricing explains small volume responses to exchange rates, but it implies either large markup or nominal cost fluctuations for domestic firms. An open question is whether such nominal fluctuations have any real effects.

Consider a French exporter that sells wine to the United States at a stable dollar price. After a euro depreciation, wine sales do not move in dollar terms because the customer does not perceive any price movement. However, a weakening euro yields larger nominal revenues for the French exporter. A weak euro may also imply larger nominal costs if the winemaker can only import dollar-priced materials. In this scenario, neither production nor international relative prices respond much to depreciations, in line with international evidence (Gopinath et al. 2016). Yet the French winemaker is clearly subject to cash flow shocks generated by currency fluctuations proportional to the mismatch between sales and costs settled in dollars. Such shocks can have important consequences for profitability and liquidity.

Nominal exchange rates are highly volatile compared to other macroeconomic and international shocks. These exchange rate movements have large real effects when emerging market firms make financial decisions that generate currency mismatches on their balance sheets.[2] Yet currency mismatches generated by operational activities priced in foreign currencies, or "invoice mismatches," remain understudied. This is the first empirical paper focused on cash flow fluctuations generated by foreign pricing. I build an invoice-weighted exchange rate index that consistently outperforms any trade-weighted effective exchange rate index at explaining cash flows, investment, and employment effects of trading firms. The results show how high trade value and cash flows sensitivities to invoice currency fluctuations do not necessarily imply large aggregate responses in the real activities of trading firms.

I exploit a micro-economic dataset containing information on customs activities and balance sheets for French firms from 2000 to 2017. The customs dataset contains the invoice currency of all trade with countries outside the European Union. I link these transactions to the income and balance sheet statements of most private and public firms in France. This dataset allows me to track the path of a euro depreciation shock from its effect on product value at

[1] Goldberg and Tille (2008), Goldberg (2010), Gopinath (2015)

[2] Calvo and Reinhart (2002), Caballero and Krishnamurthy (2003), Céspedes et al. (2004).

the border, to its impact on firm-level aggregate cash flows, all the way to its macroeconomic investment and employment effects. My empirical strategy exploits a shift-share index design that leverages the quasi-randomness of euro depreciation shocks relative to the most exposed firms. Importantly, I do not require exposures to foreign currency pricing to be randomly assigned.

The first part of the paper establishes the importance of invoice currency as a proxy for understanding heterogeneous exchange rate sensitivities of transaction values. I show that the value of transactions invoiced in foreign currencies is twice as sensitive to exchange rates as the value of transactions invoiced in euros. After a 1% yearly depreciation of the euro, foreign-priced sales values increase between 0.6 to 0.8%, from the point of view of French firms. Foreign-priced nominal imports increase by the same amount. Euro-priced exports and import values rise by 0.3%.

The explanation for the high exchange rate sensitivity of foreign-priced flows is mechanical. Prices (expressed in invoice currency terms) and volumes respond little to exchange rates within a one-year horizon. As in the example of the winemaker, this leads to stable prices and quantities expressed in dollar terms. After a euro depreciation, these stable dollar operations increase their value in euro terms. This is the valuation effects of exchange rates. Foreign-priced trade flows behave almost like asset and liability stocks denominated in foreign currencies. This is an empirical claim—I do not need to make any assumption about the micro-economic foundations to justify price or value stability.

The second part of the paper aggregates pricing exposures to the balance sheet level of each firm. There are several reasons why higher nominal sales or costs generated by a depreciation may not translate into real effects. For example, when dollar-priced exports and imports match perfectly there is no balance sheet mismatch of foreign-priced operations. Firms can hedge their operational exposures with financial instruments, or pass-through border price fluctuations to their customers or suppliers. Moreover, firms can change their product and currency mix in response to depreciations. In each of these scenarios, firm cash flows are insensitive to exchange rate shocks. Yet even if cash flows are sensitive to exchange rates, the selection of the most productive firms into trade markets (Melitz 2003) may imply that only productive firms with large cash reserves and liquidity are exposed.

To measure investment and employment sensitivities I build a firm-specific invoice-weighted exchange rate index. My index is similar to a standard effective exchange rate, except my weights represent the net pricing exposures in foreign currencies rather than trading activity exposures. To simplify interpretation, I define the invoice weights as a nominal euro exposure to foreign-priced trade at the beginning of the sample. I multiply this exposure by yearly euro depreciations to quantify how much income could be purely caused by "invoice valuation."

This invoice-weighted index is equivalent to a shift-share Bartik shock with exposure shares fixed at the beginning of the sample. The identifying assumption is that, following a depreciation shock, firms with a non-zero net invoice exposure in dollar-pricing do not experience unusually high or low growth in investment and payroll for reasons other than the valuation effect on their dollar-priced operations. I focus mostly on "dominant-pricing" exposures: trade priced in dollars when the partner country is not the United States. This focus allows me to control for fluctuations in partner currency value (a relevant endogeneity concern when the partner is a developing country) and for firm-by-partner-specific trends in trading activity.

After a currency fluctuation, each movement in the index corresponds to invoice valuation income that companies potentially gains at the border from their unhedged dominant-priced operations. I find that cash flows increase, on average, by 45 cents for every euro of invoice valuation. Salaries increase by 12 cents and tangible investment increases by 3 cents for every euro of invoice valuation. These magnitudes imply cash flow sensitivities in line with, but on the lower end of, estimates found in the corporate finance literature.[3] This is unsurprising given that even small firms in my sample are larger and have more liquidity than the median firm in France.

These average effects hide important heterogeneities. I split the sample between exporters and "domestic-oriented firms." The latter are manufacturing, construction, and wholesale companies that import from outside the European Union and sell to the domestic market in euros. Cash flows of all domestic-oriented firms increase 40 to 45 cents for every euro of invoice valuation income. Instead, large exporters' cash flows have higher pass-through: they typically respond 80 cents on the euro. However, higher pass-through for large exporters does not imply that their cash-flows are more sensitive to exchange rate shocks. One standard deviation shock of invoice valuation income explains 1% of a large exporter standard deviation in cash flows, as opposed to a 5% of standard deviation impact observed for domestic-oriented firms.

Invoice valuations explain a small share of exporters' cash flows for two reasons. First, small- and medium-sized exporters rarely use the dollar to price their operations, and the few dollar-priced sales they have are typically matched by dollar-priced imports. Only very large exporters have partial long exposures to the dollar. Domestic-oriented firms cannot operationally hedge their activities, and 40% of their trading activities are typically exposed to the dollar. Second, compared to domestic-oriented firms, the overall size of French exporters operations is much larger than the value of their extra-EU trade activities. Operational hedging and the relative size of invoice currency exposure mitigate the effects of currency fluctuations on exporters' balance sheets.

[3] Fazzari et al. (1988), Kaplan and Zingales (1997), Moyen (2004), Rauh (2006), Lewellen and Lewellen (2016), Amiti and Weinstein (2018)

I also find no significant pass-through of invoice valuations into investment or employment for all large firms. Only small domestic-oriented firms have significant investment and payroll pass-through of 7 and 12 cents on the euro, respectively. Beside the lower exposure of large exporters, the evidence suggests that liquidity and financial sophistication are the likely channels behind the lack of significant real effects for all large firms. For instance, I find suggestive evidence that only exporters financially hedge their invoice currency exposures. Other channels and concerns such as foreign ownership, mismeasurement of consolidated budget, or access to dollar financing are unlikely to be at play.

The last part of the paper estimates partial equilibrium macroeconomic effects. Invoice valuations affect aggregate investment and employment, but the effects are negligible for three reasons. First, most exporters compensate their dollar-priced exports with dollar-priced imports, decreasing the implied aggregate net exposure to invoice valuations. Second, I only find high investment pass-through estimates concentrated on small domestic-oriented firms that account for a modest amount of the economy. Third, in France, the total amount of long exposure to the dollar generated by all exporters is almost fully matched by the short exposure to the dollar generated by domestic-oriented firms. Overall, a 10% euro depreciation causes a 0.1% increase in aggregate investment and a 0.2% increase in aggregate payroll of all trading firms. The trade balance responds only by 0.1 percentage points of GDP after a 10% euro depreciation.

France is an ideal country for studying valuation effects because the dollar is used for pricing in almost all industries, but its use varies substantially. Rich data and heterogeneous dollar use even within the same industry, trading country, or company allow me to disentangle alternative channels that could explain the ability of invoice currencies to predict exchange rate sensitivities. While these robustness tests corroborate the main narrative, they are novel contributions in their own right. I show that the sensitivity estimates are unaffected by the level of saturation of the panel variation, implying low potential bias from unobservables. I verify the robustness of my results to novel information such as firm ownership and subsidiary transaction. I provide an extension of the trade sensitivity results to a 3-year long-term horizon, and I analyze extensive margin sensitivities conditional on invoice currency choice. I also show that financial hedging or foreign property are unlikely to drive my results.

Thanks to the dominance of the dollar in global trade markets, stable dollar flows can have large valuation effects on countries across the world. My study focuses on a large economy, with developed financial markets and a stable domestic currency. For this reason my invoice valuation estimates represent a lower bound to what emerging economies could experience in terms of investment and employment exposure to valuations in foreign-priced activities. Firms in developing countries are better represented by the smaller firms in my sample. This subset of smaller firms yields estimated cash flow sensitivities of investment and employment that are much higher than my average marginal estimates.

This work is related to a growing body of literature studying the consequences of local currency and dollar pricing in world trade markets. Devereux and Engel (2002) show how local currency pricing, incomplete financial markets, and a product distribution minimizing wealth effects of currency fluctuations can generate exchange rate volatility higher than shocks to economic fundamentals, reconciling the standard finding of exchange rate 'disconnect' from the real economy (Obstfeld and Rogoff 2000). Goldberg and Tille (2008) and Gopinath (2015) show that, rather than local currency pricing, world markets are dominated by a single vehicular currency: the dollar.

These departures from the standard Mundell-Fleming paradigm of producer currency pricing have important consequences for international macroeconomic models. First, monetary policy and floating exchange rates are less effective in compensating for domestic shocks (Devereux and Engel 2003, Obstfeld and Duarte 2005, Corsetti et al. 2010, Gopinath et al. 2016, Egorov and Mukhin 2019). Second, asymmetric trade volume responses occur at the border, conditional on the distribution of invoice currencies used by firms (Gopinath et al. 2016, Cravino 2017, Amiti and Weinstein 2018). Third, there are differential impacts on border prices, inflation, and exporter markups (Gopinath et al. 2010, Fitzgerald and Haller 2014, Cravino 2017, Devereux et al. 2017, Amiti et al. 2018, Auer et al. 2018, Borin et al. 2018, Chen et al. 2018, Corsetti et al. 2018). This paper differs from the previous studies because it investigates a novel real effect connected to foreign-pricing exposure: profitability and liquidity effects on investment and employment.

A large literature focuses on estimating the investment, employment, and productivity impacts of effective exchange rate depreciations. (Campa and Goldberg 1995, Nucci and Pozzolo 2001, Eichengreen 2003, Ekholm et al. 2012, Alfaro et al. 2018). While studies focusing on developing countries have consistently found positive real effects of depreciations on exporters, the effects of currency fluctuations in developed markets are inconclusive, and generally considered harder to estimate. For instance, Alfaro et al. (2018) do not find large real effects of depreciations on French firms. Another branch of literature in corporate finance studies the effects of effective exchange rates on the investments and valuations of public firms (Jorion 1990, Dominguez and Tesar 2006, Bartram et al. 2010, Eichengreen and Tong 2015). This paper differs from previous studies because it focuses on invoice currency exposures rather than trade-weighted exchange rate exposure. This focus has two main advantages. First, I can detect a consistently large pass-through of exchange rate fluctuations into cash flows for France across several kinds of firms. My estimated sensitivities are larger because I find that merchandise value at the border fluctuates with the invoice currency rather than the trading partner currency. Second, I can build an invoice-weighted exchange rate index and address endogeneity concerns related to partner countries' demand and supply shocks, or contemporaneous partner currency depreciations.

Section 2 describes the data I use. Section 3 presents the distribution and time patterns of invoice currency use in France. Section 4 contains the transaction-level estimates. Section 5 presents the firm-level results. Section 6 computes the partial-equilibrium macroeconomic estimates of invoice valuation effects. Section 7 extends my results and checks for robustness.

## 2 Data Sources

I use French Custom administrative records on export and import transactions outside of the European Union from 2000 until 2017. Each trading firm in France files a compulsory custom form whenever its merchandise value is above €1,000 (or 1,000 kilos). The database contains almost the entire universe of extra-EU trade.[4] The custom database specifies the month and year of filing, export or import flow, the partner country, an 8-digit industry code, time-invariant French firm identifier, weight or unit amount transacted, and merchandise value at the border. After 2011, the merchandise value in the original invoice currency is available, along with transport mode, and insurance contract.[5]

I link customs information with two datasets containing firm characteristics. For the period 2000–2008 I use the FICUS dataset (*Fichier Complet Unifié de Suse*). For the period 2009–2016 I use the FARE dataset (*Fichier approché des résultats d'Esane*). These datasets contain balance sheets and income statements from administrative tax records, integrated with information on employment, firm age and other business characteristics gathered by the French statistical agency (INSEE). The sample covers the universe of corporations and medium-sized "non-commercial" firms active in France.

I merge FARE and FICUS with two other datasets. The first dataset is LIFI (*Liaisons Financières entre Sociétés*), which identifies the ownership links between enterprises operating in France. The sample of firms required to file their ownership linkages in LIFI changes over the years, with almost complete coverage achieved only after 2012. However, LIFI is the most comprehensive source of French firm linkages in the period 2000–2017, with information about the residence country of the ultimate owner company. The second database is OFATS (*Outward Foreign Affiliates Statistics*), a survey containing the structure and activity of foreign affiliates of French firms.

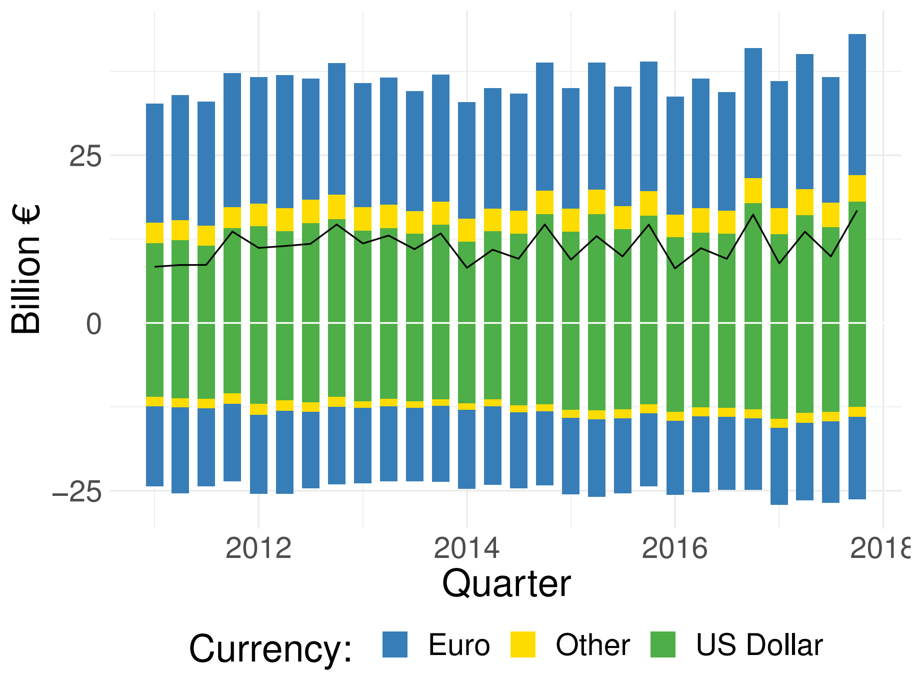
[4]The threshold was discontinued in 2010 and all the results for the period 2011-2017 represent virtually the totality of extra-EU trade. Whenever I extend the sample to the period 2000-2017, I homogenize the data to reflect the pre-2010 threshold. For more details see Appendix A and Bergounhon et al. (2018).

[5]See the Glossary for more details on these variables.

# 3 Trade and Invoice Currencies in France

Extra-EU manufacturing exports and imports account, respectively, for 8% and 6% of French GDP. Figure 1 shows the quarterly dynamics of extra-EU manufacturing trade from 2011 to 2017, decomposed by invoice currency.[6]

Figure 1: Extra-EU French Manufacturing Trade by Invoice Currency




*Note*: Quarterly nominal French manufacturing trade flows outside of the European Union from 2011 to 2017. A positive merchandise value represents exports. A negative merchandise value represents imports. The black line represents net manufacturing trade.

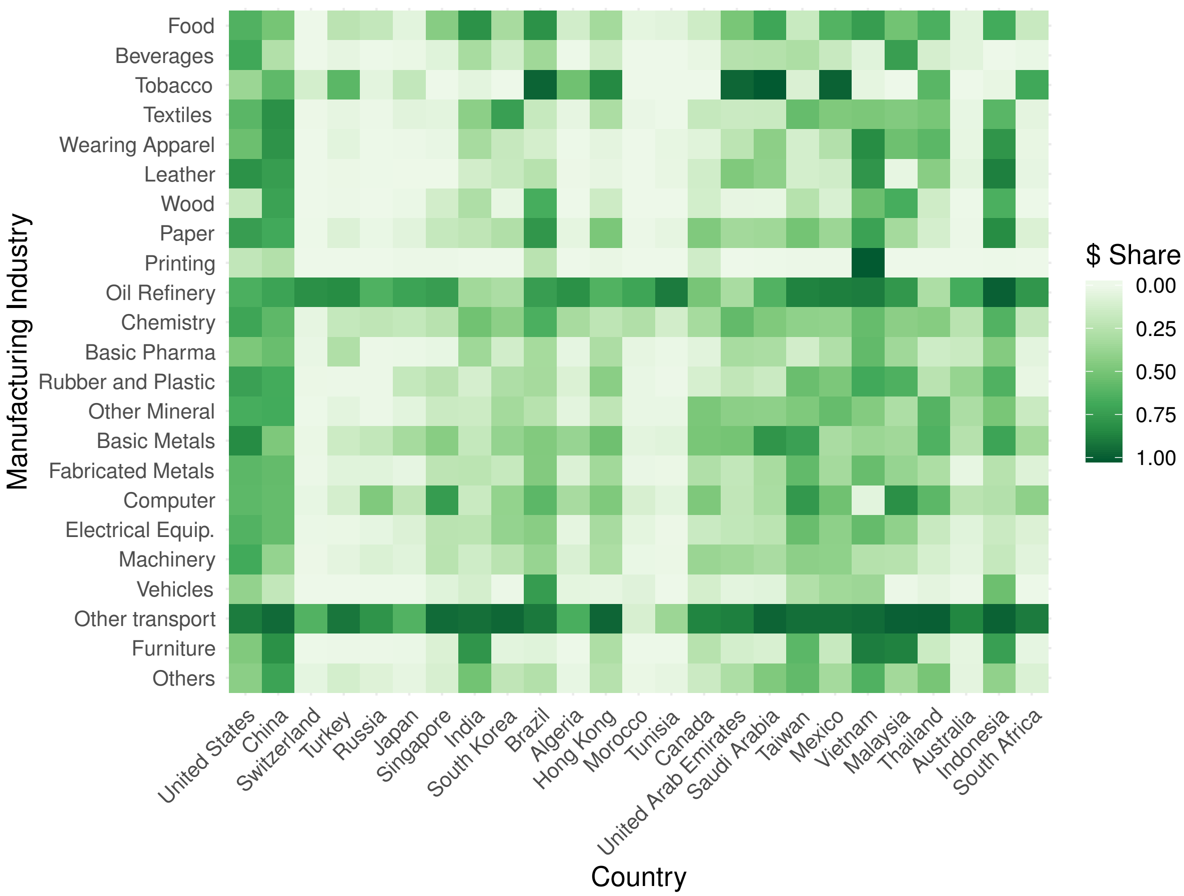
The dollar and the euro are the major currencies used to settle payments. On average, 51% of exports are invoiced in euros and 39% are invoiced in dollars. For imports, 46% are invoiced in euros and 49% are invoiced in dollars.[7] The remaining transactions are invoiced in other currencies such as, in order of importance, the yen, the Swiss franc, or the Singapore dollar. Only 25% of dollar-invoiced trade is with the United States. This evidence represents a large departure from the textbook Mundell-Fleming view on international price setting. Models fol-

[6]Invoice currency information is available from 2011 to 2017. The French Custom agency does not gather invoice currency information on trade within the EU, but most French trade within the EU is invoiced in euros. Customs declarations show that 82% of imports and 77% of exports within the EU and above €460,000 were with a eurozone country in 2015.

[7]Appendix H shows that there is a stable and increasing trend in dollar use in both French export and import flows, in line with international evidence by Maggiori et al. (2020, 2019). I show that this trend in dollar use by French firms is due to the faster growth of dollar-invoicing firms rather than differential entry-exit rates of products or increasing within-product invoice shares.

lowing the Mundell-Fleming paradigm assume that all exports are invoiced in the producer's currency. According to this theory, all exports in Figure 1 should be in euros while imports should reflect the distribution of origin country currencies.

Figure 2: Aggregate Share of Dollar Invoicing by Industry-Country Pair




*Note*: Average US dollar-pricing share over extra-EU gross manufacturing trade from 2011 to 2017. Each square represents the dollar-pricing shares by ISIC 2-digit manufacturing industry and partner country.

A large literature has recently emphasized the dominant role of the dollar in international trade pricing (Goldberg and Tille 2008, Goldberg 2010, Gopinath 2015). However, most studies exploiting micro-level evidence of dollar invoicing focus on America or Asia, where the US dollar dominates almost all transactions. France offers meaningful variation in observed invoicing choices between the domestic currency and the dollar. Figure 2 shows that dollar use is widespread and varies substantially, even within the same country or industry. The dollar use variation is particularly important for this study. Heterogeneous dollar use allows me to disentangle the dollar invoice exposure channel from industry, time, and firm specific characteristics. Firms differ widely in their invoice currency choices even within the same country-industry pair: Table I.1 in the appendix shows that country-by-industry fixed effects explain 37% of pricing variation, while country-by-industry-by-firm fixed effects explain 80% of pricing choices.

Table 1: Extra-EU Trade Activities of French Exporters and Domestic-oriented Firms

| | **Exporter** | | | **Domestic-oriented** | | |
|---|---|---|---|---|---|---|
| | Top 100 | 100-1000 | Others | Top 100 | 100-1000 | Others |
| Share of Total Exports | 47.30% | 26.69% | 18.59% | 2.66% | 2.91% | 1.84% |
| Share of Total Imports | 13.4% | 5.9% | 3.7% | 32.0% | 26.3% | 18.9% |
| Mean # of Countries | 86.4 | 53.6 | 4.9 | 40.2 | 30.2 | 2.9 |
| Mean # of Industries | 448.8 | 201.2 | 11.6 | 306.3 | 177.7 | 10.9 |
| Mean # of Currencies | 16.0 | 7.8 | 1.4 | 7.2 | 5.1 | 1.5 |
| Mean # of Curr. per Country | 1.6 | 1.4 | 1.0 | 1.5 | 1.4 | 1.1 |
| Mean # of Curr. per Count.-Ind. | 1.2 | 1.1 | 1.0 | 1.2 | 1.1 | 1.0 |
| Mean EUR-invoiced gross trade | 45% | 66% | 95% | 48% | 47% | 49% |
| Mean USD-invoiced gross trade | 41% | 28% | 3% | 48% | 49% | 43% |

*Note*: Descriptive statistics of French trade with countries outside the European Union (extra-EU) in the period 2011-2017. A firm is classified as an exporter when its mean value of exports (over the whole period) is higher than its imports. All other firms are classified as domestic-oriented. Exporters and domestic-oriented firms are then divided into the top 100, top 101 to 1000 and other firms, according to the size of their average gross trading activities. Exporters in the sample are 139,507. Domestic-oriented firms are 191,846. Shares of total exports and imports represent the share of overall extra-EU export or import values accounted by each subgroup of firms. The Mean # of countries is the simple mean within each group of the number of countries each firm trades with. Similarly, the Mean # of industries represents the mean number of 8-digit industry code each firm in the group trades in. The Mean # of currencies per country is the simple mean of the number of unique currencies used by each firm in each country. The mean invoice shares represent the simple mean of each firm's gross trade invoiced in either euros (EUR) or US dollars (USD) over the total gross trade of the firm.

Table 1 summarizes the trade activities of French firms. I divide the sample into exporters and domestic-oriented firms. When the average amount of extra-EU exports of a firm is larger than its imports, I call the firm an exporter. All other firms are classified as domestic-oriented. I then rank these firms according to their gross trade size and place them in one of three subgroups: top 100, 101 to 1000, and all firms will less trade.

The largest firms account for most French trade, as in other countries (Bernard et al. 2007). The top 100 exporters account for 48% of exports and 13% of imports. The top 100 domestic-oriented firms account for 32% of imports. The largest firms typically trade hundreds of products, while their smaller counterparts trade 12 products on average. Small and large traders also differ in their currency use. The top 100 exporters and importers invoice their goods in anywhere from 5 to 16 distinct currencies. The smallest traders instead use only one or two currencies.

Multi-currency use, however, nearly disappears when conditioning on product-country pairs. Firms price in one single currency once a specific product enters a market, regardless of their size. Large firms tend to use more currencies than small firms because they trade with more countries. Both large exporters and domestic-oriented firms split their gross trade activities between euros and dollars. In contrast, small exporters almost never price in dollars, while small domestic-oriented firms buy dollar-priced goods like their larger counterparts.

Table 2: Invoicing Transition Matrix - Single-currency Products

| | Euro | Partner | Dominant |
|---|---|---|---|
| Euro | 95.77% | 2.02% | 2.21% |
| Partner | 0.69% | 98.82% | 0.49% |
| Dominant | 1.80% | 1.49% | 96.71% |

*Note*: Yearly probability that a product switches from one type of pricing regime to another. Products are defined as a unique combinations of country-firm identifier-trade flow-8-digit industry code-insurance contract-transport mode. The sample of products is limited to the ones being transacted in one single currency during their whole life cycle, from 2011 to 2017. Euro-priced goods have their invoice value filed in euros. Partner-priced goods are invoiced in the currency of the partner country. Dominant-priced goods are invoiced in US dollars but the partner country is not the United States. Probabilities are computed by total number of switches over total number of transactions.

This study offers one of the longest periods of observable invoice currency choices for a developed country. Table 2 shows product-level dynamics of currency switching over years. To control for time-invariant characteristics, I define a product as a unique combination of 8-digit industry code, firm identifier, partner country, insurance contract, and transport mode.[8] I present switches between three main pricing regimes: *euro*, when a product is invoiced in the domestic currency, *partner* when a product is invoiced in the currency of the trading country, *dominant* when a product is invoiced in dollars but the partner country is not the US.

The choice of pricing regime is stable over time, with the probability of maintaining the same single-pricing choice ranging from 96% to 99%. I confirm this stability when I compute the percentage of products with a non-responding invoicing share over their total transacted value, from 2011 to 2017. Table I.3 in appendix shows that over 85% of all products never change their invoice currency value share. Intuitively, large firms are more likely to adjust their invoice currency choices over time.

[8]For each product-year combination, I count a switch whenever the invoice currency observed in one year is different from the currency used in the previous year. Switching probabilities are computed in the sample of products using only one currency per year. Filed transactions with multiple currency use are more likely to represent trades with different buyers or sellers. Table I.2 in the appendix repeats the estimation including multiple-invoiced products.

# 4 Transaction Value Sensitivities to Exchange Rate

This section estimates the average effect of depreciations on trade invoiced in different currencies. There are two main takeaways. First, from the point of view of a French firm, the value of transactions invoiced in foreign currencies is twice as sensitive to exchange rates as the value of transactions invoiced in euros. Second, movements in nominal euro prices, as opposed to any real demand response, drive this result.

## 4.1 Specification and Estimate Interpretation

My benchmark specification for estimating exchange rate sensitivity is

$$\Delta y_{jt} = \sum_l \overbrace{\beta_l^{€} D_j^{€} \Delta e_{t-l}^{€/p}}^{\text{Euro}} + \overbrace{\beta_l^{P} D_j^{P} \Delta e_{t-l}^{€/p}}^{\text{Partner}} + \overbrace{\beta_l^{D} D_j^{D} \Delta e_{t-l}^{€/\$}}^{\text{Dominant}} + \gamma_l^D D_j^D \Delta e_{t-l}^{\$/p} + \phi x_{jt} + \alpha_j + \delta_{t\times\Delta} + \epsilon_{jt} \tag{1}$$

$\Delta y_{jt}$ is the log difference between either price (in euros), volume, or value (in euros) of product $j$, between year $t$ and the year of the last transaction. A product $j$ is a unique combination of firm identifier, 8-digit industry code , partner country, and invoice currency. The exchange rate $e_t^{€/p}$ is the log average euro value per unit of currency $p$ in year $t$. An increase in $\Delta e_t^{€/p}$ implies a euro depreciation vis-a-vis $p$ during the reference period for $\Delta_{jt}$. $\alpha_j$ absorbs differential average product growth, and $x_{jt}$ includes controls for partner's GDP growth and inflation. $\delta_{t\times\Delta}$ is a year-by-period-length fixed effect absorbing time-specific shocks. The estimates $\beta_l^{€}$, $\beta_l^{p}$, and $\beta_l^{D}$ represent the sensitivity of $y$ to exchange rate shocks, that is, the percentage change in $y$ after a 1% euro depreciation.[9]

Equation (1) compares exchange rate sensitivities for three different pricing regimes:

- **Euro**: $D_j^{€} = 1$ when the price is specified in the domestic currency.
- **Partner**: $D_j^{P} = 1$ when the price is specified in the currency of the partner's country, e.g. the yen when trading with Japan or the dollar when trading with the US.
- **Dominant**: $D_j^{D} = 1$ when the price is specified in dollars but the partner country is not the US.[10]

[9]For dominant-priced products I estimate exchange rate sensitivities to both euro-dollar and partner-dollar fluctuations, which represent the two sub-components of the bilateral exchange rate $\Delta e_t^{€/p}$. Appendix C shows how this specification implies that $\beta_l^D$ represents the response of $y_{jt}$ to a uniform euro depreciation vis-a-vis all world's currencies. Under invoice currency price stickiness, $\beta_l^D$ is also less likely to be biased by demand or supply effects.

[10]I exclude from the analysis all transactions using a vehicular currency different from the dollar.

I estimate heterogeneous average effects of euro depreciations conditional on these pricing regimes. The identification assumption is that unobservable drivers of $\Delta y_{jt}$ are not correlated with exchange rate shocks. This implies that unobservable product dynamics in any of the pricing regimes must not be differentially correlated with exchange rate shocks compared to the other pricing regimes. Section 7 verifies that this assumption is likely to hold, using a novel robustness strategy. The estimates do not represent the effects of choosing one pricing regime over the other since invoice currency choice is endogenous to unobservable firm and product characteristics, even though it is stable over long periods (Engel 2006, Gopinath et al. 2010).

## 4.2 Benchmark Transaction Sensitivities

Table 3 shows contemporaneous sensitivity estimates on prices, volumes, and values of trade transactions at an annual frequency from 2011 to 2017. All nominal variables are expressed in euro terms, so the results can be interpreted from the point of view of French firms. Transactions are split between exports and imports. The top three coefficients represent the percentage change in the dependent variable after a 1% euro devaluation shock vis-a-vis all currencies.

Partner and dominant currency price sensitivities range between 60 to 80% of the depreciation shock, with a slightly larger sensitivity for imports. Price sensitivities are near zero when products are priced in euros. The estimates confirm that prices are stable in units of the invoice currencies. Most studies comparing price pass-throughs conditional on invoice currency report similar estimates (Gopinath et al. 2010, Cravino 2017, Devereux et al. 2017, Amiti et al. 2018, Auer et al. 2018, Borin et al. 2018, Chen et al. 2018, Corsetti et al. 2018).

Volume sensitivities in Columns 2 and 5 are generally lower than price sensitivities. Only euro-priced export volumes increase by 0.3% after a 1% euro depreciation. This confirms that price stability in the invoice currency has allocative export consequences after a depreciation. Because euro-invoiced prices do not change, the exported good becomes almost 1% cheaper when converted into the customer's currency, increasing demand.Papers estimating pass-through to volumes are in line with mine.[11] On the import side, there is no significant volume response within the year. Import volumes show significant reductions only after two years, especially for dominant-priced products, as Section 7.4 will show.[12]

[11]Estimates of exchange rate pass-through to volumes are consistently lower than 1 in the literature (Campa 2004, Berman et al. 2012, Fitzgerald and Haller 2017, Cravino 2017, Amiti et al. 2018, Borin et al. 2018, Chen et al. 2018). These volume sensitivity estimates should not be interpreted as elasticity estimates. $\Delta$Volume$^{€}$ does not represent market shares, and I am not controlling for the relevant industry prices. For a state-of-the-art elasticity estimation of exchange rate shocks that exploits invoice currency exposures, see Auer et al. (2018).

[12]I do not take a stance on why invoice currency captures heterogeneous sensitivities to exchange rates. A vast literature proposes a variety of valid explanations. See, for instance Gopinath et al. (2010), Berman et al. (2012), Strasser (2013), Amiti et al. (2014), Chung (2016), Goldberg and Tille (2016), Devereux et al. (2017), Amiti et al.

Table 3: Short-term Yearly Sensitivities to a 1% Euro Depreciation

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | $\Delta$Price$^{€}$ | $\Delta$Volume | $\Delta$Value$^{€}$ | $\Delta$Price$^{€}$ | $\Delta$Volume | $\Delta$Value$^{€}$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Euro $\times \Delta e$(€/ Partn.) | 0.062$^{***}$ | 0.250$^{***}$ | 0.318$^{***}$ | 0.160$^{***}$ | -0.038 | 0.167 |
| | (0.022) | (0.080) | (0.082) | (0.043) | (0.130) | (0.169) |
| Partner $\times \Delta e$(€/ Partn.) | 0.670$^{***}$ | -0.078 | 0.531$^{***}$ | 0.836$^{***}$ | -0.047 | 0.883$^{***}$ |
| | (0.058) | (0.154) | (0.168) | (0.067) | (0.156) | (0.196) |
| Dominant $\times \Delta e$(€/ \$) | 0.758$^{***}$ | -0.035 | 0.646$^{***}$ | 0.766$^{***}$ | -0.093 | 0.794$^{***}$ |
| | (0.043) | (0.138) | (0.144) | (0.049) | (0.139) | (0.175) |
| Dominant $\times \Delta e$(Partn. / \$) | -0.064 | -0.160 | -0.174 | -0.075 | 0.109 | 0.110 |
| | (0.052) | (0.118) | (0.136) | (0.053) | (0.178) | (0.209) |
| Observations | 1.7M | 1.6M | 2M | 1.1M | 1M | 1.4M |
| $R^2$ | 0.368 | 0.353 | 0.326 | 0.425 | 0.403 | 0.360 |

*Note*: Yearly exchange rate sensitivity regression estimated as in equation (1) on an unbalanced transactions panel of extra-EU trade from 2011 to 2017. The dependent variables are log differences of either unit values (in euros), volumes (in kilos), or values (in euros) of a product in the period $\Delta$. $\Delta$ is defined as the period between two transactions, often but not always coinciding with one year. A product is defined as a unique combination of firm identifier-partner country-8-digit industry code-invoice currency. Euro-priced goods have their value invoiced in euros. Partner-priced goods are invoiced in the currency of the partner country. Dominant-priced goods are invoiced in US dollars but the partner country is not the United States. $\Delta e(i/j)$ represents the log difference in yearly average value of currency $i$ in units of currency $j$. An increase in $\Delta e(i/j)$ means a depreciation of currency $i$. Controls include partner GDP and CPI inflation, fixed effects for period length $\Delta$-by-year and product fixed effects. I include one lag for all the covariates in the regression. The sum of price and volume coefficients does not exactly equal the values coefficient. This is because I estimate volume sensitivity in a sample that contains only products specifying the weight of the merchandise, while I estimate price and volume effects in the full sample. All variables are winsorized annually at their 1st and 99th percentiles. Standard errors clustered by country-year in parenthesis.

Columns 3 and 6 summarize nominal transaction value sensitivities to exchange rates. This is the main variable I use for the aggregation exercise in later sections. It represents the sum of price and volume effects. There are two main takeaways from Table 3. First, transaction values of partner and dominant-priced goods are, on average, twice as sensitive to exchange rate fluctuations as euro-priced goods (Table I.5 in the appendix shows that this difference is significant). Second, this sensitivity is generated by valuation effects being larger than demand effects, on average. The large exchange rate sensitivities observed for foreign-priced goods represent fluctuations in nominal merchandise values rather than a volume response. The established importance of the invoice currency in determining short-term sensitivities to exchange rates motivates the next question: Do these nominal value fluctuations have any real effects?

# 5 Firm Sensitivities to Exchange Rates

The product-level estimates show that exchange rate fluctuations change foreign-invoiced operations of firms only nominally, in the short-run. This calls for a focus on net, rather than gross, trade operations priced in dollars and aggregated at the firm level. After showing how to measure valuation effects with an invoice-weighted index, this section describes the distribution of dollar pricing exposure across firms. It then shows the effect of invoice-weighted exchange rates on firms' aggregate trade flows, cash flows, investment, and payroll. Finally, it studies heterogeneities across different kinds of firms.

## 5.1 Invoice-Weighted Exchange Rate Index

I generate a firm-by-time-specific treatment variable called the "invoice-weighted exchange rate index" to capture the valuation effects of foreign-priced transactions:

$$\textbf{Invoice-weighted}: I_{ft} = \sum_j \left( \widetilde{\text{Exports}}^{j}_{ft_0} - \widetilde{\text{Imports}}^{j}_{ft_0} \right) \Delta e_t^{€/j} \qquad \begin{cases} f : \text{firm} \\ j : \text{invoice currency} \\ t : \text{year} \end{cases} \tag{2}$$

$I_{ft}$ sums over each firm's nominal exposure in invoice currency $j$ at time $t_0$ multiplied by the yearly shock in euro value vis-a-vis currency $j$. This index serves as a proxy for "invoice valuation" income. Its unit of measurement is the euro. Suppose that at time $t = 0$, firm $f$ sells €1000 worth of dollar-priced goods to Japan and this is $f$'s only trade activity. A 1%

(2018). My purpose is to establish that the invoice currency is a good proxy for evaluating the share of activities on each firm's balance sheet that are likely to fluctuate with the value of the currency.

depreciation shock to the euro at time 1 implies $I_{f1}$= €10 income gain.

$I_{ft}$ represents the profits generated by all operationally unhedged product activities priced in foreign-currencies after a euro revaluation. The index refers to a benchmark case of full price stickiness and no quantity response with respect to time $t_0$ activities. In Appendix D I show that $I_{ft}$ can be interpreted as a first-order effect of depreciations on the value of firm operations in a standard open economy model with sticky prices. The index also represents a measure of exposure familiar to many firms engaged in foreign trade: most annual reports of large corporations include the maximum operating income effect of a depreciation in the functional currency.

I will compare the performance of $I_{ft}$ to a standard measure of exchange rate exposure by considering the following version of the effective exchange rate:

$$\textbf{Trade-weighted}: T_{ft} = \sum_c \left(\text{Exports}^c_{ft_0} - \text{Imports}^c_{ft_0}\right) \Delta e_t^{€/c} \tag{3}$$

$c$ represents the trading partner country and its currency. The two main differences with $I_{ft}$ are the country-specific trade weights and bilateral euro-to-currency-of-$c$ depreciations.

To make a comparison between firm-level estimates with transaction-level sensitivities in Section 4, I compute four different invoice-weighted indices:

$$\textbf{Euro-weighted}: I^{€}_{ft} = \sum_c \left(\widetilde{\text{Exports}}^{€}_{ft_0c} - \widetilde{\text{Imports}}^{€}_{ft_0c}\right) \Delta e^{€/c} \tag{4}$$

$$\textbf{Partner-weighted}: I^{c}_{ft} = \sum_c \left(\widetilde{\text{Exports}}^{c}_{ft_0c} - \widetilde{\text{Imports}}^{c}_{ft_0c}\right) \Delta e^{€/c} \tag{5}$$

$$\textbf{Dominant-weighted}: I^{D}_{ft} = \sum_{c \neq \text{USA}} \left(\widetilde{\text{Exports}}^{\$}_{ft_0c} - \widetilde{\text{Imports}}^{\$}_{ft_0c}\right) \Delta e^{€/\$} \tag{6}$$

$$\textbf{Dominant-weighted Partner}: I^{D_c}_{ft} = \sum_{c \neq \text{USA}} \left(\widetilde{\text{Exports}}^{\$}_{ft_0c} - \widetilde{\text{Imports}}^{\$}_{ft_0c}\right) \Delta e^{\$/c} \tag{7}$$

Appendix D shows that these indices capture the full set of competition and valuation effects caused by depreciations. All four indices are firm-level weighted versions of the exchange rate shocks in the transaction-level specification (1). The euro-weighted index captures the specific effects of euro-invoiced transactions. The partner-weighted exchange rate in (5) and the dominant-weighted exchange rate in (6) sum to the invoice-weighted exchange rate index in (2). The benchmark firm-level specification will estimate the contemporaneous effects of all four indexes (4)–(7), rather than (2).

In practice, I cannot observe the invoice currency exposure of French firms for any year before 2011. Since the beginning-of-sample reference year is $t_0 = 2000$, I build a proxy for exports and imports invoiced in currency $j$ at time $t_0$:

$$\widetilde{\text{Exports}}^{j}_{ft_0} = \sum_{ic} \text{Exports}^{ic}_{ft_0} \cdot j\text{-invoiced Export Share}^{ic}_{f,\text{Post-2011}}$$
$$\widetilde{\text{Imports}}^{j}_{ft_0} = \sum_{ic} \text{Imports}^{ic}_{ft_0} \cdot j\text{-invoiced Import Share}^{ic}_{f,\text{Post-2011}}$$
$$\begin{cases} f: \text{firm} \\ j: \text{invoice currency} \\ t: \text{year} \\ i: \text{6D industry} \\ c: \text{country} \end{cases}$$

To proxy for time $t_0$ exposure in currency $j$, I weight exports to all combinations of destination country $c$ and industry $i$ at time $t_0$—$\text{Exports}^{ic}_{ft_0}$—by their post-2011 average share of invoicing in $j$. I then sum all imputed country-industry-firm combinations of exposures to obtain firm $f$'s total exposure to currency $j$ at time $t_0$. This allows me to impute the invoicing shares observed for each product after 2011 to the years 2000–2016.

As long as the pricing decisions remain stable within industry-country-firm combination, my proxies represent the invoicing exposure in 2000. Section 3 validates the hypothesis of currency choice stability for the period between 2011 and 2016.[13]

## 5.2 Identification Strategy

All the invoice-weighted indices in the previous sections are Bartik shift-share shocks where the shares are firm-level invoice exposures, and the shifts are exchange rate shocks. The firm-specific exposures cannot be used as a source of identification because they are likely correlated with unobserved firm characteristics (Goldsmith-Pinkham et al. 2018).

Following Borusyak et al. (2018), I show how I can still identify invoice valuation effects in this context. Formally, the moment conditions for identifying the capital-normalized dominant-weighted index $I^D_{ft}/K_{t_0}$ are:

**A1** $\mathbb{E}[\Delta e^{€/\$}_t | \epsilon_t, \upsilon_t] = \mu$ for all $t$

**A2** $\mathbb{E}[\Delta e^{€/\$}_t \Delta e^{€/\$}_{t-l} | \epsilon_t, \epsilon_{t-l}, \upsilon_t, \upsilon_{t-l}] = 0$ for many and all $l$.

$$\begin{cases} \epsilon_t = \sum_f \frac{\text{Exports}^D_f - \text{Imports}^D_f}{K_{t_0}} \epsilon_{ft} \\ \epsilon_{ft}\text{: unobservable residuals} \\ \upsilon_t\text{: controls} \end{cases}$$

The first condition requires exchange rate shocks to vary quasi-randomly with respect to the unobservable residual of the most exposed firms. $\epsilon_t$ is a macroeconomic weighted average of the structural residual of the dependent variable, with larger weights assigned to firms with larger dominant-pricing exposure. In practice, this requires that the most dominant-

[13] A valid concern is that what seems to be a stable share in invoice currency use after 2011 may not be a representative trend of the yearly 2000s. ECB (2007) shows the French Euro share of settlement payments in goods and services quickly jumped to its long-term share in 2001, contrary to other countries such as Spain or Greece.

pricing exposed firms in the sample do not experience unusual growth in the outcome variable after a euro-dollar depreciation shock, other than through the valuation effect of their trading activities. The second condition requires that exchange rate shocks are not auto-correlated and that there are enough shocks to asymptotically dominate the endogeneity of invoicing shares. An event study based on a single exchange rate fluctuation would not satisfy this condition. Instead, I exploit one of the longest time series available in the literature, to leverage on many shocks.

Are these conditions plausible? The quasi-randomness of euro-dollar exchange rate shocks vis-a-vis real decisions of the most exposed firms is supported by evidence showing that exchange rates behave like hard-to-predict random-walks with shocks unrelated to macroeconomic fundamentals (Meese and Rogoff 1983, Obstfeld and Rogoff 2000). France is a prime candidate to fulfill this requirement because it is in a currency union with exchange markets and monetary policy only weakly related to its domestic condition. Moreover, its firms are not particularly exposed to dollar funding, unlike in many developing countries. Condition **A2** is more demanding because my empirical strategy exploits 15 shocks in the overall sample. However, it is testable, as shown in Section 7.5.

## 5.3 Invoice Exposures of Firms

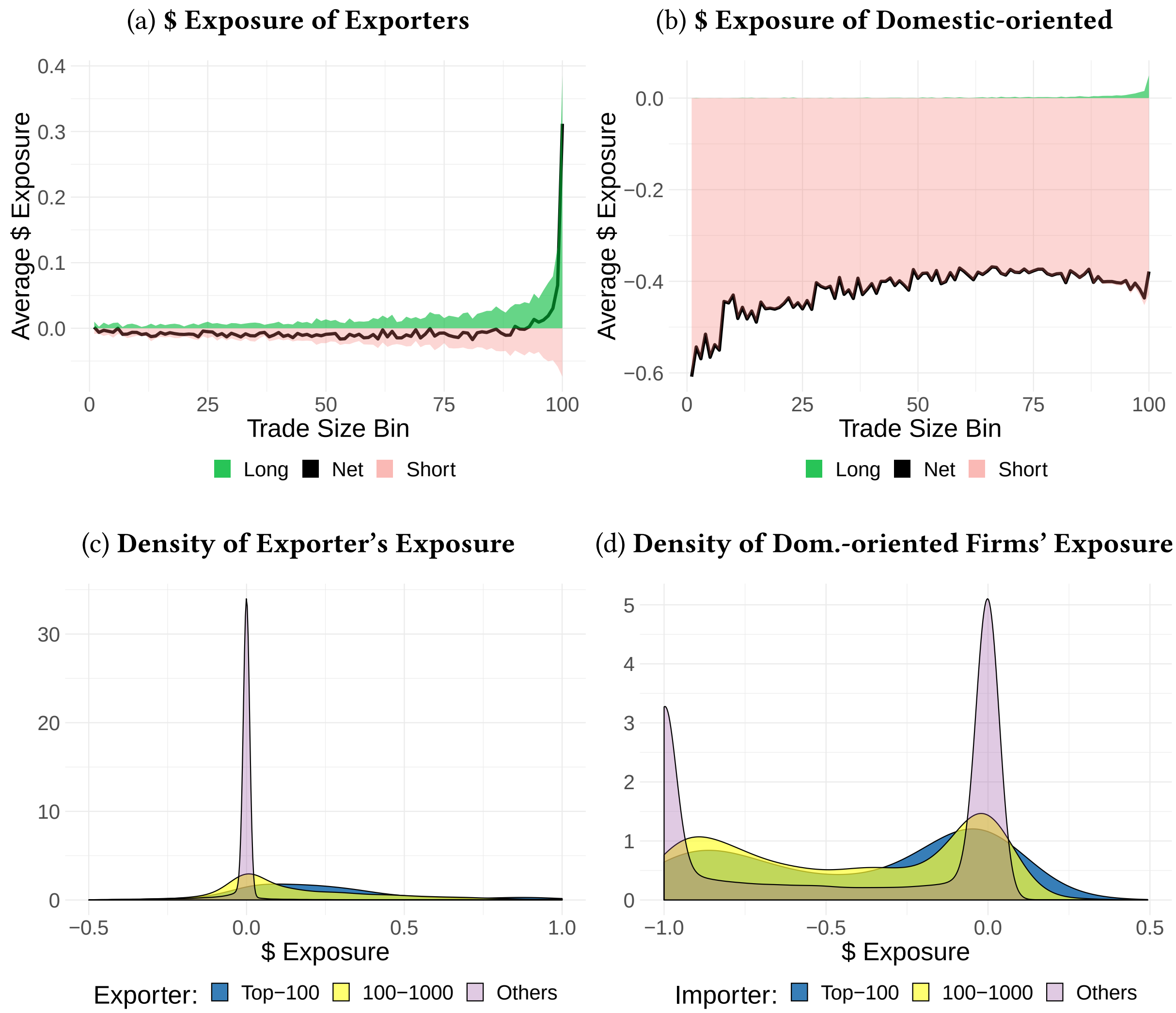
The dominant-weighted exchange rate index defined in (6) exploits each firm's share of net dollar pricing exposure to isolate the extent to which their cash flows are subject to currency fluctuations. Before estimating such effects, Figure 3 analyzes how 2011–2017 average net exposures in dollar pricing (normalized by gross trade) distribute across firms. Panels 3a and 3b show the decomposition of net dollar exposures between dollar-priced exports and imports for exporters and domestic-oriented firms.

Only the largest exporters have long average exposures to the dollar, implying positive net exports in dollars. As exporters decrease in size they avoid dollar-priced transactions. Moreover, the few dollar-priced exports for smaller exporters match with dollar-priced imports. Domestic-oriented firms have quite different exposure behavior. Regardless of size, at least 40% of their import activities are, on average, priced in dollars. By definition, domestic-oriented firms import from countries outside the EU but do not export outside the EU. As a consequence, they cannot hedge their dollar-priced operations with dollar-priced revenues.[14]

Panels 3c and 3d show the distribution of average net dollar exposures of firms in my sample. The cross section of exposures of domestic-oriented firms has a bi-modal distribution,

[14] The fact that even small importers are largely shorting the dollar is particularly interesting from the lenses of the corporate finance literature, which has consistently found that small firms often try to avoid short exposures to foreign currencies (Salomao and Varela 2018).

Figure 3: Average Dollar Exposure over Gross Trade by Quantile Bins of Trade Size




*Note*: Average net dollar exposures of exporters and domestic-oriented firms from 2011 to 2017. Positive values represent the amount of exported dollar-priced goods, normalized by total gross trade of the firm. Negative values represent average amount of imported dollar-priced goods, normalized by total gross trade of the firm. In panels 3a and 3b I show average exposures within 100 quantile bins of gross average trade size. Panels 3c and 3d show the distribution of average cross-sectional exposure of each firm in the sample, split between trade size bins for top 100, 101 to 1000, and other firms.

while exporters exposures are uni-modal. Small domestic-oriented firms are either highly exposed to the dollar, or not exposed at all. This pattern does not harm my identification strategy. If anything, it increases the importance of using firm-specific exposure weights as in (2).[15]

## 5.4 Firm-level Sample

This section links transaction-level sensitivities in Section 4.2 with firm-level sensitivities. To allow a consistent imputation of invoice exposure, I limit firm-level results to a balanced panel of firms active in all years from 2000 to 2016.

Table 4: Description of Representativeness and Composition of the Firm-level Sample

| | **Exporters** | **Domestic-oriented** |
|---|---|---|
| *Number of Firms* | 13,765 | 8,989 |
| *Share of Total Exports* | 57.0% | 8.97% |
| *Share of Total Imports* | 21.3% | 42.0% |
| *Percent of Small Firms* | 27.98% | 37.54% |
| *Percent of Large Firms* | 37.13% | 30.37% |
| *Percent of Manufacturers* | 58.0% | 39.9% |
| *Percent of Wholesalers* | 22.0% | 47.1% |
| *Percent of Multinationals* | 35.5% | 33.3% |
| *Percent of Joint Stock Companies* | 14.7% | 12.4% |
| *Percent of Fin. Constrained Companies* | 22.07% | 22.17% |

*Note*: Composition of the balanced sample for the firm-level exchange rate sensitivity estimation. The sample consists of all French firms in the FARE and FICUS dataset active in all years from 2000 to 2016, and trading manufacturing goods outside the European Union. A firm is classified as an exporter when its mean value of exports (over the whole period) is higher than its imports. All other firms are classified as domestic-oriented. *Share of Total Exports* and *Imports* show the amount of total extra-EU export and import value that exporters or domestic-oriented firms account for. The last set of statistics shows the percentage of different categorical characteristics of firms present within the exporters and domestic-oriented groups. Firms assigned to the bottom and top terciles of capital stock value in 2000 are called *Small* or *Large*, respectively. *Manufacturers* and *Wholesalers* are assigned according to the main activity of the firm, as indicated by the FARE and FICUS datasets. *Multinationals* are firms with residence of their ultimate owner outside of France, or firms owned by a group with subsidiaries abroad. *Financially constrained companies* are those at the bottom tercile of a Kaplan and Zingales index.

Tables 4 and 5 show the characteristics of the firm-level balanced panel. While the transaction-level sample contains 139,507 exporters and 191,846 domestic-oriented companies, the firm-level results rely on observations from 13,756 exporters and 8,989 domestic-oriented compa-

[15] The bi-modal distribution is not driven by any observable characteristic of domestic-oriented firms, e.g. industry or productivity.

Table 5: Descriptive Balance Sheet Characteristics of the Firm-level Sample

| | **Exporters** | | | **Domestic-oriented** | | |
|---|---|---|---|---|---|---|
| Variable$_t$ / Capital$_{t-1}$ | Mean | Median | Std Dev. | Mean | Median | Std Dev. |
| *Sales* | 3.07 | 1.51 | 5.40 | 2.59 | 0.64 | 5.61 |
| *Cash Flows* | 0.51 | 0.17 | 1.46 | 0.69 | 0.22 | 1.73 |
| *Net Income* | 0.15 | 0.00 | 0.66 | 0.17 | 0.00 | 0.73 |
| *Number of Employees** | 36.04 | 23.00 | 32.84 | 32.27 | 18.00 | 31.88 |
| *Salaries* | 0.95 | 0.50 | 1.43 | 1.21 | 0.64 | 1.68 |
| *Cash Holdings* | 0.65 | 0.12 | 1.84 | 0.91 | 0.19 | 2.20 |
| *Tangible Capital* | 0.80 | 0.88 | 0.33 | 0.76 | 0.83 | 0.35 |
| *Financial Capital* | 0.12 | 0.03 | 0.22 | 0.14 | 0.04 | 0.23 |
| *Total Debt* | 0.69 | 0.22 | 1.72 | 0.85 | 0.25 | 1.98 |
| *Net Working Capital* | 1.45 | 0.48 | 3.79 | 1.99 | 0.69 | 4.32 |
| *Equity* | 0.56 | 0.23 | 1.15 | 0.70 | 0.29 | 1.30 |
| *Contingency Reserve* | 0.07 | 0.00 | 0.20 | 0.08 | 0.00 | 0.23 |
| *Interests Charged* | 0.04 | 0.01 | 0.11 | 0.06 | 0.02 | 0.15 |
| *Tangible Capital Expenditure* | 0.05 | 0.02 | 0.18 | 0.05 | 0.01 | 0.20 |
| *Tangible Acquisitions* | 0.09 | 0.04 | 0.17 | 0.10 | 0.04 | 0.19 |
| *Total Factor Productivity** | 2.23 | 2.17 | 0.99 | 2.12 | 2.01 | 0.92 |
| *Gross Trade* | 1.47 | 0.12 | 5.73 | 2.33 | 0.22 | 6.66 |

*Note*: Descriptive statistics of the balanced sample for the firm-level exchange rate sensitivity estimation. The sample consists of all French firms in the FARE and FICUS datasets active in all years from 2000 to 2016, and trading manufacturing goods outside the European Union. All variables are normalized by the beginning-of-period total capital stock net of depreciation, except the ones with a *. The table reports mean, median, and standard deviation of firm-year observations in the two groups of exporters and domestic-oriented firms. Variables are winsorized annually at their 1st and 99th percentiles. Sales represent the total revenue, or turnover of the firm. Cash flows represent gross operating profits. Tangible capital expenditure and tangible capital acquisitions are net of depreciations. Tangible acquisitions include only positive expenditure in new fixed capital assets. Total factor productivity is computed with the Levinsohn and Petrin procedure (see the Glossary for more details). Gross trade is the sum of total extra-EU exports and imports of the firm, as reported in the customs dataset.

nies. However, these firms still account for the majority of French trade with countries outside the EU. Exporters manage 57% of exports and 21.3% of imports. Domestic-oriented firms manage 42% of imports and 9% of exports.

Exporters are, on average, larger than domestic-oriented firms. They are more likely to be multinationals, registered as joint stock corporations, and to have more employees. The differences between exporters and domestic-oriented firms in my sample are generally not as stark as they would be if I computed firm characteristics in the overall sample of trading firms. Exporters are typically much larger than firms focusing on the domestic market (Melitz and Redding 2014). These firms in my sample are similar because of the implied focus on firms trading outside the EU in every year between 2000 and 2016. At worst, this selection could bias my estimates towards zero.

## 5.5 Benchmark Firm-level Sensitivity to Invoice Valuations

The benchmark specification estimating the liquidity effects of invoice currency mismatch is

$$\frac{Y_{f,t}}{K_{f,t-1}} = \overbrace{\beta^{€}\frac{I^{€}_{f,t}}{K_{f,t_0}}}^{\text{Euro}} + \overbrace{\beta^{c}\frac{I^{c}_{f,t}}{K_{f,t_0}}}^{\text{Partner}} + \overbrace{\boldsymbol{\beta^{D}}\frac{\boldsymbol{I^{D}_{f,t}}}{\boldsymbol{K_{f,t_0}}}}^{\text{Dominant}} + \beta^{D_c}\frac{I^{D_c}_{f,t}}{K_{f,t_0}} + \mu X_{f,t} + \alpha_f + T_{t_0,f,c,e}\times\delta_t + \gamma_{3\text{D}}\times\delta_t + u_{ft} \tag{8}$$

$I^{€}_{ft}$, $I^{c}_{ft}$, $I^{D}_{ft}$, and $I^{D_c}_{ft}$ are defined as in (4)–(6). The dependent variables are normalized by the start-of-year capital stock to reflect the standard practice in corporate finance.[16] The invoice-weighted indices are also normalized by capital. The $\beta$ coefficients can be interpreted as a euro-on-euro pass-through coefficient. One euro gained from an "invoice valuation" implies $\beta$ euros gained on $Y_{f,t}$.

$\beta^{D}$ is the preferred estimation coefficient for the valuation effects of invoice currency fluctuations because it exploits variation between the euro and a currency not in common with the trading partners of the firms. The fixed effects included in the regression are firm-specific $\alpha_f$ and 3-digit industry-time-specific $\gamma_{3D}\times\delta_t$. $T_{t_0,f,c,e}$ represents the amount of trade of firm $f$ in country $c$, for import/export flow $e$ at the beginning of the sample. By interacting $T_{t_0,f,c,e}$ with a year dummy I control non-parametrically for each firm's trade patterns over the years.[17] Other controls include lagged total factor productivity, lagged sales growth, and the lagged dependent variable.

[16] See Kaplan and Zingales (1997), Rauh (2006), Moyen (2004), Lewellen and Lewellen (2016). This normalization is also justified by the model specification in Appendix D.

[17] Controlling for trends in trade activities would be impossible in a study using trade-weighted exchange rates because the non-parametric control would perfectly correlate with the treatment.

I also run a horse-race between the invoice-weighted and trade-weighted indexes to allow a straightforward comparison with other studies.[18]

$$\frac{Y_{f,t}}{K_{f,t-1}} = \overbrace{\beta^T \frac{T_{f,t}}{K_{f,t_0}}}^{\text{Trade-weighted}} + \overbrace{\beta^I \frac{I_{f,t}}{K_{f,t_0}}}^{\text{Invoice-weighted}} + \mu X_{f,t} + \alpha_f + \gamma_{3D} \times \delta_t + u_{ft} \tag{9}$$

$T_{f,t}$ and $I_{f,t}$ are defined in Section 5.1. In this case I cannot control non-parametrically for firm trade shares lest they absorb the effects of the trade-weighted index.[19]

Table 6: Benchmark Firm-level Pass-through of Invoice Valuations

| | **Cash Flows** | | | **Tangible Capital Expenditure** | | | **Salaries and Wages** | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Trade-weighted | 0.084*** | 0.021 | | 0.008*** | 0.003* | | 0.024*** | 0.003 | |
| | (0.025) | (0.016) | | (0.003) | (0.002) | | (0.008) | (0.007) | |
| Invoice-weighted | | 0.295*** | | | 0.022*** | | | 0.100*** | |
| | | (0.076) | | | (0.007) | | | (0.028) | |
| Euro-Pricing | | | -0.022 | | | 0.000 | | | 0.006 |
| | | | (0.040) | | | (0.005) | | | (0.017) |
| Partner-Pricing | | | 0.243 | | | 0.066* | | | 0.201** |
| | | | (0.164) | | | (0.039) | | | (0.085) |
| Dominant-Pricing | | | 0.447*** | | | 0.033*** | | | 0.129** |
| | | | (0.132) | | | (0.011) | | | (0.052) |
| Observations | 252,987 | 252,987 | 250,734 | 252,987 | 252,987 | 250,734 | 252,987 | 252,987 | 250,734 |
| $R^2$ | 0.657 | 0.657 | 0.659 | 0.124 | 0.124 | 0.127 | 0.835 | 0.835 | 0.837 |

*Note*: Benchmark pass-through estimation of €1 invoice valuation income. Columns 1, 4, and 7 correspond to specification (9) with covariates including only the trade-weight index and controlling for lagged total factor productivity, lagged sales growth, lagged dependent variable, year and firm fixed effects. Columns 2, 5, and 8 run the full specification in (9) with the same controls as Columns 1,4, and 7, and including the invoice-weighted index a defined in equation (2). Columns 3, 6, and 9, represent the benchmark specification in (8) with controls including lagged productivity, lagged sales growth, lagged dependent variable, year, firm, 3-digit industry code-by-year, and trade exposure-by-year fixed effects. Cash flows are defined as gross operating profits. Tangible capital expenditures are defined as change in book value of fixed assets, net of depreciation. All variables are normalized by total capital stock and winsorized annually at their 1st and 99th percentiles. Standard errors double clustered by year and firm. In the context of this analysis, clustering standard errors by year is akin to clustering following Adão et al. (2018).

[18]The exercise is similar in spirit to Gopinath et al. (2016).

[19]In appendix G I show how this regression introduces downward bias in $\beta^I$. As a consequence, I consider it a useful exercise but do not use it as my benchmark specification.

Table 6 shows the results of specifications (8) and (9) for the three main firm-level variables of interest: cash flows, tangible capital expenditures, and salaries. The trade-weighted exchange rate index has an effect on cash flows, investments, and salaries of 8 cents, 0.8 cents and 2 cents on the dollar, respectively. However, including the invoice-weighted index knocks down the magnitude of the trade-weighted index to almost zero. The effects of the invoice-weighted index are around 10 times as big as the effects of the trade-weighted index estimated in isolation.

Using the preferred valuation effect estimate—the dominant-weighted index in columns 3, 4 and 5—as a reference, invoice valuations cause cash flows to increase 45 cents on the euro. Cash flows in Table 6 represent Gross Operating Profits. This measure excludes possible compensating effects of financial or extra-ordinary income. However, the fact that cash flow effects are close to the pass-through at the border reveals how dollar-pricing exposed firms can do little except absorbing the invoice valuation shocks within their operations.[20] Tangible investments have a pass-through of 3 cents on the dollar, while the salary sensitivity is higher, at 12 cents on the dollar.

To help comparison with other studies, a simple rescaling of the estimates shows an implied investment sensitivity to cash flows of 7 cents on the euro ($0.03/0.45 = 0.07$). This is on the lower end of sensitivities typically found in the corporate finance literature.[21] The salary sensitivity to cash flows is 30 cents on the euro. This is exactly in line with other payroll sensitivities to cash flow found by Schoefer (2016), Garin and Silvério (2019), Acabbi et al. (2019).[22]

To interpret the results in terms of percentage changes of real variables I also run the specification in (8) on invoice-weighted indices normalized by sales instead of capital. The results in Table 7 can be interpreted as percentage responses of the dependent variable after an invoice valuation equivalent to 1% increase of sales. While payroll effects are still larger than investment effects, the difference is not as stark as in Table 6. This estimation shows that the full effect on salaries is due to a response in the number of persons employed rather than a wage response.

Appendix F shows what other balance sheet components absorb the effects of invoice valuations. The two most important components are cash reserves and net working capital. The

[20] Appendix E explains how the lower cash flow sensitivity estimate is an artifact of measurement error introduced with the generation of the firm-level invoice-weighted index.

[21] Estimates of benchmark cash flow sensitivities of investments range from 0.48 in Amiti and Weinstein (2018), to 0.111 in Rauh (2006), to 0.702 in Kaplan and Zingales (1997). See also Fazzari et al. (1988), Moyen (2004), Lewellen and Lewellen (2016).

[22] In appendix D, I show that exchange rate fluctuations with stable dollar prices can affect both expected profitability and current cash flows. Therefore, I do not explicitly run an instrumental variable estimation to compute sensitivity to cash flows because unobservable profitability shifts imply that the exclusion restriction does not hold. Moreover, a reduced form estimation is not subject to weak instrument concerns.

Table 7: Effects of Sales-Normalized Index on Outcome Changes

| | $\Delta$ Tan. Capital | $\Delta$ Salaries | $\Delta$ Employment |
|---|---|---|---|
| | (1) | (2) | (3) |
| Euro-weighted / Sales | 0.047 | 0.140*** | 0.073 |
| | (0.054) | (0.049) | (0.081) |
| Partner-weighted / Sales | 0.425 | -0.069 | 0.139 |
| | (0.273) | (0.157) | (0.188) |
| Dominant-weighted / Sales | 0.362*** | 0.449*** | 0.502*** |
| | (0.127) | (0.094) | (0.160) |
| Observations | 250,202 | 218,619 | 232,187 |
| $R^2$ | 0.124 | 0.168 | 0.152 |

*Note*: Percentage effects of an increase in euro-weighted, partner-weighted and dominant-weighted invoice valuation income equivalent to a 1% increase in sales. The invoice-weighted covariates are defined as in equations (4)-(6), and normalized by the 2000 value of firms' sales. The dependent variables are defined as log difference in the stock of gross tangible capital, log difference in salaries, and log difference in number of effective employees. Controls include lagged productivity, lagged sales growth, lagged dependent variable, year, firm, 3-digit industry code-by-year, and trade exposure-by-year fixed effects. Variables are winsorized annually at their 1st and 99th percentiles. Standard errors double clustered by year and firm.

fact that dividends, issues, official debt, and financial income mostly do not respond to invoice valuation is likely due to the fact that the results are driven by small financially constrained firms, as the next section shows.

### 5.5.1 Channels of Invoice Valuation Effects

How do invoice valuation effects differ across companies? Figure 4 decomposes cash flows, investment, and salaries sensitivities by firm asset size and market orientation. This decomposition also shows which groups of firms drive the average results.

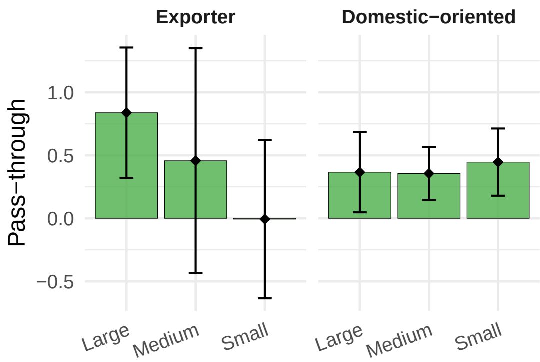
Cash flow pass-through estimates are significant for all domestic-oriented firms, and for large exporters. This is not surprising given that small and medium exporters rarely invoice their goods in dollars, and if they do they match their dollar imports with exports. To reflect the heterogeneity in exposure shares, panel 4b normalizes the pass-through estimates by the dependent variable standard deviation. Panel 4b shows that even though the pass-through into cash flow is high for large exporters, one standard deviation shock in invoice valuation explain less than 1% of their cash flow standard deviation. The main reason is that the overall size of exporters balance sheet is much larger than their extra-EU trade operations. For instance, the ratio between extra-EU gross trade and total capital is 1.4 for exporters, and 2.3 for domestic-oriented companies. Moreover, all exporters operationally hedge their foreign-priced activities, at least in part. In contrast, one standard deviation shock in invoice valuation explains 4 to 5% of cash flow standard deviation of medium and small domestic-oriented firms.

Most of the effects on investments and salaries are significant only for small domestic-oriented firms. Figure 5 explores how liquidity and financial sophistication are the likely channels behind this lack of pass-through into large firms' real variables. I split the results between multinationals and domestic firms, high-growth firms and low-growth firms, joint-stock and limited liability companies, large and small firms, and financially constrained and unconstrained firms (see the Glossary for detailed definitions). Figure 5 shows that significant real effects are concentrated on domestic small private firms.

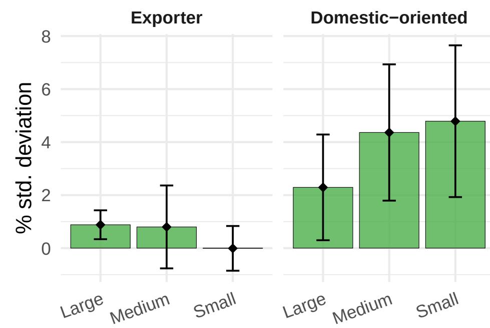
Multinationals, firms with large collateral, or with access to stock markets, have more ways to insulate optimal investment decisions from cash flow fluctuations. For instance, section 7.6 shows how only the financial income of large exporters moves in the opposite direction of invoice valuation shocks, implying the use of financial hedging instruments. Moreover, most firms in my sample are larger and more liquid than the average French company. Table I.8 shows that the larger companies in my sample are even more liquid than the average public French company. To verify that focusing on establishment-level declarations is not leading to noisy estimates for large firms, Table I.9 also replicates the pass-through estimation on consolidated balance sheet measures.

Figure 4: Decomposed Effects of Dominant-weighted Index

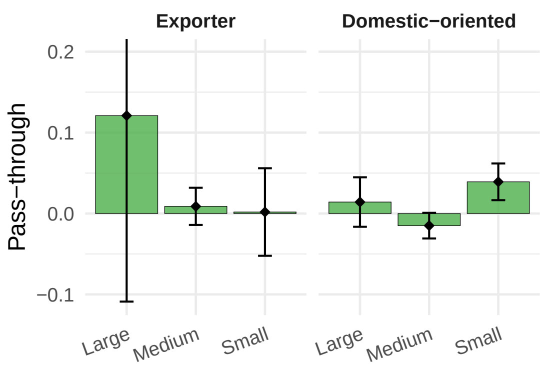
(a) **Cash Flows**



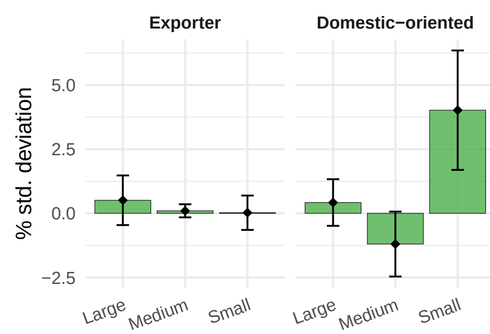

(b) **Standardized Cash Flows**



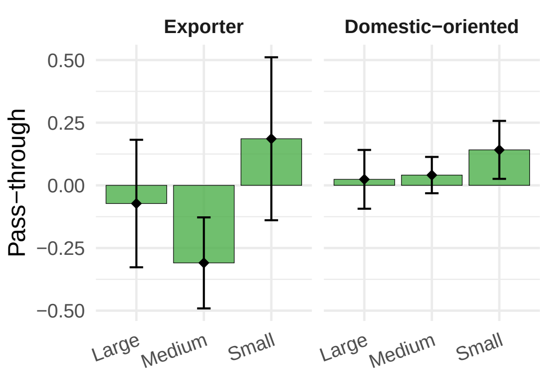

(c) **Tangible Investments**



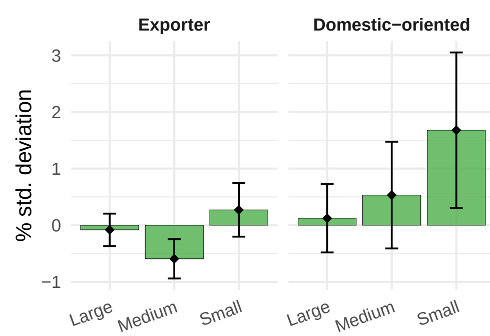

(d) **Standardized Tangible Investments**




(e) **Salaries**



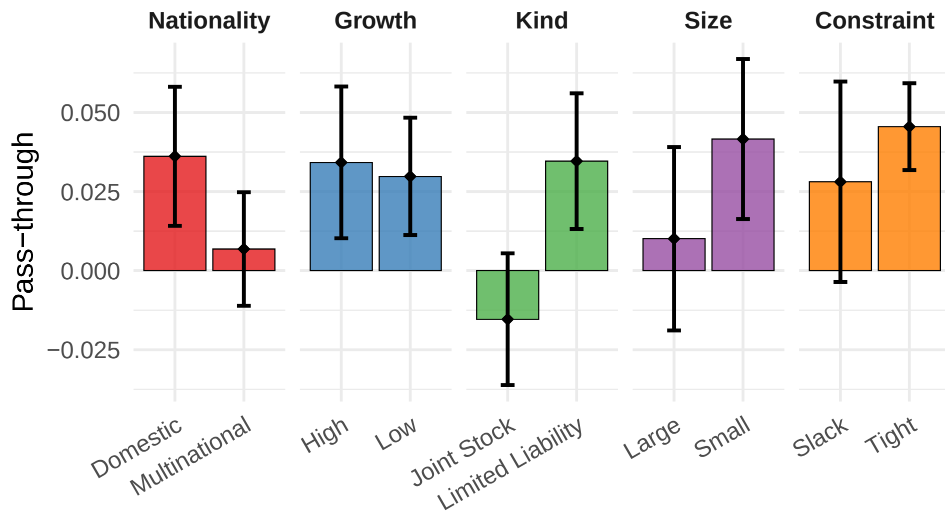

(f) **Standardized Salaries**



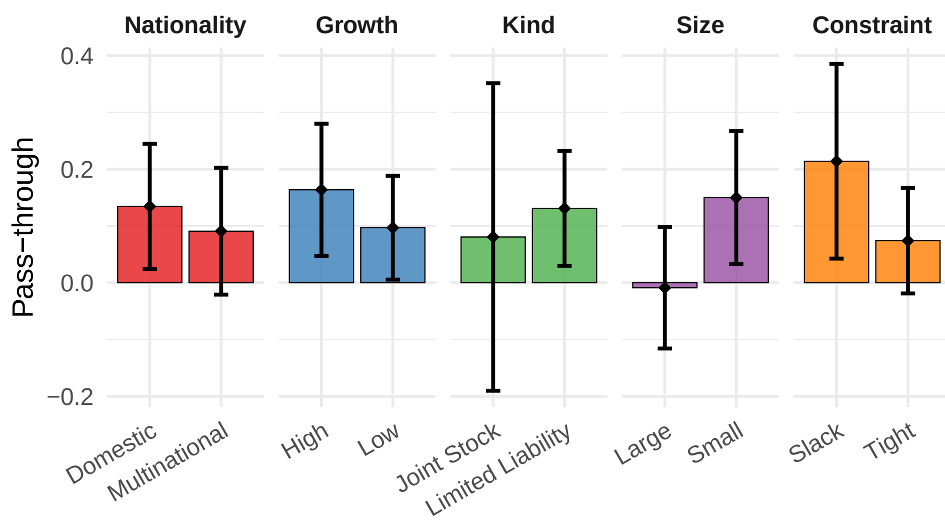

*Note*: The left-hand-side graphs represent the heterogeneous effects of the dominant-weighted index on cash flows, tangible capital expenditure, and salaries. The estimation follows the benchmark specification in equation (8), except here I interact each invoice-weighted index with a dummy identifying the six groups of firms. The figures on the right-hand-side show the standardized regression coefficients. The latter represent the effects of a standard deviation dominant-weighted shock, as a standard deviation percentage of the group's dependent variable. The right-hand-side graphs are estimated from separate regressions following specification (8) for each firm group, after normalizing all variables. Controls include lagged productivity, lagged sales growth, lagged dependent variable, year, firm, 3-digit industry code-by-year, and trade exposure-by-year fixed effects. Standard errors for the 95% confidence intervals are double clustered by year and firm.

Figure 5: Heterogeneity of Pass-through Effects

(a) Tangible CAPEX Pass-through to Dominant-weighted Index




(b) Salaries Pass-through to Dominant-weighted Index




*Note*: Heterogeneous effects of the dominant-weighted exchange rate index on tangible investments and payroll. The estimation follows the benchmark specification in equation (8) where I interact each invoice-weighted index with a dummy identifying the following heterogeneous categories. *Nationality*: firms are defined as multinationals if in any year of the sample their ultimate owner has residence outside of France, or if their group has subsidiaries outside of France. All other firms are called domestic. *Growth*: top and bottom terciles of average yearly sales growth in the period 2000-2016. *Legal form*: I distinguish between joint stock and limited liability corporations. Only joint stocks corporations can be public. *Size*: top and bottom terciles of total capital stock value of the firm in 2000. *Financial Constraint*: Top and bottom tercile bins of the Kaplan and Zingales constraint index. Controls include lagged productivity, lagged sales growth, the lagged dependent variable, year, firm, 3-digit industry code-by-year, and trade activity-by-year fixed effects. Standard errors for the 95% confidence intervals are double clustered by year and firm.

# 6 Aggregate Sensitivities to Exchange Rates

This section investigates the aggregate invoice valuation effects on French investment and employment. The firm-level estimates in Section 5 provide capital expenditure and payroll sensitivities representing average marginal effects on invoice-exposed firms. However, the macroeconomic nature of exchange rate shocks calls for an understanding of the aggregate average magnitude of invoice valuation effects generated by depreciations. While the macroeconomic estimates represents a partial equilibrium exercise, their magnitude are informative of when the underlying invoice currency exposure chosen by firms can amplify or offset exchange rate shocks.

## 6.1 Aggregate Investment and Payroll Effects of Invoice Valuations

To compute the aggregate effects of invoice valuations, I weight the firm-level average marginal estimates by the dominant-pricing exposure of each firm and by how much each firm contributes to the aggregate outcome. In practice, I multiply the average estimated invoice valuation effects by the average net exposure to dominant-priced trade of all French manufacturers between 2011–2017.[23] The estimate represents the percentage response in aggregate outcome after a 10% euro depreciation:

$$\Delta\text{Aggregate Effect on Y} = \frac{1}{\text{Tot. }\overline{\overline{Y}}} \sum_f \overbrace{\overline{\text{Exports}}_f^D - \overline{\text{Imports}}_f^D}^{\text{Net Dominant Exposure}} \cdot \overbrace{\beta_y^D}^{\text{Marginal Estimate}} \cdot \overbrace{0.1}^{\text{10\% Depreciation}} \tag{10}$$

Table 8 shows the partial-equilibrium percentage changes in aggregate cash flows, investment, and payroll, computed as in equation (10). The first set of estimates reflects the estimated invoice valuation effects conditional on observed exposures. The aggregate impact on the French economy is marginal. A 10% Euro depreciation generates a 0.4% increase in the aggregate cash flows of traders, 0.1% increase in investment, and 0.2% increase in payroll. These effects translate into additional investment and payroll equivalent to 0.001 and 0.005 percentage points of GDP, respectively.

Why are the aggregate effects so small? First, the marginal average estimates are relatively small (Section 5.5.1 shows how only small domestic-oriented firms in the sample contribute to significant real effects). Second, the operational hedge of dollar-priced exports and imports observed in the balance sheet of exporters imply that net exposures to dominant-priced trade

[23] This implies that I apply the same average estimate in Table 6 to all firms (exporters and domestic-oriented), regardless of size, for simplicity. Table I.10 in the appendix shows the same exercise taking into account all the indices estimated in Table 6, not just the dominant-weighted coefficient.

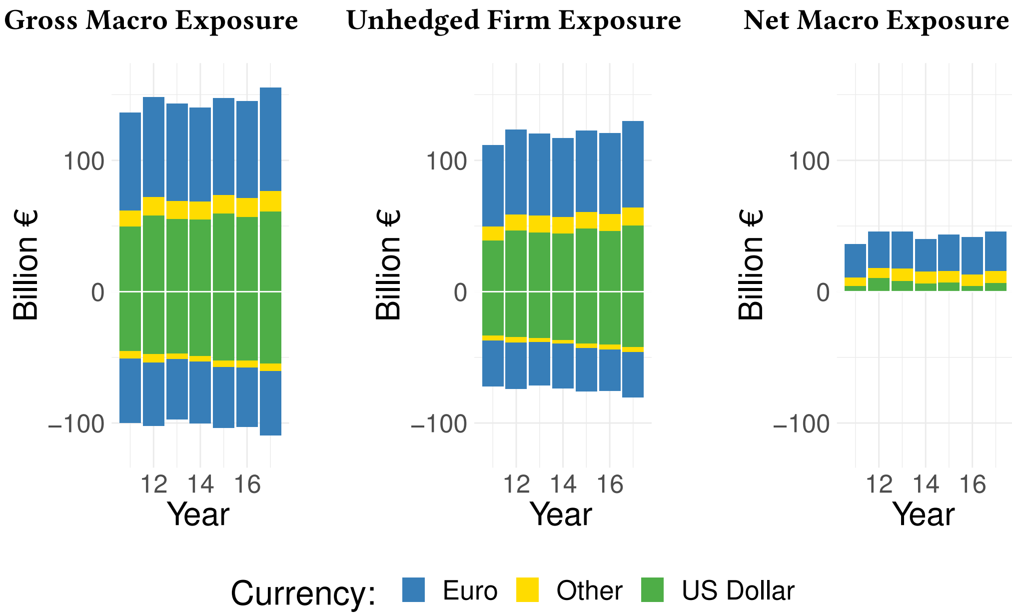
Table 8: Aggregate Effects of Invoice Valuations after a 10% Euro Depreciation

| | $\Delta$ Cash Flows | $\Delta$ Tangible CAPEX | $\Delta$ Salaries |
|---|---|---|---|
| **Average Estimates on Actual Exposure** | | | |
| Exporters | 2.6% | 0.6% | 1.0% |
| Domestic-oriented | -2.1% | -0.5% | -0.9% |
| All | 0.4% | 0.1% | 0.2% |
| **Upper bound Estimates on Actual Exposure** | | | |
| Exporters | 2.6% | 6.0% | 1.8% |
| Domestic-oriented | -2.1% | -5.0% | -1.5% |
| All | 0.4% | 1.0% | 0.3% |
| **Average Estimates on Unhedged Counterfactual** | | | |
| Exporters | 3.6% | 0.9% | 1.4% |
| Domestic-oriented | -3.1% | -0.8% | -1.3% |
| All | 0.4% | 0.1% | 0.2% |

*Note*: This table shows the partial-equilibrium percentage changes in aggregate cash flows, investment, and payroll generated by dominant-price exposure after a 10% Euro depreciation. *Cash flows* are defined as gross operating profits. *Tangible CAPEX* defined as the yearly difference in fixed gross capital. The estimated percentage changes are aggregate effects within the whole sample of French firms trading outside the European Union. This sample of firms accounts for 50% of tangible capital and salary expenditure of all manufacturers in France. The effects are computed following equation (10). The first set of estimates (*average estimates on actual exposure*) reflects the aggregate invoice valuation effects conditional on observed exposures. The second set of estimates (*upper bound estimates on actual exposure*) represent a counterfactual case in which the cash flows sensitivities of investments and payroll are equivalent to the highest estimates found by the literature: 70 cents on the dollar for investment (Kaplan and Zingales 1997), and 50 cents on the dollar for payroll (the upper bound used by Schoefer 2016). The third set of estimates (*average estimates on unhedged counterfactual*) applies the actual invoice valuation effect estimates on a counterfactual exposure case in which the total amount of dollar-priced exports is sold only by exporters, and the total amount of dollar-priced imports is purchased only by domestic-oriented firms.

are low. Both marginal effects and net dominant exposure to exchange rates in equation (10) contribute to a low aggregate effect.

Figure 6: Aggregate Macroeconomic Exposure




*Note*: This figure represents gross and net pricing exposure to dollar, euro and other currencies for the French extra-EU trade between 2011 to 2017. *Gross Macro Expsoure* shows the total gross exposures of all extra-EU trade. Exports are in the positive axis, while imports are in the negative axis. *Unhedged Firm Exposure* shows the gross exposure, after netting out within-firm hedging of operations invoiced in the same currency. *Net Macro Exposure* shows the overall net exposure of France in the three pricing regimes.

To show the marginal estimates contribution I create a counterfactual case in which the cash flow sensitivities of investments and payroll are as large as the upper bound found by the literature: 70 cents on the dollar for investment (Kaplan and Zingales 1997), and 50 cents on the dollar for payroll (Schoefer 2016). This exercise gives an idea on the counterfactual macroeconomic effects if French traders could not absorb invoice valuations on their operations. The real effects become 10 times larger for investments and almost double for payroll.

To show the impact of operational hedging of firms, the third set of results in Table 8 applies the estimated pass-through effects to a counterfactual case in which the total amount of dollar-priced exports is sold only by exporters, and the total amount of dollar-priced imports is purchased only by domestic-oriented firms. In other words, I fix the total amount of trade in dollars, but I do not allow within-firm operational hedging. In this case, the same devaluation shock presents 3 to 4 percentage point higher heterogeneous effects for exporters and domestic-oriented firms. However, the net effect on the economy does not change.

In fact, the net effect of invoice valuation on the overall economy is low in all scenarios. This is because of a "macroeconomic" hedge. Figure 6 shows the relative importance of within-firm and within-country operational hedging in determining aggregate exposure to the dollar. On top of the natural hedge often exploited by large firms, France has almost the same aggregate amount of dollar-priced imports and dollar-priced exports.

### 6.2 Aggregate Effects on the Trade Balance

I use the exchange rate sensitivities of trade flows estimated in Section 4.2 to infer aggregate trade balance effects. This exercise can be seen as a revision of the Marshall-Lerner condition accounting for invoice currencies.[24] For simplicity, I use the estimates in Table 3 without studying possible heterogeneous effects.[25] Following the notation commonly used to explain the Marshall-Lerner condition, I compute the trade balance effect after a 10% depreciation:

$$\begin{aligned}\frac{\partial(\text{Trade Balance / GDP})}{\partial\mathcal{E}^{€/p}} = \; & \overbrace{\text{share}^{€}_{X}}^{0.04}\overbrace{\frac{\partial X^{€}}{\partial\mathcal{E}^{€/p}}}^{3.8} + \overbrace{\text{share}^{P}_{X}}^{0.013}\overbrace{\frac{\partial X^{P}}{\partial\mathcal{E}^{€/p}}}^{5.68} + \overbrace{\text{share}^{D}_{X}}^{0.02}\overbrace{\frac{\partial X^{D}}{\partial\mathcal{E}^{€/\$}_{\perp\mathcal{E}^{\$/p}}}}^{6.97} \\ & - \underbrace{\text{share}^{€}_{M}}_{0.025}\underbrace{\frac{\partial M^{€}}{\partial\mathcal{E}^{€/p}}}_{2.72} - \underbrace{\text{share}^{P}_{M}}_{0.009}\underbrace{\frac{\partial M^{P}}{\partial\mathcal{E}^{€/p}}}_{9.0} - \underbrace{\text{share}^{D}_{M}}_{0.017}\underbrace{\frac{\partial M^{D}}{\partial\mathcal{E}^{€/\$}_{\perp\mathcal{E}^{\$/p}}}}_{7.52}\end{aligned}$$

The overall effect is a 0.08 percentage point improvement in the extra-EU manufacturing trade balance, almost fully generated by a net imbalance of euro-priced goods. There are almost no dominant- or partner-invoice valuation effects on the trade balance because dollar-priced aggregate imports and exports almost perfectly match (see Figure 6). However, extra-EU French manufacturing has a euro-pricing trade surplus equivalent to 1.5% of GDP, which generates foreign demand improvement effects after a euro depreciation. Given the distribution of French invoicing, the Mundell-Fleming paradigm provides a good approximation of France's short-term *net* trade response to a euro depreciation.

## 7 Extensions and Robustness

This section addresses the main robustness concerns regarding transaction-level and firm-level estimates. The three main concerns with the transaction-level estimates are endogeneity, attrition bias, and alternative channels confounding the relevance of invoice currencies. I address each of these concerns first. An analysis of the long-term responses also confirms the

[24]See Rose (1991) for reference.

[25]The analysis in Section 7.2 shows that the heterogeneous effects are limited

economic validity of the sensitivity estimates. The main concerns with the firm-level estimates are the validity of assumptions **A1** and **A2**. In particular, I verify that no particular set of shocks drives the result, the treatment is balanced on observable characteristics of firms, and financial exposure is not likely to drive the results.

## 7.1 Robustness of Transaction-level Sensitivity to Endogeneity

General equilibrium dynamics affecting exchange rates may bias the sensitivity estimates. For instance, demand shifts co-moving with depreciations may confound the estimates.

To address endogeneity concerns, Table 9 shows a coefficient stability test that incrementally saturates the panel variation. Column 1 runs the estimation with no controls. The sensitivity estimates are similar to the ones in the benchmark specification. Therefore, we can interpret the sensitivity estimates as average unconditional effects, easier to interpret and aggregate into macroeconomic effects. Column 2 adds French and partner country macroeconomic controls such as output and inflation. Columns 3 and 4 add firm-, industry-, and country-specific fixed effects. Column 5 introduces time fixed effects and it corresponds to the benchmark specification in Table 3. Column 6 controls for firm-time-industry fixed effects. In Column 6, the coefficients on exports can be interpreted as effects on markups, while the coefficients on imports can be interpreted as controlling for demand shifts. Despite the saturation level of the specification, the coefficients remain stable.

Using the Oster (2019) bias estimator, Table 9 implies a potential upward bias on the dominant-priced export sensitivity of 0.06 and a *downward* bias of dominant-priced import sensitivity of 0.3. In other words, the magnitude of the potential bias is unlikely to offset the evidence of higher exchange rate sensitivity of dollar-priced transactions.

## 7.2 Heterogeneities in Transaction Sensitivities

Heterogeneities underlying the estimation of transaction-level sensitivities raise two concerns. First, alternative economic channels correlated to the invoice currency distribution may better explain the observed differential sensitivities. This case does not necessarily harm identification but it can change the interpretation and external validity of this study. Second, if a specific subgroup of firms or products drives the transaction-level results, invoice currency is not a good proxy for operational currency exposure of firms. This is especially important in light of the aggregation analysis to the firm and macro economic level in Sections 5 and 6.

I test whether dominant-priced products consistently imply higher value sensitivities to exchange rates than euro-priced ones, across a battery of alternative pass-through determinants. I modify specification (1) to

Table 9: Yearly Pass-through of a 1% Euro Depreciation, Robustness to Fixed Effects Pattern

| | *Dependent variable:* $\Delta$Value$^{€}$ | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ***Panel A. Exports*** | | | | | | |
| Euro $\times \Delta e$(€/ Partn.) | 0.361$^{***}$ | 0.393$^{***}$ | 0.352$^{***}$ | 0.336$^{***}$ | 0.318$^{***}$ | 0.321$^{***}$ |
| | (0.055) | (0.066) | (0.062) | (0.076) | (0.082) | (0.097) |
| Partner $\times \Delta e$(€/ Partn.) | 0.627$^{***}$ | 0.689$^{***}$ | 0.574$^{***}$ | 0.525$^{***}$ | 0.531$^{***}$ | 0.714$^{***}$ |
| | (0.173) | (0.156) | (0.124) | (0.164) | (0.168) | (0.199) |
| Dominant $\times \Delta e$(€/ \$) | 0.691$^{***}$ | 0.694$^{***}$ | 0.630$^{***}$ | 0.632$^{***}$ | 0.646$^{***}$ | 0.839$^{***}$ |
| | (0.101) | (0.106) | (0.097) | (0.135) | (0.144) | (0.202) |
| Observations | 2M | 2M | 2M | 2M | 2M | 2M |
| $R^2$ | 0.001 | 0.004 | 0.033 | 0.327 | 0.326 | 0.552 |
| ***Panel B. Imports*** | | | | | | |
| Euro $\times \Delta e$(€/ Partn.) | 0.088 | 0.243$^{***}$ | 0.254$^{***}$ | 0.317$^{**}$ | 0.167 | 0.026 |
| | (0.075) | (0.090) | (0.098) | (0.159) | (0.169) | (0.241) |
| Partner $\times \Delta e$(€/ Partn.) | 0.763$^{***}$ | 0.997$^{***}$ | 0.976$^{***}$ | 0.997$^{***}$ | 0.883$^{***}$ | 0.946$^{**}$ |
| | (0.120) | (0.081) | (0.093) | (0.191) | (0.196) | (0.426) |
| Dominant $\times \Delta e$(€/ \$) | 0.589$^{***}$ | 0.737$^{***}$ | 0.787$^{***}$ | 0.799$^{***}$ | 0.794$^{***}$ | 0.824$^{**}$ |
| | (0.158) | (0.085) | (0.114) | (0.223) | (0.175) | (0.321) |
| Observations | 1.4M | 1.4M | 1.4M | 1.4M | 1.4M | 1.4M |
| $R^2$ | 0.001 | 0.004 | 0.050 | 0.359 | 0.360 | 0.823 |
| French GDP, CPI | | ✓ | ✓ | ✓ | | |
| Partner GDP, CPI | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Firm | | | ✓ | | | |
| Industry code | | | ✓ | | | |
| Country | | | ✓ | | | |
| Invoicing | | | ✓ | | | |
| Firm $\times$ Ind. $\times$ Count. $\times$ Inv. | | | | ✓ | ✓ | |
| Year $\times$ $\Delta$ | | | | | ✓ | |
| Firm $\times$ Ind. $\times$ Year $\times$ $\Delta$ | | | | | | ✓ |
| Ind. $\times$ Country $\times$ Inv. | | | | | | ✓ |

*Note*: Yearly sensitivity regression estimated as in equation (1) on unbalanced panel of manufacturing products in the extra-EU trade customs dataset from 2011 to 2017. $\Delta$ defined as the period between two transactions, often but not always coinciding with one year. $\Delta e(i/j)$ represents the log difference in yearly average value of currency $i$ in units of currency $j$. An increase in $\Delta e(i/j)$ means a depreciation of currency $i$. I include one lag for all the exchange rates. Standard errors clustered by country $\times$ year.

$$\Delta y_{jt} = \sum_h \overbrace{\tilde{\beta}_h \, Q^h_{jt} \cdot \Delta e^{€/p}_t}^{\text{Euro Pass-through}} + \overbrace{\tilde{\beta}^P_h \, D^P_j \cdot Q^h_{jt} \cdot \Delta e^{€/p}_t}^{\text{Additional Partner Pass-through}} + \overbrace{\tilde{\beta}^{\mathbf{D}}_{\mathbf{h}} \, \mathbf{D}^{\mathbf{D}}_{\mathbf{j}} \cdot \mathbf{Q}^{\mathbf{h}}_{\mathbf{jt}} \cdot \boldsymbol{\Delta} \mathbf{e}^{€/\$}_{\mathbf{t}}}^{\text{Additional Dominant Pass-through}}$$
$$+ \tilde{\gamma}^D \, D^D_j \cdot Q^h_{jt} \cdot \Delta e^{\$/p}_t + \phi x_{jt} + \alpha_j + \delta_t + \epsilon_{jt} \tag{11}$$

There are two differences from the benchmark specification in (1). First, I interact all sensitivity estimations with quantile bins or categories of an alternative explanatory variable $Q^h_{jt}$. Second, the coefficient of interest, $\tilde{\beta}^D_h$, is interpreted as an *additional* sensitivity to euro depreciation compared to euro-priced goods. Specification (11) non-parametrically tests whether the higher exchange rate sensitivity of dominant-priced goods is ever knocked down by an alternative heterogeneous pass-through explanation. If no $\tilde{\beta}^D_h$ is statistically different from zero for all $h$, then the level of $Q^h_{jt}$ is capturing the heterogeneous sensitivities better or as well as the invoice currency.[26]

Figure 7 shows the estimates of specification (11) for several alternative pass-through channels. The channels are:

- **Rauch classification**: This is more of a falsification test. The first line of Figure 7 shows that when prices are established in a centralized market with daily price updates, invoice currency does not matter, as theory predicts (Engel 2006, Gopinath et al. 2010).

- **market share**: Previous studies show that the market share of a product is an important determinant of exchange rate pass-through into import prices.[27] I observe larger exchange rate sensitivities of dominant-priced goods conditional on any market share level.

- **subsidiary partner or multinational**: I find that higher sensitivities of dominant-priced transactions are not explained by the fact that currency choices are related to intra-firm trade. Nor do dominant-priced products lose their additional sensitivity when

[26] I do not rule out that combining all the channels tested in this section could explain pass-through as well as invoice currency choice. However, a multiple factors estimation would make the coefficients more sensitive to the specification, harder to aggregate to the firm-level, and less intuitive. Further, some of these alternative variables are not available in standard datasets.

[27] Import price pass-through to exchange rates is U-shaped vis-a-vis the size of the product's market share (Feenstra et al. 1996, Amiti et al. 2016, Auer and Schoenle 2016, Garetto 2016). Very small firms will pass-through the shock to consumers because they have little market share to lose, while large firms will pass-through exchange rate fluctuations because they dominate the movement in the industry price. Devereux et al. (2017) adds to this result that the market share of the buyer matters too, given that larger importers are more productive and have a higher elasticity of import demand. Devereux et al. (2017) links this finding with evidence in line with optimal invoice currency choice conditional on market share.

the transacting firm is a multinational or a domestic corporation. This addresses concerns about the characteristics of intra-firm trade and transfer pricing (Vicard 2015).

- **dollar trade over sales or costs**: The share of dollar-invoiced inputs is both a determinant of export price pass-through and of invoice pricing choices (Gopinath et al. 2010, Chung 2016, Amiti et al. 2018). Higher exchange rate sensitivities of dollar priced exports may simply reflect firms with high dollar costs selecting into dollar export pricing. On the other hand, firms may be more willing to accept dollar priced costs when they know that a large share of their sales are in dollars. These selection scenarios still mean that invoice currency matters, but they would imply systematic absence of firm-level exposure and markup sensitivities. Controlling for these channels, I find that dollar-priced transactions are still more sensitive than euro-priced.

- **firm size and productivity**: Firm size and productivity both determine pass-through (Berman et al. 2012, Goldberg and Tille 2016). The literature mostly justifies this as a market share effect. I observe larger exchange rate sensitivities of dominant-priced goods conditional on firms size and productivity.

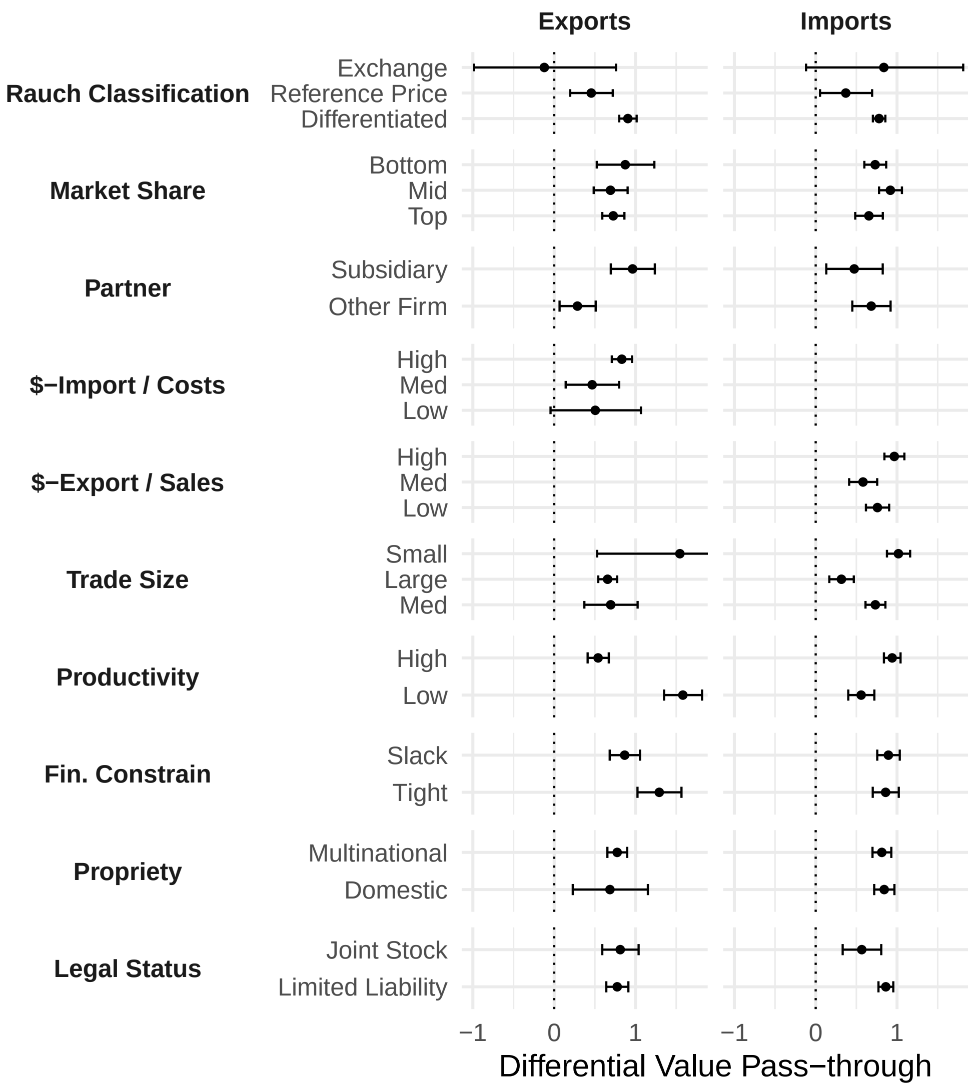
- **financial constraint or legal form**: Financially constrained firms are often associated with higher pass-through (Strasser 2013). However even conditional on this channel dollar-priced goods are more sensitive to exchange rate shocks.

## 7.3 Extensive Margin

In this section I study the extensive margin effects of euro depreciations. This investigation allows me to evaluate a potential attrition bias introduced by focusing only on products being actively transacted. Table 10 shows the probability that products either enter or exit the extra-EU trading market after depreciations. The novelty of this estimation is to study differential entry and exit probabilities conditional on the pricing regime of the product. I only study heterogeneous extensive margin responses of euro-priced, and dominant-priced products. The specification is similar to the benchmark estimation in equation (1), except for the definition of the dependent variables. The outcome to estimate entry probability is a dummy equal to 1 when a product is transacted in year $t$ and not transacted in $t-1$. The outcome to estimate exit probability is a dummy equal to 1 when a product is not transacted in year $t$, and transacted in year $t-1$.

None of the estimated probabilities are significantly different from zero. The estimation has low power because the invoice currency is observable only between 2011 to 2017. However, the coefficients' magnitude can still be informative of the potential bias direction. The estimates

Figure 7: Differential Dominant Invoicing Pass-through by Heterogeneity




*Note*: This figure tests whether dominant-priced goods have significantly higher exchange rate sensitivity than euro-priced goods, conditional on a battery of alternative explanations for heterogeneous exchange rate pass-through. I estimate the coefficients in this figure with a specification following equation (11). A significant coefficient in this figure implies that at the specified level of the alternative channel being tested, dollar-priced goods have transaction values (in euros) more sensitive to the exchange rate shocks than euro-priced goods. Section 7.2 and the Glossary explains the definition of each channel and its relation to the literature. Controls include partner GDP and CPI inflation, together with firm identifier-by-8-digit industry code-by-partner country-by-invoice currency, and year fixed effects. 95% confidence intervals computed from standard error values clustered by year × country.

Table 10: Extensive Margin Effects of Euro Depreciations

| | Exports | | Imports | |
|---|---|---|---|---|
| | Entry | Exit | Entry | Exit |
| | (1) | (2) | (3) | (4) |
| Euro $\times \Delta e$(€/ Partn.) | 0.014 | -0.057 | -0.033 | 0.002 |
| | (0.055) | (0.132) | (0.097) | (0.302) |
| Dominant $\times \Delta e$(€/ \$) | 0.040 | -0.060 | 0.057 | -0.049 |
| | (0.057) | (0.136) | (0.178) | (0.413) |
| Dominant $\times \Delta e$(Partn. / \$) | -0.016 | 0.084 | 0.138 | -0.013 |
| | (0.052) | (0.130) | (0.190) | (0.423) |
| Observations | 18.9M | 6.4M | 13.7M | 4.4M |
| $R^2$ | 0.149 | 0.697 | 0.133 | 0.705 |

*Note*: This table studies the extensive margin response to a euro depreciation from 2011 to 2017. I show the estimates of a linear probability model for product entry $\mathbb{P}(\text{Entered}_t = 1 \,|\, \text{Entered}_{t-1} = 0)$, or exit $\mathbb{P}(\text{Entered}_t = 0 \,|\, \text{Entered}_{t-1} = 1)$ in the extra-EU trading market. A product is defined as a unique combination of firm identifier-8-digit industry code-country-invoice currency. I estimate separate probability of entry and exit for dominant-priced and euro-priced products. Partner-pricing cannot be estimated due to the low rates of entry and exit observed for this pricing regime. Controls include partner country GDP and CPI inflation, with product, and year fixed effects. Standard errors clustered by year $\times$ country. Table I.11 replicates this estimation with a Probit model, showing that the coefficients are virtually unchanged.

signs go against the evidence of strategic invoicing in response to exchange rate movements. For instance, Table 10 shows that more importers enter dollar-invoicing purchase, when the dollar is more expensive. These correlations are informative of how the dollar-pricing sensitivities in the benchmark results may be, if anything, downward-biased. Extensive margin responses may also introduce a bias in the firm-level estimates if the most exposed firms have differential effects on their product mix after depreciations. Table I.12 in the appendix shows how differential extensive margin responses of highly exposed firms are unlikely to generate upward bias in the estimates. Finally, Table I.13 shows how invoice currency switches do not imply large attrition bias.

## 7.4 Long Term Dynamics of Transaction Sensitivities

This paper focuses on the importance of invoice valuation effects in the short-term. However, long-run dynamics are a useful extension in this context. First, long-run dynamics may imply swings in firms' expected profitability that can change the interpretation of the investment and employment effects estimated in Section 5.5. Second, they shed light on whether standard competitive depreciations forces are still at play.

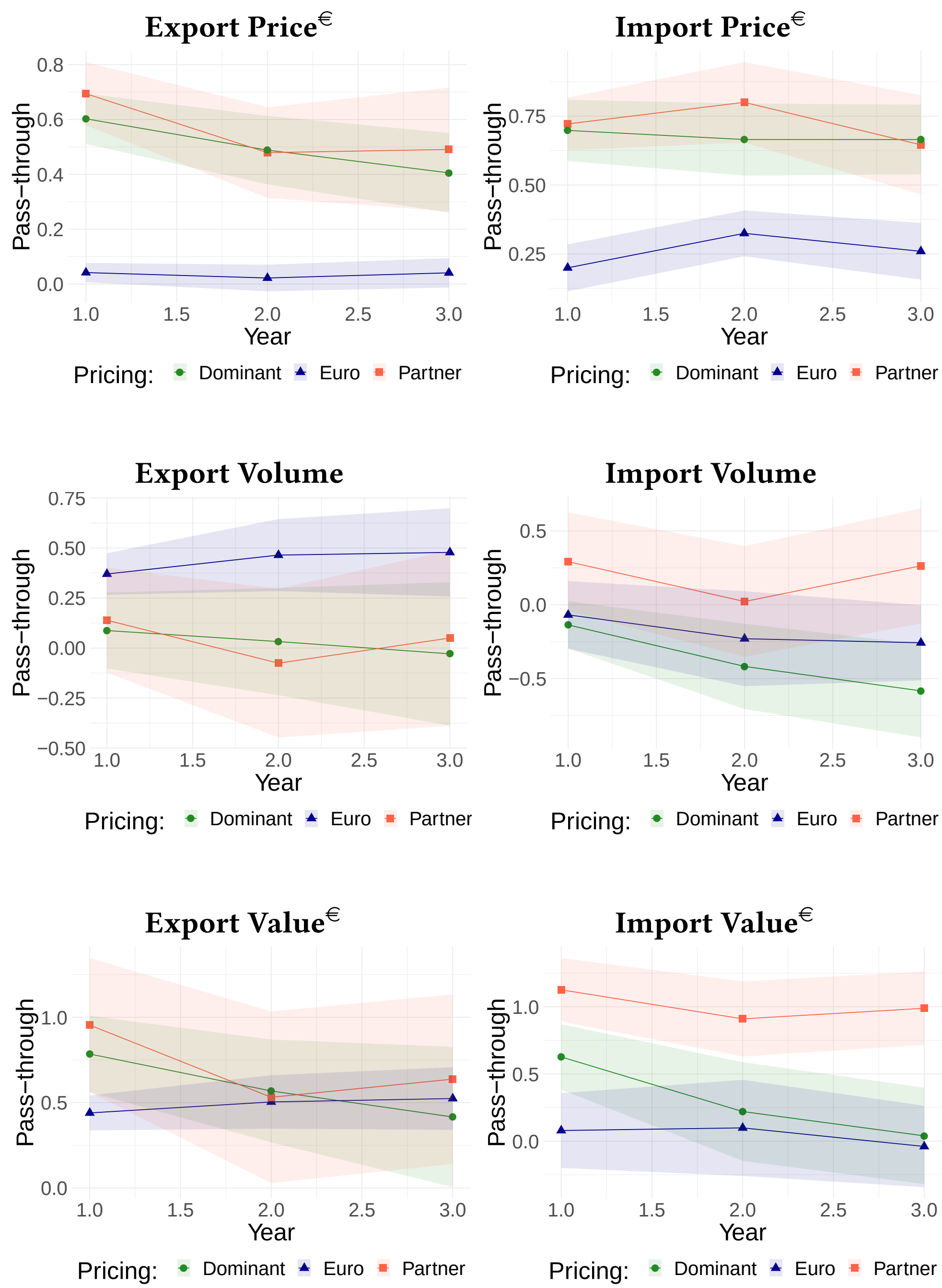
Figure 8 shows the cumulative effects on prices, volumes and transaction values of a 1% euro depreciation, after three years from the shock. The evidence on price stability in invoice currency holds in the long run for all invoice regimes.[28] Volumes are more sensitive to depreciations in the long-run. In particular, import volumes of dominant-priced products change from an almost zero response after the first year, to a 0.6% decrease after 3 years. This evidence is in line with expenditure switching forces towards domestic goods. Volumes of euro-priced inputs also decrease, but their response is not significantly different from zero, in line with the fact that after a depreciation euro-invoiced prices do not increase as much as dollar-priced ones.[29]

Within the one year horizon, valuation effects are larger than volume effects. This leads dollar-priced transactions to generate larger short-run cash flow effects for both export and import flows. However, two years after the depreciation, volume responses increase and have magnitudes comparable to the valuation effects. This delayed pick up of volume responses imply that euro- and dominant-priced transaction values do not have differential exchange rate sensitivities after two years from the shock.

[28]This is in line with the evidence in Gopinath et al. (2010).

[29]Volume responses of partner-priced imports do not significantly decrease after a depreciation. The stability of partner-priced volumes may be due to specific characteristics of dollar-priced imports from the US.

Figure 8: Long-term Impulse Response Sensitivities to a 1% Euro Depreciation




*Note*: This figure replicates the estimation in specification (1) at a yearly frequency with one contemporaneous effect and two lags. No coefficients with lag larger than two are significant. The graphs represent the cumulated response of changes in prices (in euros), volumes, and values (in euros) after a uniform 1% euro depreciation. The sample includes all yearly extra-EU transactions from 2000 to 2017. The euro-, partner-, and dominant-indices for the estimations are akin to a euro depreciation shock interacted by a dummy for euro-pricing, partner-pricing or dominant-pricing of the product (see the Glossary for more details on their definition). A product is defined as a unique combination of 6-digit industry code-firm identifier-partner country. Controls include partner country GDP growth, CPI inflation, product and year fixed effects. 95% confidence intervals computed from standard errors clustered by year $\times$ country.

## 7.5 Shock Visualization and Balance Test

Borusyak et al. (2018) show how shift-share estimates can be identically obtained from a just-identified IV regression estimated at the level of the shift shocks (in my case, time). I describe a simplified application of this result in my setting.

I can re-define the normalized dominant-weighted index in (6) as

$$\frac{I^D_{f,t}}{K_{f,t_0}} = \widetilde{I}^D_{ft} = s^D_f \Delta e^{€/\$}_t \qquad \text{where} \quad s^D_f = \sum_{c \neq USA} \frac{\widetilde{\text{Exports}}^D_{ft_0c} - \widetilde{\text{Imports}}^D_{ft_0c}}{K_{ft_0}}.$$

This definition clearly separates the share component, $s^D_f$, and the shift component, $\Delta e^{€/\$}_t$. $s^D_f$ is the net share of exposure to dominant-priced operations, relative to the company's initial capital stock $K_{ft_0}$.[30]

Re-define specification (8) in its residualized version:

$$\widetilde{Y}^{\perp}_{ft} = \beta^D \widetilde{I}^{D\perp}_{ft} + \epsilon_{ft}. \tag{12}$$

$\widetilde{Y}^{\perp}_{ft}$ and $\widetilde{I}^{D\perp}_{ft}$ are the residuals from the projection of the dependent variable and the dominant-weighted index on the controls of specification (8).

Then, the following second stage regression with instrument $\Delta e^{€/\$}_t$, can recover $\beta^D$ (see Appendix G):

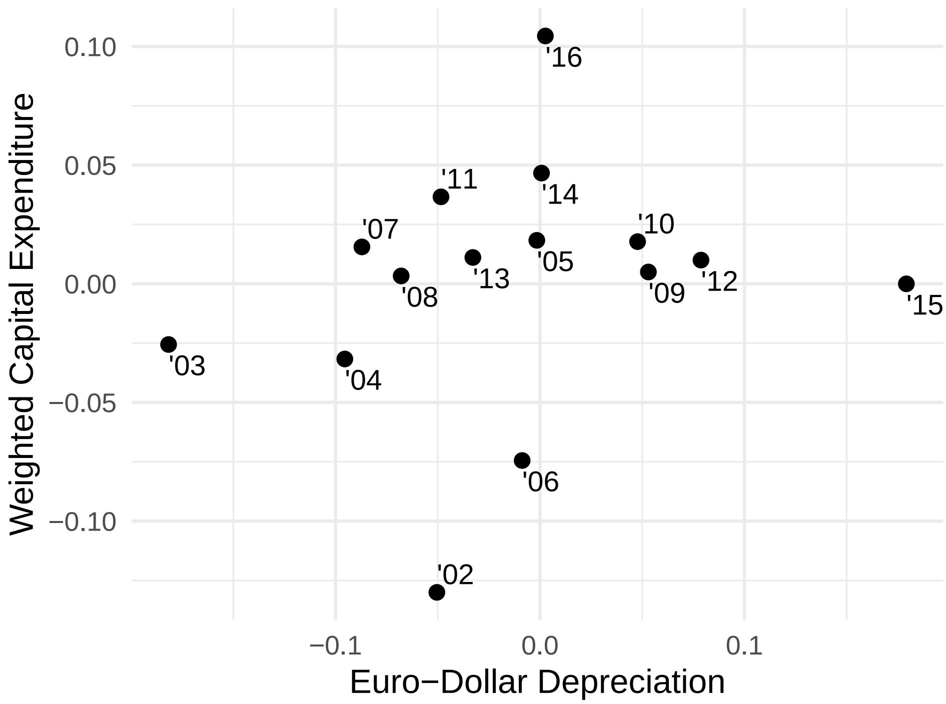
$$\widehat{\widetilde{Y}^{\perp}_t} = \beta^D \widehat{\widetilde{I}^{D\perp}_t} + \epsilon_t. \tag{13}$$

For any given time $t$, $\widehat{\widetilde{Y}^{\perp}_t}$ and $\widehat{\widetilde{I}^{D\perp}_t}$ are the sum across all French firm of the residualized dependent variable and dominant-weighted index, weighted by the dominant-exposure shares $s^D_f$. They are a proxy for the macroeconomic level of the dependent variable of interest $Y_t$, with more weight given to firms exposed to dominant pricing. $\epsilon_t$ coincides exactly with the aggregate structural residual defined in the identification assumptions **A1** and **A2**.

The estimation in (13) clarifies my identification strategy. Euro-dollar fluctuations are the instrumental variable. The invoice-weighted index is the covariate variable of interest, which in turn affects the outcome. The key identifying assumption is that exchange rate movements are independent from unobserved potential outcomes of firms highly exposed to dominant pricing. The relevant identifying variation is at the yearly-level.

[30] The shares do not sum to one, nor are they always positive, but nothing in the results of Borusyak et al. (2018) requires that shares be non-negative. I thank Kirill Borusyak for pointing out how their forthcoming paper shows that under some circumstances the heterogeneous treatment effect interpretation of the estimates may require non-negativity of shares.

Figure 9: Main specification transformed and run at the currency-time level




*Note*: Relation between the weighted level of tangible capital expenditures and euro-dollar depreciations for each year of the sample. The relation represents the reduced form equivalent of the estimation in equation (13). This exercise tests whether any outlier exchange rate shock is likely to drive the estimates. The weighted capital expenditure is computed as $\text{CAPEX}_t^{\perp} = \sum_f s_f^D \text{CAPEX}_t^{\perp}$. Where $\text{CAPEX}_{ft}^{\perp}$ represents the firm $f$ residual capital expenditure from a projection on the controls used in the benchmark estimation (8). $\text{CAPEX}_{ft}^{\perp}$ is weighted by the net dominant-price exposure of each firm $s_f^D$. $s_f^D$ is computed as the nominal exposure in dominant-priced activities in 2000, over total capital stock of the firm in 2000. Euro-dollar depreciations are computed as yearly log differences of the average euro value per dollar units.

The equivalence result in (13) can help visualizing whether a certain set of outlier shocks is driving the results. In particular, Figure 9 shows the relation between the macroeconomic weighted level of tangible capital expenditures $\widehat{\widetilde{\text{CAPEX}}}_t^{\perp}$ and each year's depreciation shock.[31]

No single shock drives the positive relation between depreciation and weighted capital expenditure. Figure 9 also highlights that depreciation episodes are not aligned with macroeconomic or financial shocks experienced by France. [32]

Finally, to verify that the invoice valuation effects are likely not driven by unobservable firm characteristics, Figure 10 shows a balance test between the dominant-weighted index and several lagged balance sheet variables. A significant correlation in this balance test could point to pre-trends of firm dynamics correlated with exchange rate depreciations. All the firms charactersitics in the sample are balanced for dominant-weighted invoice index shocks. Table I.7 in the appendix also shows how estimates change as I gradually add fixed effects. The firm-level sensitivities remain fairly stable, but less so than in the same test applied for transaction-level sensitivities.

## 7.6 Dollar Financing and Hedging

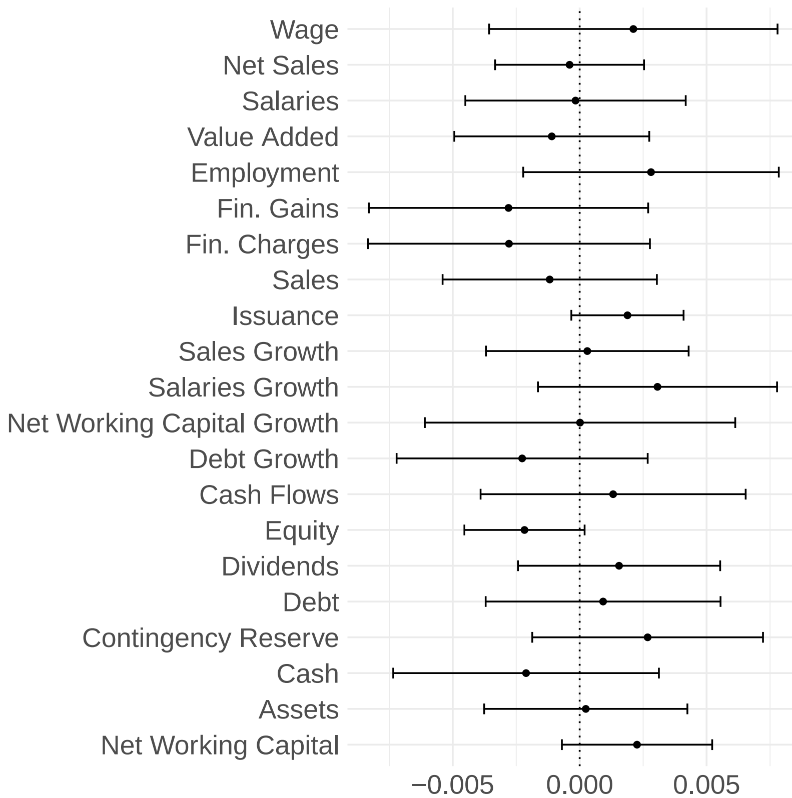
The standard concern when estimating investment effects of exchange rate shocks is correlation between unobserved profitability shocks and currency fluctuations. Appendix D shows how unobservable shocks such as demand and supply effects of trading partners are more likely to be proportional to measures of country-specific exposure rather than invoicing activities. Moreover, my empirical strategy allows to non-parametrically control for country-specific trading share exposures, thus I am not concerned about unobserved trade shocks correlation. Since Figure 5 shows that my estimates are driven by local domestic firms, and not multinationals, I am also not concerned about correlation with unobserved foreign ownership patterns.

A more relevant concern is the extent of dollar financing. If dollar financing is concentrated in firms invoicing their international activities in dollars, then the invoice-weighted treatment may be correlated to financial shocks such as foreign bank liquidity. When dollar financing is in place to hedge operational exposures, it will bias my estimates towards zero. When firms decide to take financial exposures in line with their foreign-pricing exposure, it will bias

[31] Figure 9 shows all the currency shocks present in the invoice-weighted index, rather than in the dominant-weighted index. This is simply to show that most of the sensitivity of French firms arises from fluctuations in the euro-dollar value.

[32] For example, French banks' crossborder US dollar liabilities to institutions in the US collapsed in the summer of 2011 (Berthou et al. 2018). The European debt crisis started in early 2010 and disappeared by the end of 2015. But from 2010 to 2014 the yearly euro-dollar index oscillated between appreciations and depreciation, with no clear pattern identifying the worst years of the crisis. France was on a peak-to-trough economic contraction for most of 2002, 2008, 2012, 2015, and 2016.

Figure 10: Correlation between Residualized Dominant-weighted Index and Lagged Variables



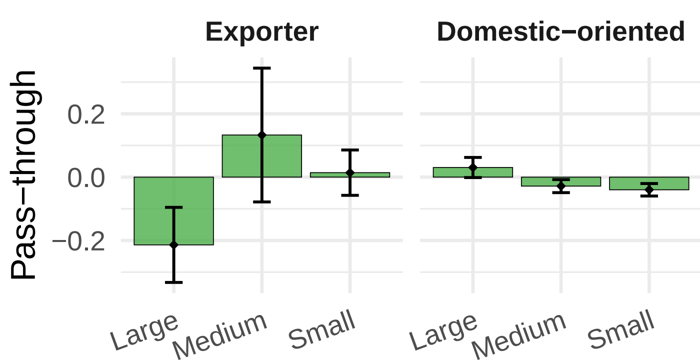

*Note*: Balance test of the standardized dominant-weighted index defined as in equation (6), on residualized and standardized lagged balance sheet variables. The residuals are extracted from projecting the lagged variable of interest on all the controls of the benchmark specification in (8). Controls include twice lagged productivity, sales growth, and dependent variable, and including year, firm, 3-digit industry code-by-year, and trade exposure-by-year fixed effects. The figure tests whether the treatment variable is balanced across observables firms characteristics. Standard errors for the 95% confidence intervals are clustered by year only.

my estimates upward. Since small domestic-oriented companies drive most of the firm-level results, the main concern is whether such firms leverage their short invoice exposure to the dollar by also borrowing in dollars, or using derivatives to short the dollar.

According to the BIS locational banking statistics, only 2% of total bank claims or liabilities in France are denominated in dollars. Moreover, direct dollar financing by US banks in France is positively correlated with the size of firms (Berthou et al. 2018). Derivative use by small and medium sized firms is also uncommon (Clark and Mefteh-Wali 2010, Lyonnet et al. 2016).

I cannot observe the currency in which firms' securities and debts are denominated, nor the kind of financial instruments used by the firms in my sample. However, I can observe net financial gains. This is not a comprehensive measure of currency hedging or leverage operated by firms. However, the correlation pattern between invoice-weighted indices and financial gains can be informative of the potential direction of the bias for different subgroups of firms. If firms hedge their invoice currency exposures I should observe a negative correlation between financial gains and the invoice-weighted index. If firms leverage on their invoice currency exposure I should observe a positive correlation. Figure 11 shows that most firms with large exposures have financial gains going in the opposite direction of invoice valuations. This is suggestive of firms moderately engaging in currency hedging.

Figure 11: Pass-through heterogeneity of 1 euro of invoice valuation to Financial Gains




*Note*: Heterogeneous effects of the dominant-weighted index on the 6 group of firms showed above, following the benchmark specification in equation (8). I assign firms to three quantiles of capital stock in the year 2000, and I define them accordingly as small, medium, and large firms. When the average amount of extra-EU exports of a firm is larger than its imports, I call the firm an exporter. All other firms are classied as domestic-oriented. Net financial gains are defined as total financial gains net of total financial charges. 95% confidence intervals computed from standard errors double clustered by firm and year.

# 8 Conclusion

This paper explores real effects generated by currency exposure in foreign-priced operations. Previous studies find that dollar-priced trade responds little, in dollar terms, to depreciations. However, I find that nominal invoice valuation effects can have investment and employment consequences for illiquid firms.

My first contribution is to study currency mismatch effects arising from foreign-pricing of production and input activities, as opposed to mismatches arising from financial positions. I find that trade values and cash flows of dollar-pricing exposed firms are highly sensitive to euro-dollar exchange rate fluctuations, regardless of the size or market orientation of firms. My second contribution is to develop an invoice-weighted exchange rate index that outperforms any trade-weighted index in explaining cash flows, investments, and employment outcomes for trading firms. My third contribution is to reconcile the observed large sensitivities of gross trade flows to exchange rates with the standard evidence of 'disconnect' between exchange rates and real macroeconomic variables. In France, large nominal fluctuations do not impact real aggregate variables because exposed firms are liquid and hedge their dollar-priced exports with dollar-priced imports.

There are two main implications for future research. First, since France is a large developed country, with mature financial markets and large traders, the estimated effects should be considered a lower bound. More research focused on other countries is necessary. Second, I do not take a stance on the reasons behind firms' exposure choices. All the effects measured in this paper are internally valid and conditional on the snapshot of dollar-pricing choices observed. However, counterfactual exercises require a deeper understanding of these choices.

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# Appendix

## A Data Sources and Representativeness

### A.1 Customs Dataset

The customs dataset consists mainly of administrative records from compulsory filing of invoices for French trade outside of the European Union. For this reason the French customs data are regarded as high quality. Generally, the French customs agency gathers information of trade both inside and outside of the European Union. Intra-EU trade is recorded under the DEB legal framework (*Déclaration d'Echange de Biens*). Extra-EU trade is recorded under the DAU legal framework (*Document Administratif Unique*). The DAU framework has received only one main revision in 2010, when the threshold of €1,000 or 1,000 kilos under which a firm trading outside of the EU was not mandated to file a trading report was discontinued. For this reason, whenever I extend the sample to the period 2000-2016, I homogenize the data to reflect the pre-2010 threshold.

Intra-EU trade records do not gather information on currency of invoicing. Moreover, most within-EU French trade is with countries of the eurozone. Extra-EU trade records the invoice currency after the year 2011. This is because after 2011 companies must declare the merchandise value in the original invoice. The latter is the ex-VAT value in the currency specified in the contract, excluding insurance, freight or boarding costs. Before 2011, only the merchandise value at the border is available, which is only recorded in euros, and contains boarding or transport cost. Typically, merchandise value at the border represents a FOB/CIF shipping agreement for exports and imports. Whenever my analysis focuses on the period from 2011 to 2017 I use the merchandise value in the original invoice. Whenever I extend the sample years from 2000 to 2016, I use the merchandise value at the border variable, and I typically impute the invoice currency observed post-2011 to the border value. Insurance and freight costs do not represent, however, a large part of the trade value. For instance, in 2017 the FOB value of extra-EU exports was €190 Billions, while the merchandise value was €185 Billions. The CIF value of imports in 2017 was €168 Billions, while their merchandise value is €160 Billions. By aggregating the value of all transactions under analysis, I verified that the customs data of this paper corresponds exactly with the underlying source of aggregate data provided by national and international statistical agencies such the INSEE or the Eurostat.

For the purpose of this analysis I clean the customs dataset in the following way. I drop from the customs declatations all transactions with the following 8-digit industry CN codes: 98807300, 98808400, 98809900, 9880XX00, 98808500, 99050000, 99190000, 9930*, 9931*, 99999999.

This is because the latter codes correspond to personal belongings, group of firms, or missing codes. See Bergounhon et al. (2018) for more details on this. I also drop all firm identifiers equal to 000000000, 777777777, 222222222, 202020202, 888888888, 999999999, 111111111. All partner country codes equal to masked codes such as "QU", "QV", or "QW", or representing within-EU countries of origin/destination. Finally, I drop from the sample all transactions which do not indicate the 8-digit industry code, firm identifier, partner country, trade flow, and value of transaction.

## A.2 FARE and FICUS

The sample of FARE and FICUS contains the universe of tax declarations of corporations and part of the self-employed firms active in France. Firms with annual sales below €32,600 (€81,500 for retail and wholesale sectors) can enter a micro-business regime and opt out of a comprehensive tax declaration requirement.

The unit of analysis of the firm-level dataset is the legal entity rather than the consolidated corporation. This causes discrepancies with aggregate French statistics. Indeed, aggregate statistics are computed by INSEE after consolidating all legal units into business groups (Béguin and Haag 2017). Since FARE and FICUS are the base from which the Eurostat computes its Structural Business Statistics and Business Demographics, or from which INSEE computes its annual reports on French entrepreneurship, I can compare the magnitude of such discrepancies. I focus only on firms in manufacturing, for simplicity. I take the year 2011 as a reference, since it is the first year in which I have data on currency of invoicing and of period of reference for the macroeoconomic estimates in section 6.

Table A.1: Study of Discrepancy between the FARE dataset and public statistics in 2011

| | **This paper** (FARE) | **Eurostat - SBS** (FARE after elaboration) | **OECD - STAN** (National Accounts) |
|---|---|---|---|
| Number of Firms | 207,172 | 206,998 | Not Available |
| Number of Effective Employees | 1,912K | 2,972K | 2,607K |
| Turnover | €1,057,211M | €899,958M | Not Available |
| Tangible Capital Expenditure | €30,145M | €31,554M | €54,031M (Total) |

Table A.1 compares the aggregate statistics for different variables of manufacturing firms available in FARE and in public datasets such as the Eurostat Structural Business Statistics (SBS) and the OECD STAN database. The underlying source of the SBS is also FARE, however the SBS values are elaborated by the INSEE for time consistency and improved aggregation quality. However, INSEE still advises to use the disaggregated FARE dataset in legal units for microeconometric studies (Béguin and Haag 2017). Regardless of rielaborations, or different sources, the total value of most variables of interest is close to what is reported by aggregate macroeconomic statistics. The largest discrepancy is in number of effective employees, which is 2 millions in my dataset, and 2.6 to 3 millions in the other datasets. The fact that aggregate value statistics closely match macroeconomic statistics ensure that the macroeconomic exercise in Section 6 has valid order of magnitudes.

By aggregating all the information available in FARE, I verified that extra-EU trading manufacturers account for 50% of total tangible capital expenditure and payroll of the whole manufacturing sector in France. Hence to compute the percentage changes in investment and salaries in the manufacturing sector it is sufficient to halve the effects in Table 8. Manufacturing tangible capital expenditure is equivalent to 2% of French GDP, while manufacturing payroll is equivalent to 5% of GDP (source: OECD STAN).

I only make minimum cleaning in the FARE and FICUS datasets. Mostly because focusing on extra-EU trading firms implies that I focus on large firms with high reporting quality. There are only few duplicate records, and the definitions of the FICUS variables are often perfectly in line with the definitions of the FARE variables. Therefore, it is straightforward to merge the two datasets. The only year in which many variables are not available is 2008, the year in which the FICUS dataset switched to FARE. In 2008, many important variables such as total assets are not available. That is why I typically normalize my variables by total capital stock. However, the main variables of interest are available also for the year 2008.

### A.3 LIFI

LIFI contains time series of the financial links between enterprises operating in France. Before 2012, the information was filed with a compulsory questionnaire whenever the firm owned by a foreign entity had equity above €1.2M or more than 500 employees, or it ever entered the questionnaire in previous years. In 2012, the LIFI questionnaire has been discontinued to lighten the bureaucracy burden on French firms. Information on corporate links is now gathered from administrative data, in particular from the Bank of France, the RECME questionnaire (registry of firms controlled by the state) and ORBIS data by Bureau Van Dijk. Firms send information on their ownership structure to the Bank of France on a voluntary basis but the submission is always strongly encouraged. In practice, it seems that these data is necessary to obtain an evaluation of the firm value when they ask for a banking service. For this reason, information on financial linkages after 2012 is considered highly reliable and exhaustive.

To solve sample inconsistency problems in the LIFI database I define a firm to be a multinational if it has *ever* been owned by a group with a foreign ultimate owner or if the group *ever* owned firms with residence outside of France. I also create a definition of multinational firms that can vary over the years according to the information contained in LIFI. The results do not change under the latter measure. To make sure that my definition of multinational firm is valid, I also cross-check the definition with information contained in OFATS. I extend the definition under those (few) cases in which a firm with subsidiaries abroad has not been already defined as multinational.

# B Glossary

**3-digit industry code** APE code, concorded to the NA coe (*Nomenclature agrégée*) index at the 3-digit A64 level. This is an industry code defined by INSEE, the French statistical agency. Every business in France is classified under an activity code entitled APE (*Activité Principale Exercée*)or NAF code. This code represents the main activity of the firm, as assigned by the French statistical agency (INSEE) according to several survey and administrative records in their posession.. 26, 27, 29, 30, 32, 33, 49, 79

**6-digit industry code** Concorded version of the six-digit HS industry code. I concord all codes over time following the algorithm described in Appendix B of Behrens et al. (2018).. 18, 24, 25, 41, 78, 82

**8-digit industry code** Concorded version of the 8-digit CN industry code. CN codes change every year. For this reason I concord all codes over time following the algorithm described in Appendix B of Behrens et al. (2018).. 6, 9–12, 15, 44, 45, 73, 74, 77, 81, 85

**cash flows** The measure of cash flow mostly used in this paper is Gross Operating Profit (GOP). The GOP measures earnings after deducting the direct costs of producing the products or providing the services. It is similar but it does not coincide to a EBITDA measure (earnings before interest, tax, depreciation and amortization). This is because the GOP does not include overhead costs, such as selling, general and adminsitrative costs. The GOP, is the most similar measure to the EBITDA recoverable from FARE and FICUS.. 23, 27, 28, 30, 31, 79

**core product** I call core products the subset of firms' products (defined as unique combination of firm-identifier-country-industry code) that a firm in my sample buys or sells continously in the whole sample: from 2000 to 2016.. 25, 78

**dollar-exports over sales** total firm exports priced in dollars at the beginning of the sample, over total sales of the firm at the beginning of the sample. I divide this measure in three quantile bins. The measure is firm-specfic and it does not change over time.. 43

**dollar-imports over costs** total firm imports priced in dollars at the beginning of the sample, over total variable costs of the firm. I divide this measure in three tercile bins. I divide this measure in three quantile bins. The masure is firm-specfic and it does not change over time.. 43

**domestic-oriented** When the average amount of extra-EU imports of a firm is larger than its exports, I call the firm domestic-oriented. The average is computed in reference to the time period of interest for the exercise, typically 2011-2017 for transaction-level results and 2000-2016 for firm-level results.. 9, 20, 22, 23

**dominant-priced product** When the currency used to specify the value of the invoice in customs declarations is the US dollar, but the partner country of the transaction is not the United States. This definition holds for both import and export transactions.. 11, 19, 41, 45, 46, 48, 85

**euro-priced product** When the currency used to specify the value of the invoice in customs declarations is the euro. This definition holds for both import and export transactions.. 10, 11, 15, 41, 45, 46, 85

**exporter** When the average amount of extra-EU exports of a firm is larger than its imports, I call the firm an exporter. The average is computed in reference to the time period of interest for the exercise, typically 2011-2017 for transaction-level results and 2000-2016 for firm-level results.. 9, 20, 22, 23

**financial constraint** For each firm in the 2000-2016 sample I compute a standard Kaplan and Zingales (KZ) index with the following coefficients: $-1.002$·Cash Flow / Tangible Capital$+$ $3.139$·Debt/Total Capital$-39.368$·Dividends / Tangible Capital$+-1.315$·Cash / Tangible Capital, taken from Lamont et al. (2001). I then call financially constrained all firms at the top yearly tercile bin of the KZ index. Many firms in my sample are private, and their balance sheet data is not consolidated. Therefore, this definition is an imperfect proxy and it is complemented with information on firm's size or legal form. I also replicate my results with other proxies of financial constraint such as firm's age, interest charges, or leverage. All results are in line with the ones showed using the KZ index. Results available on request.. 22, 32, 43

**firm growth** I compute the average yearly sales growth of each firm in the period 2000-2016. Then I assign each firm to 3 quantile bins accordingly: high growth, mid growth, and low growth.. 32

**firm identifier** SIREN code. A 9-digit time-consistent firm identifier present in most administrative databases of French firms.. 6, 7, 10–12, 15, 18, 24, 25, 41, 44, 45, 73, 74, 77–79, 81, 82

**firm size** I divide the sample of firms in three quantiles by gross total capital stock in 2000. I call firms in the first quantiles *small*, firms in the second quantile *medium*, and firms in the top quantile *large*. 22, 32, 43

**insurance contract** Incoterm code. A series of three-letter trade terms related to common contractual sales practices, the Incoterms rules are intended primarily to clearly communicate the tasks, costs, and risks associated with the global or international transportation and delivery of goods.. 6, 10, 11, 74

**invoice currency** variable contained in the customs dataset after 2011. It is the original currency in which the merchandise value is specified.. 7, 12, 15, 18, 44, 45, 77, 81

**invoice valuation** A proxy representing the amount of euros gained purely from the valuation effects that a euro depreciation has on foreign-priced operations, assuming that prices are fully sticky and there is no volume response of trade. It is a proxy for an upper bound of valuation effects. Its unit of measurement is the euro. 1 unit movement of the invoice-weighted exchange rate indices in this paper correspond to 1 euro of invoice valuation.. 17

**legal form** I distinguish between joint stock corporations (*Société Anonyme*, SA) and limited liability corporations (*Société à responsabilité limitée*, and *Société par actions simplifiée*). Only joint stock corporations can become public. Moreover, SAs have higher disclosure requirements. For this reason, the legal form of a company is a good proxy for financial constriant of a firm.. 21, 32, 43

**manufacturer vs. wholesaler firm** Every business in France is classified under an activity code entitled APE (*Activité Principale Exercée*)or NAF code. This code represents the main activity of the firm, as assigned by the French statistical agency (INSEE) according to several survey and administrative records in their posession. I concord the APE code (which follows the NAF classification) with the 1-digit ISIC Rev. 4 classification. Firms with main activity assigned to the ISIC code 'C' are called manufactuers, firms with main activities assigned to the code 'G' are called wholesalers. Most of the other firms in my sample are in the construction sector.. 22

**market share** Following Amiti et al. (2014), I define the market share of a product as the total value of an eight-digit industry-by-firm combination over the total four-digit industry trade flow. I then assign products to three yearly quantiles of market share. I allow the products to have market share quantile switching over years.. 42

**merchandise value at the border** Value in euros of the merchandise at the border. It is available from 2000 to 2017. This value represents FOB/CIF value for exports an imports.. 6, 59

**merchandise value in the original invoice** ex-VAT value in the actual currency specified in the invoice. Its value may be dependent on the insurance contract (incoterm code) chosen by traders. It is available only after 2011.. 6, 7, 59

**multinational** I define a firm to be a multinational if it has *ever* been owned by a group with a foreign ultimate owner or if the group *ever* owned firms with residence outside of France. I also create a definition of multinational firms that can vary over the years according to the information contained in LIFI. The results do not change under the latter measure. To make sure that my definition of multinational firm is valid, I also cross-check the definition with information contained in OFATS. I extend the definition under those (few) cases in which a firm with subsidiaries abroad has not been already defined as multinational.. 6, 21, 22, 43

**nationality** Using the LIFI database, I define a firm to be a multinational if it has *ever* been owned by a group with a foreign ultimate owner or if it belongs to a group that *ever* owned firms with residence outside of France. I call all the other firms 'domestic'. I also create a definition of multinational firms that can vary over the years according to the information contained in LIFI. The results do not change under the latter measure. To make sure that my definition of multinational firm is valid, I also cross-check the definition with information contained in the OFATS database. This allows me to understand if there is any domestic firm with subsidiary abroad. If there are I change their definition to multinational.. 32

**partner country** The extra-EU country on the other side of the trade. It is the country of destination (if export flux) and country of origin (if import). For the case of import, it's the country where the good was originally produced, hence it does not necessarily correspond to the country where the good has recently been shipped from. This information is not available for export flows.. 6–8, 10–12, 15, 18, 24, 25, 41, 44, 45, 73, 74, 77, 78, 81, 82

**partner-priced product** When the currency used to specify the value of the invoice in customs declarations is the same of of the partner country on the other side of the trade e.g. the US dollar when the partner country is the US, or the yen when the partner country is Japan. This definition holds for both import and export transactions.. 10, 11, 15, 41, 85

**product-level dominant-weighted index** This index represents the average post-2011 share of product value invoiced in the dominant currency, and multiplied by the euro-dollar exchange rate. It represents the dollar invoicing share of a product, when the USA is not the partner country of the transaction. A product is defined as a unique combination of firm identifier-6-digit industry code-partner country-trade flow. In the majority of cases the dominant share of a product is either 1 or 0.

$$\Delta\text{Product-level Dominant Index}_{fcpet} = \$\text{-Share}_{fcpe,\text{Post-2011}}\Delta e_t^{€/\$} \qquad \begin{cases} f: \text{firm} \\ p: \text{6D industry} \\ c: \text{country} \neq \text{USA} \\ e: \text{export/import} \\ t: \text{year} \end{cases}$$

. 24, 41, 82

**product-level euro-weighted index** This index represents the average post-2011 share of product value invoiced in euros, and multiplied by the bilateral exchange rate. A product is defined as a unique combination of firm identifier-6-digit industry code-partner country-trade flow. In the majority of cases the euro share of a product is either 1 or 0.

$$\Delta\text{Product-level Euro Index}_{fcpet} = €\text{-Share}_{fcpe,\text{Post-2011}}\Delta e_t^{€/c} \qquad \begin{cases} f: \text{firm} \\ p: \text{6D industry} \\ c: \text{country/currency} \\ e: \text{export/import} \\ t: \text{year} \end{cases}$$

. 24, 41, 82

**product-level partner-weighted index** This index represents the average post-2011 share of product value invoiced in partner currency, and multiplied by the bilateral exchange rate. A product is defined as a unique combination of firm identifier-6-digit industry code-partner country-trade flow. In the majority of cases the partner share of a product is either 1 or 0.

$$\Delta\text{Product-level Partner Index}_{fcpet} = \; c\text{−Share}_{fcpe,\text{Post-2011}}\Delta e_t^{€/c} \quad \begin{cases} f : \text{firm} \\ p : \text{6D industry} \\ c : \text{country/currency} \\ e : \text{export/import} \\ t : \text{year} \end{cases}$$

. 24, 41, 82

**productivity** I estimate firm-year varying productivity with a standard Levinsohn and Petrin procedure. First, I compute real output, real tangible capital, and real cost of materials using 2-digit industry-specific deflators of output prices, intermediaries, and capital from the INSEE National Account Statistics (base year, 2014). Output is total production, tangible capital is the book value of fixed assets (gross of depreciation), cost of materials is the merchandise and raw materials purchase, with their respective change in inventories. I use the effective number of employees to proxy for real labor costs. I take the 2-digit industry-specific input shares of production estimated with the Levinsohn and Petrin procedure to compute each firm's productivity $A_{ft}$ as $\log A_{ft} = \log Q_{ft} - \hat{\beta}^K_{\text{ind.}} \log K_{ft} - -\hat{\beta}^L_{\text{ind.}} \log L_{ft} - \hat{\beta}^M_{\text{ind.}} \log M_{ft}$. 23, 27, 29, 30, 32, 33, 43, 49, 79

**Rauch classification** It follows the industry classification of manufacturing products built by Rauch (1999). It split manufacturing goods between products officially traded in organized exchanges, products with informally quoted prices (reference price), and differentiated products.. 42

**subsidiary partner** I use information from the OFATS survey to understand whether the firm is trading with a country where one of its subsidiaries is active. Whenever I use this control I limit the sample to the firms answering to the OFATS survey.. 43

**tangible capital acquisition** It includes only fixed capital acquisitions declared by the firm. It is similar but it does not coincide with the benchmark measure of capital expenditure. For one, tangible acqusitions can never be negative. The original name for this variable in the FICUS and FARE datasets is *investissement corporel, hors apports.*. 23, 79

**tangible capital expenditure** Difference between the year $t$ and year $t-1$ of gross tangible capital stock, meaning the book value of capital stock before depreciation.. 23, 30, 79

**trade flow** By trade flow I mean an identifier of either extra-EU export flow or extra-EU import flow.. 10, 11

**transport mode** Variable contained in the customs dataset after 2011. For exports it's the main mean of transport after the French frontier. For imports it's the main mean of transport until the French frontier.. 10, 11, 74

# C Avoid Misspecification under Invoice Currency Price Stickiness

Consider the benchmark exchange rate transaction sensitivity in equation (1):

$$\Delta y_{jt} = \sum_l \overbrace{\beta_l^{€} D_j^{€} \Delta e_{t-l}^{€/p}}^{\text{Euro}} + \overbrace{\beta_l^{P} D_j^{P} \Delta e_{t-l}^{€/p}}^{\text{Partner}} + \overbrace{\beta_l^{D} D_j^{D} \Delta e_{t-l}^{€/\$}}^{\text{Dominant}} + \gamma_l^{D} D_j^{D} \Delta e_{t-l}^{\$/p} + \phi x_{jt} + \alpha_j + \delta_{t\times\Delta} + \epsilon_{jt} \tag{14}$$

The sensitivity of dollar-priced products is measured against the following decomposition of the bilateral exchange rate:

$$\Delta e_t^{€/p} \equiv \Delta e_t^{€/\$} - \Delta e_t^{p/\$}. \tag{15}$$

With stable prices in invoice currency units, estimating sensitivities only from bilateral exchange rates can lead to omitted variable bias. Consider a French exporter selling to a Japanese consumer with demand function $Y_X(\cdot)$ at a fully sticky dollar price $\bar{P}_X^{\$}$. Define the bilateral exchange rate as $\mathcal{E}^{€/¥}$. Sales in euros at time $t$ are:

$$\text{Sales}_t^{€} = \underbrace{\mathcal{E}_t^{€/\$} \bar{P}_X^{\$}}_{\substack{\textbf{Valuation}\\\textbf{Effect}}} \cdot \underbrace{Y_X\left(\mathcal{E}_t^{¥/\$} \bar{P}_X^{\$}\right)}_{\substack{\textbf{Demand}\\\textbf{Effect}}}$$

Sales vary according to two components. The first is a valuation effect of dollar prices: $\mathcal{E}_t^{€/\$} \bar{P}^{\$}$. The second is the Japanese consumer's demand response after the price in yen responds to a yen appreciation: $\mathcal{E}_t^{¥/\$} \bar{P}^{\$}$. Regressing $\Delta \text{Sales}_t^{€}$ only on bilateral depreciations $\Delta e_t^{€/¥}$ would mix valuation and demand effects, resulting in a bias dependent on the correlation between $\Delta e_t^{€/\$}$ and $\Delta e_t^{¥/\$}$. Separating the two exchange rate components allows me to study the two effects separately.

For the case of an import flow, the movements in $\Delta e_t^{€/\$}$ and $\Delta e_t^{p/\$}$ do not separate valuation and demand effects. With a fully sticky dollar price, movements in the euro-dollar exchange rate capture both demand and valuation effects of the importer:

$$\text{Costs}_t^{€} = \underbrace{\mathcal{E}_t^{€/\$}\bar{P}_M^{\$}}_{\substack{\textbf{Valuation}\\\textbf{Effect}}} \cdot \underbrace{Y_M\left(\mathcal{E}_t^{€/\$}\bar{P}_M^{\$}\right)}_{\substack{\textbf{Demand}\\\textbf{Effect}}}$$

However, controlling for $\Delta e_t^{p/\$}$ is still important because it keeps fixed the value of the partner's currency vis-a-vis the dollar. This has two consequences. First, estimating the effects of movements in $\Delta e_t^{€/\$}$ when $\Delta e_t^{p/\$}$ is fixed implies—by definition in (15)—estimating a *uniform* euro depreciation vis-a-vis all currencies $p$ and the dollar.[33] This is exactly the interpretation that I want for the sensitivity estimates. Second, controlling for variation in partner currency value alleviates concerns about the correlation between exchange rates and unobserved macroeconomic shocks experienced by trade partners. For instance, emerging market currencies typically depreciate during an economic crisis. This confounding factor is controlled by $\Delta e_t^{p/\$}$. In practice, I control for $\Delta e_t^{p/\$}$ only for the dominant-priced goods case. Controlling for $\Delta e_t^{p/\$}$ does not meaningfully change the sensitivity estimates for the case of euro- and partner-pricing.[34]

# D From Transaction to Firm Sensitivities: a Stylized Model

In this Section I build a stylized model to understand how to aggregate product-level estimates to the firm-level and give intuition behind real decisions of companies. Product-level valuation effects aggregate up in a straightforward index of weighted exchange rate shocks, where the weights represent the aggregate activities invoiced in foreign currencies. In a world with sticky prices in invoice currency, trade-weighted effective exchange rates capture neither the valuation effect nor the competition effect of currency fluctuations. Rather, they are more likely to capture demand and supply shocks of trading partners. Finally, valuation effects can boost investment by increasing firm liquidity and profitability, and these effects are hard to disentangle.

Consider a two-period fully-sticky-price partial equilibrium model of French firms. All prices are preset at the beginning of time and firms cannot adjust them. The sources of uncertainty are exchange rates, idiosyncratic firm productivity, and country-specific demand. The latter two shocks represent two possible sources of omitted variable bias.

[33] Equation (15) holds for all currencies $p$ in the world, in equilibrium. If $\Delta e_t^{p/\$}$ does not move for all $p$, then it must be that $\Delta e_t^{€/\$}$ and $\Delta e_t^{€/p}$ move by exactly the same amount for all $p$.

[34] Table I.4 in the appendix replicates the benchmark results interacting $\Delta e_t^{p/\$}$ with all pricing regimes and dropping year fixed effects. The results are similar. Table I.4 also presents a novel test of price stability in invoice currency terms, an extended version of the horse-race test implemented by Gopinath et al. (2016) on aggregate bilateral flows.

A French firm starts operations on period one with a fixed set of invoice currencies and preset prices. I do not explicitly model price setting or invoicing currency choice for two reasons. First, such a model better reflects my empirical strategy, which is agnostic to the determinants of currency choice but observes high stickiness in prices and currency switching. Second, the results would remain the same even with endogenous currency choices and price setting, as long as a micro foundation for price stability in invoice currency is introduced in the model.

The firm sells one good in both France and Japan. The price for French consumers is preset in euros. In Japan instead, some consumers have contracted a preset price in dollars and others have contracted their price in euros. The French firm faces the following demand functions:

$$\begin{aligned}
\text{France:} \quad Y_{Ft} &= \left(\frac{\bar{P}_F^{€}}{\mathcal{P}_F}\right)^{-\rho_F} D_{Ft} \\
\text{Japan}^{€}\text{:} \quad Y_{Jt}^{€} &= \left(\frac{\mathcal{E}_t^{¥/€}\bar{P}_J^{€}}{\mathcal{P}_J}\right)^{-\rho_J^{€}} D_{Jt} \\
\text{Japan}^{\$}\text{:} \quad Y_{Jt}^{\$} &= \left(\frac{\mathcal{E}_t^{¥/\$}\bar{P}_J^{\$}}{\mathcal{P}_J}\right)^{-\rho_J^{\$}} D_{Jt}
\end{aligned}$$

Demand shocks $D_{FT}$ and $D_{Jt}$ are country-specific and occur in both period 1 and 2. $\bar{P}_i^c$ is the currency $c$-unit price of the good sold in country $i$ for customers subject to $c$-invoicing. The upper bar signals that $\bar{P}_i^c$ cannot change over time. Aggregate country prices $\mathcal{P}_i$ are also constant over time for simplicity. The exchange rate $\mathcal{E}^{¥/€}$ is defined as yens per unit of euro. The elasticities of substitution of euro- and dollar-pricing consumers are different to allow for possible endogenous selection of invoice currency on consumer characteristics (an unobserved dimension in the dataset).

Production employs a combination of labor $L_t$, capital $K_t$ determined at time $t-1$, and dollar-invoiced imported intermediate inputs $X_t$ in a Cobb-Douglas production function that includes firm-specific productivity $A_t$:

$$Y_t = A_t {L_t}^{\alpha_L} K_t^{\alpha_K} {X_t}^{\alpha_\$} \, ; \qquad \alpha_L + \alpha_K + \alpha_\$ = 1$$

$\alpha_\$$ is the share of dollar priced inputs, observable from customs declarations. Denote $\bar{W}$ as the constant wage in France, $\bar{i}$ as the nominal rental rate of capital, and $\bar{P}_X^{\$}$ as the sticky dollar price of intermediary materials. To reflect the low sensitivity of import volumes to exchange rates found in Section 4.2, there can be no expenditure switching into domestic materials.

Nominal marginal costs are defined as:

$$\text{MC}_t(A_t, \mathcal{E}^{€/\$}) = \frac{(\bar{W})^{\alpha_L}(\bar{i})^{\alpha_K}(\mathcal{E}_t^{€/\$}\bar{P}^{\$})^{\alpha_\$}}{A_t \alpha_L^{\alpha_L}\alpha_K^{\alpha_K}\alpha_\$^{\alpha_\$}}$$

The profit at time $t$ is defined as:

$$\Pi_t = \overbrace{\bar{P}^{€} \cdot Y_F(\bar{P}^{€}; D_{Ft})}^{\text{Revenues}_{Ft}} + \overbrace{\mathcal{E}^{€/\$}\bar{P}^{\$} \cdot Y_J^{\$}(\mathcal{E}_t^{¥/\$}\bar{P}^{\$}; D_{Jt})}^{\text{Revenues}_{Jt}^{\$}} + \overbrace{\bar{P}^{€} \cdot Y_J^{€}(\mathcal{E}_t^{¥/€}\bar{P}^{€}; D_{Jt})}^{\text{Revenues}_{Jt}^{€}} \\ - \underbrace{\text{MC}(A_t; \mathcal{E}^{€/\$}) \cdot Y_t}_{\text{Cost}_t} \tag{16}$$

Where $Y_F(\cdot)$ is the demand function of French consumers, $Y_J^{\$}(\cdot)$ is the demand function of Japanese customers with sticky dollar price, and $Y_J^{€}(\cdot)$ is the demand of Japanese customers with sticky euro price. $Y_t$ is total production.

Assuming that the log-changes of exchange rates, idiosyncratic productivity, and demand have a normal distribution and are correlated, we can write the following expression of profit at time $t$, conditional on expectation at time $t-1$:[35]

$$\Pi_t = \mathbb{E}_{t-1}[\Pi_t]$$

$$\overbrace{+(\mathbb{E}_{t-1}[\text{Rev.}_{Jt}^{\$}] - \alpha_\$\mathbb{E}_{t-1}[\text{Cost}_t])\Delta e_t^{€/\$}}^{\text{Valuation Effect}} \tag{17}$$

$$\overbrace{-\rho_J^{\$}(\mathbb{E}_{t-1}[\text{Rev.}_{Jt}^{\$}] - \mathbb{E}_{t-1}[\text{Cost}_{Jt}^{\$}])\Delta e_t^{¥/\$} + \rho_J^{€}(\mathbb{E}_{t-1}[\text{Rev.}_{Jt}^{€}] - \mathbb{E}_{t-1}[\text{Cost}_{Jt}^{€}])\Delta e_t^{€/¥}}^{\text{Competition Effect}} \tag{18}$$

$$\overbrace{+(\mathbb{E}_{t-1}[\text{Rev.}_{Jt}] - \mathbb{E}_{t-1}[\text{Cost}_{Jt}])\Delta d_{Jt}}^{\text{Japanese Demand Shock}} \tag{19}$$

$$+ \overbrace{\mathbb{E}_{t-1}[\text{Cost}_t]\Delta a_t}^{\text{Productivity Shock}} + \overbrace{(\mathbb{E}_{t-1}[\text{Rev.}_{Ft}] - \mathbb{E}_{t-1}[\text{Cost}_{Ft}])\Delta d_{Ft}}^{\text{Domestic Demand Shock}} \tag{20}$$

$$+ \text{covariance}\ (\Delta e_t^{€/¥}; \Delta e_t^{¥/\$}; \Delta d_{it}; \Delta a_t) \tag{21}$$

Expression (17) shows how to capture valuation effects when prices are stable in invoice currency. It also highlights limitations of previous approaches in the literature. Suppose to run a perfect experiment, in which a firm has random invoicing currency pricing (I will relax this assumption in Section 5).

[35]The proof of this decomposition is in appendix H. A similar expression arises from a first-order approximation of equation (16) around its steady state. The fact that (17) identifies a first-order effect highlights that the focus of this paper is on currency mismatching and not on risk-related effects of exchange rate fluctuations.

First, a standard trade-weighted bilateral exchange rate index using Japanese exports and imports as shares does not capture competition effects in (18). Expression (18) multiplies yen-dollar and euro-yen depreciations with non-observable product-specific markups, rather than trade-weighted sales to Japan. Second, (19) highlights that demand shocks have the same weighting structure of trade-weighted effective exchange rates. Therefore, trade-weighted indices do not capture the correct market share effects and are also more likely to capture unobserved demand and supply effects. This is especially true when studying exchange rates of developing countries. The dollar pricing index in (17) does not have the same problem because dollar invoiced activities do not coincide with trade activities.[36] Moreover, dollar-invoiced revenues from Japan $\text{Rev.}^{\$}_{Jt}$ and total dollar-invoiced costs $\alpha_{\$}\text{Costs}_t$ are perfectly observable in the dataset. Product-specific markups of exported products are not. Most trade-weighted indices typically use total sales and costs to proxy for the correct amount.

At the end of period one, the French producer chooses how much to invest. In period two there is production and death. For simplicity, I do not include a discount factor. The entrepreneur can pay for investment with internal funds $\Pi_1$ or external funds $B$ . External funds have a quadratic cost $C(B)$. Borrowing costs can be micro-founded by agency problems. They motivate the notion that the Modigliani-Miller hypothesis must fail in order for cash flow effects to impact investments. At time one the French producer solves:

$$\max \mathbb{E}_1[\Pi_2(A_2, \mathcal{E}_2^{j/\$}, K_1 + I_1)] - I_1 - C(B) \quad \text{s.t.}$$

| | |
|---|---|
| Internal + External Funds | $I_1 = \Pi_1 + B$ |
| Cost of debt | $C(B) = \frac{1}{2}\left(\frac{B}{K_1}\right)^2 K_1$ |

The solution is:

$$\frac{I_1}{K_1} = \frac{1}{K_1}\Pi_1(\Delta e_1^{j/\$}; \Delta a_1; \Delta d_{J1}) + \mathbb{E}_1[\Pi'(\Delta e_2^{j/\$}; \Delta a_2; \Delta d_{J2} | \Delta e_1^{j/\$}; \Delta a_1; \Delta d_{J1})] - 1 \quad (22)$$

There are two main effects determining investment decisions. The first, a liquidity effect, is due to the fact that internal funds are cheaper than acquiring debt. The second effect represents the expected marginal profitability of investing an additional unit of capital, the $q$-theory element.

[36]The dollar pricing index would do a better job at disentangling country-specific demand effects even if the model assumed that demand variation is exactly invoicing-country specific: $\Delta d_{ict}$. In this scenario, demand shock weights would coincide with index weights. However, demand shock variation does not coincide with exchange rate variation. Demand shocks would be country-invoicing-time specific, while the euro-dollar exchange rate is time specific.

Exchange rate fluctuations can impact both current cash flows and future profitability. To understand this, assume exchange rates are unit root processes, as empirical studies repeatedly demonstrate. When prices do not reset in period one, exchange rate shocks will permanently change the profit levels coming from dollar-priced goods relative to euro-invoiced goods. The results is a level increase of expected dollar activities at time 1 $\mathbb{E}_1[\text{Revenues}^j_{J2}]$ in (17). This is not caused by financial constraints. The exchange rate shock changes the optimal firm size and that is why investment occurs.

Contemporaneous profitability shifts prevent me from instrumenting current cash flows with the invoice-weighted exchange rate index to measure investment sensitivity. The exclusion restriction on the relation between current cash flows and exchange rate does not hold without controlling for profitability. I will instead run a reduced form regression of investment on invoice-weighted exchange rate shocks. I treat currency fluctuations as-good-as-randomly assigned, but I will not be able to distinguish between a liquidity effect or a profitability shock. However, I provide suggestive evidence that most effects are significant only for small and financially constrained firms. [37].

# E From Transaction to Firm Sensitivities: Empirics

Table E.1 compares trade value sensitivity to exchange rate in the new balanced firm sample at different aggregation levels from 2000 to 2017. Columns 1 and 2 replicate a pass-through estimation at the transaction-level, with products defined as a 6-digit industry code-country-firm combination. The product-level invoice-indexes have imputed exposures for pre-2011 years but mantain the dataset at a level of disaggregation close to the one in the benchmark transaction-level estimates of Table 3 (see the Glossary for more detail). The coefficients of interest for Columns 1 and 2 are similar to the estimates in Section 4.2. The similarity of the estimates to the post-2011 ones confirms first that the benchmark pass-through estimates are not driven by small-sample bias, and second, that the post-2011 shares are a good predictor of past currency pricing shares.

Columns 3 and 4 repeat the estimation at the firm level, separating export flows from import flows. The invoice-weighted indices are computed as in definitions (4)–(7), normalizing by total firm trade flow in 2000. Trade flows for firms pricing in dominant and partner currencies remain more sensitive to the exchange rates than euro-priced goods. However, the estimates drop by around 20 to 30 percentage points compared to the product-level estimates.

The dollar-pricing sensitivity for exporters declines because once I aggregate the results

[37] Other channels not included in this model but that are potentially correlated to exchange rates and profitability are complementarities between R&D and foreign sourcing (Bøler et al. 2015)

Table E.1: Sequential aggregation of pass-through - from product-level to firm-level

| | *Dependent variable:* $\Delta$ Value$^{€}$ | | | | | |
|---|---|---|---|---|---|---|
| | **Product Level** | | **Firm-Flux Level** | | **Firm Level** | |
| | Exports | Imports | Exports | Imports | Exporters | Importers |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta$ Euro-weighted | 0.379*** | 0.004 | 0.269*** | −0.235 | 0.269*** | −0.220 |
| | (0.036) | (0.131) | (0.086) | (0.152) | (0.078) | (0.137) |
| $\Delta$ Partner-weighted | 0.930*** | 1.084*** | 0.668*** | 0.621*** | 0.634*** | 0.644*** |
| | (0.171) | (0.122) | (0.129) | (0.072) | (0.161) | (0.120) |
| $\Delta$ Dominant-weighted | 0.780*** | 0.606*** | 0.444 | 0.394** | 0.227 | 0.418*** |
| | (0.097) | (0.120) | (0.425) | (0.190) | (0.275) | (0.139) |
| Observations | 1,270,192 | 551,481 | 219,909 | 151,762 | 123,232 | 65,888 |
| $R^2$ | 0.075 | 0.080 | 0.039 | 0.044 | 0.038 | 0.052 |

*Note*: This table shows the changes in exchange rate sensitivities when aggregating the dataset from the product-level to the firm-level. Columns 1 and 2 replicates the sensitivity estimation at the product-level in specification (1), with products defined as a unique combination of 6-digit industry code-country-firm identifier. The dependent variable for Columns 1 and 2 is the yearly log-changes in total value of the product, in euros. The euro-, partner-, and dominant-weighted indices for the estimations in Columns 1 and 2 are defined at the product-level and they are akin to an exchange rate shock interacted by a dummy for euro-pricing, partner-pricing or dominant-pricing. Columns 3 and 4 repeat the estimation at the firm-level, separating export from import flows. The invoice-weighted indices are computed at the firm-level, as in equations (4)-(7), without netting export with import exposures, and normalizing by firm value of trade in 2000. The dependent variable in Columns 3 and 4 is the log-change of extra-EU export or import values of a firm. Columns 5 and 6 estimate the effects of the invoice-weighted indices on net trade value changes of exporter and domestic-oriented firms. I limit the sample to exporters and domestic-oriented firms with total net value of trade never oscillating between negative and positive values between 2000 and 2016. In Columns 5 and 6, the invoice-weighted indices are defined exactly as in (4)-(7), and normalized by net trade value of the firm in 2000. Controls include trade-weighted indices of partner country GDP, and inflation, product, firm, and year fixed effects. I include one lag for all covariates. All variables are winsorized annually at their 1st and 99th percentiles. Standard errors of Columns 1 and 2 are clustered by country-year. Standard errors of Columns 3 to 6 are double clustered by firm identifier and year. In the context of this analysis, clustering standard errors by year is akin to clustering following Adão et al. (2018).

from the product-level to the firm-level, most of the sample presents virtually zero net dollar exposure (Figure 3a). The import sensitivity estimates decline for a different reason. The sample of Columns 1 and 2 contains all product combinations active in all the years between 2000 and 2016. Similarly, the firm-level invoice-weighted indices can only be defined for products active between 2000 and 2016. However, fluctuations in the total trade of firms — the dependent variable of Columns 3–6 — include products that either exit or enter a firm's mix between 2000 and 2016. The drop in my estimate is due to measurement error of actual invoice-exposure due to entry and exit of firms' products over the years. This measurement error does not invalidate my identification technique. It simply changes the interpretation of the invoice-weighted shock in representing exposures generated by *core* products of firms, rather than actual exposure.[38]

# F Decomposition of Invoice Valuation Effects

This section deconstructs the full effects of a euro depreciation on the activity of French companies. Following Lewellen and Lewellen (2016), I decompose cash flows in the following accounting identity:

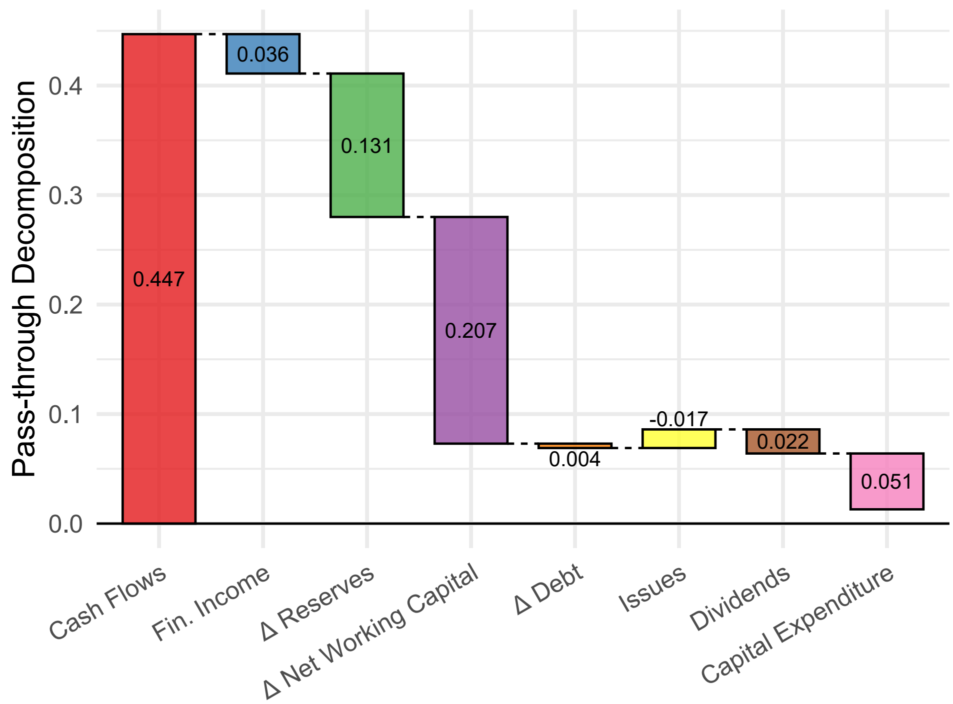
$$\begin{aligned}\text{Cash Flows}^* \approx\ & \Delta\text{Cash Reserves} + \Delta\text{Net Working Capital} + \text{Tot. Capital Expenditure} \\ & - \Delta\text{Debt} - \text{Issues} + \text{Dividends} - \text{Financial Income} \qquad (23)\end{aligned}$$

The symbol $\Delta$ in this equation means a simple year-on-year difference, not a log difference. Cash Flows$^*$ in (23) do not represent gross operating profits. Cash Flows$^*$ include extraordinary income, deferred taxes, the unremitted portion of earnings in unconsolidated subsidiaries, losses from the sale of property, plant and equipement, and other funds from operations. Consolidated cash flows are not fully retrievable from the dataset available in this paper because each firm represents a legal entity rather than a consolidated business. However, since most results are driven by small domestic firms, the relation still holds approximately when I estimate the pass-through of an invoice-weighted exchange rates on all the components in (23) separately.

This allows me to deconstruct the full firm's cash flow pass-through caused by 1 euro of

[38] An alternative explanation for the drop in estimates is heterogeneous effects across products and firms. Table I.6 in the appendix runs the same regression in Columns 1 and 2 weighting by the relative importance of products within the firm. The results remain stable, ruling out heterogeneous effects of pass-through across different products within firms. Table I.6 also confirms that the exchange rate sensitivities of firm-level trade flows related to core products only remain in line with product-level sensitivities.

Figure F.1: Decomposition of 1% Euro Depreciation Shock into Cash Flow Pass-through




*Note*: This figure deconstructs the effect of 1 euro of invoice valuation on cash flows components of firms. All the effects are computed from separate estimations of the components of interest, following the benchmark firm-level specification in equation (8). The effects refer to the dominant-weighted exchange rate index component. The labels within each bar chart show the magnitude of the coefficients. For the case of issues, dividends, and financial income the sign of the regression is flipped, to reflect the correct contribution as shown in the accounting identity (23). Controls include lagged productivity, lagged sales growth, the lagged dependent variable, year, firm, 3-digit industry code-by-year, and trade activity-by-year fixed effects. All the effects are significant at the 5% level except dividends and $\Delta$ Debt.

invoice valuation. Figure F.1 shows the composition of the pass-through effects on operational cash flows. There is an effect of 5 cents on the dollar for total capital expenditure (the effects on investment are higher than in Table 6 because they include intangible and financial capital expenditures). The other two most important responses in firms' balance sheets are firms changes in reserves and net working capital. The fact that dividends, issues and debt mostly do not respond is likely due to the fact that the results are driven by small financially constrained firms. A small part of the effects on operational cash flows are offset by net financial income (4 cents on the euro). Net working capital and cash reserves are, on average, a more important instrument of shock absorption for firms in my sample.

# G Proofs

## G.1 First-order Valuation Effects of Toy Model in Section D

Rewrite the profit equation in (16) by decomposing the total cost into production costs of the goods sold in France ($\text{Costs}_{Ft}$), costs of the dollar-priced goods sold in Japan ($\text{Costs}^{\$}_{Jt}$), and costs of the euro-priced goods sold in Japan ($\text{Costs}^{€_{Jt}}$).

$$
\begin{aligned}
\Pi_t =& \overbrace{\bar{P}^{€} \cdot Y_F(\bar{P}^{€}; D_{Ft})}^{\text{Revenues}_{Ft}} + \overbrace{\mathcal{E}^{€/\$}\bar{P}^{\$} \cdot Y_J^{\$}(\mathcal{E}_t^{¥/\$}\bar{P}^{\$}; D_{Jt})}^{\text{Revenues}^{\$}_{Jt}} + \overbrace{\bar{P}^{€} \cdot Y_J^{€}(\mathcal{E}_t^{¥/€}\bar{P}^{€}; D_{Jt})}^{\text{Revenues}^{€}_{Jt}} \\
& - \underbrace{\text{MC}(A_t; \mathcal{E}^{€/\$}) \cdot Y_F(\bar{P}^{€}; D_{Ft})}_{\text{Costs}_{Ft}} - \underbrace{\text{MC}(A_t; \mathcal{E}^{€/\$}) \cdot Y_J^{\$}(\mathcal{E}_t^{¥/\$}\bar{P}^{\$}; D_{Jt})}_{\text{Costs}^{\$}_{Jt}} \\
& - \underbrace{\text{MC}(A_t; \mathcal{E}^{€/\$}) \cdot Y_J^{€}(\mathcal{E}_t^{¥/€}\bar{P}^{€}; D_{Jt})}_{\text{Costs}^{€}_{Jt}}
\end{aligned}
$$

Multiply and divide each component by their conditional expected value at time $t-1$. Then, for each revenue and cost component, define their unexpected variation as $\Delta x = \log X_t - \log \mathbb{E}_{t-1}[X_t]$.

$$
\begin{aligned}
\Pi_t =& \frac{\text{Rev.}_{Ft}}{\mathbb{E}_{t-1}[\text{Rev.}_{Ft}]}\mathbb{E}_{t-1}[\text{Rev.}_{Ft}] + \frac{\text{Rev.}^{\$}_{Jt}}{\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}]}\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] + \frac{\text{Rev.}^{€}_{Jt}}{\mathbb{E}_{t-1}[\text{Rev.}^{€}_{Jt}]}\mathbb{E}_{t-1}[\text{Rev.}^{€}_{Jt}] \\
& - \frac{\text{Costs}_{Ft}}{\mathbb{E}_{t-1}[\text{Costs}_{Ft}]}\mathbb{E}_{t-1}[\text{Costs}_{Ft}] - \frac{\text{Costs}^{\$}_{Jt}}{\mathbb{E}_{t-1}[\text{Costs}^{\$}_{Jt}]}\mathbb{E}_{t-1}[\text{Costs}^{\$}_{Jt}] - \frac{\text{Costs}^{€}_{Jt}}{\mathbb{E}_{t-1}[\text{Costs}^{€}_{Jt}]}\mathbb{E}_{t-1}[\text{Costs}^{€}_{Jt}] \\
=& (\Delta\text{rev.}_{Ft} + 1)\mathbb{E}_{t-1}[\text{Rev.}_{Ft}] + (\Delta\text{rev.}^{\$}_{Jt} + 1)\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] + (\Delta\text{rev.}^{€}_{Jt} + 1)\mathbb{E}_{t-1}[\text{Rev.}^{€}_{Jt}] \\
& - (\Delta\text{costs}_{Ft} + 1)\mathbb{E}_{t-1}[\text{Costs}_{Ft}] - (\Delta\text{costs}^{\$}_{Jt} + 1)\mathbb{E}_{t-1}[\text{Costs}^{\$}_{Jt}] - (\Delta\text{costs}^{€}_{Jt} + 1)\mathbb{E}_{t-1}[\text{Costs}^{€}_{Jt}]
\end{aligned}
$$

Assume that the stochastic unexpected component of the model's shocks have a multivariate log-normal distribution where all shocks are potentially correlated:

$$\begin{bmatrix} \Delta e_t^{€/\$} \\ \Delta e_t^{¥/\$} \\ \Delta d_{Ft} \\ \Delta d_{Jt} \\ \Delta a_t \end{bmatrix} \sim \mathcal{N}(\mu,\, \Omega) \quad \text{for all } t$$

I can rewrite each unexpected component of revenue and cost in the profit function as:

$$\begin{aligned}
\Delta \text{rev}_{Ft} =& \Delta d_{Ft} - \frac{1}{2}\sigma_F^2 \\
\Delta \text{rev}_{Jt}^{\$} =& \Delta e_t^{€/\$} - \rho_J^{\$} \Delta e_t^{¥/\$} + \Delta d_{Jt} \\
& - \frac{1}{2}\left(\sigma_{€}^2 + \rho_J^{\$\,2} \sigma_{¥}^2 + \sigma_J^2 - 2\rho_J^{\$}\sigma_{€,¥} - 2\rho_J^{\$}\sigma_{J,¥} + 2\sigma_{€,J}\right) \\
\Delta \text{rev}_{Jt}^{€} =& \rho_J^{€} \Delta e_t^{€/¥} + \Delta d_{Jt} \\
& - \frac{1}{2}\left(\rho_J^{€2}\sigma_{€}^2 + \rho_J^{€2}\sigma_{¥}^2 + \sigma_J^2 + 2\rho_J^{€}\sigma_{€,¥} + 2\rho_J^{€}\sigma_{€,J} + 2\rho_J^{€}\sigma_{J,¥}\right) \\
\Delta \text{costs}_{Ft} =& \alpha_{\$}\Delta e_t^{€/\$} - \Delta a_t + \Delta d_{Ft} \\
& - \frac{1}{2}\left(\alpha_{\$}^2\sigma_{€}^2 + \sigma_a^2 + \sigma_F^2 - 2\alpha_{\$}\sigma_{€,a} + 2\alpha_{\$}\sigma_{€,F} - 2\sigma_{a,F}\right) \\
\Delta \text{costs}_{Jt}^{\$} =& \alpha_{\$}\Delta e_t^{€/\$} - \Delta a_t - \rho_J^{\$}\Delta e_t^{¥/\$} + \Delta d_{Jt} \\
& - \frac{1}{2}\left(\alpha_{\$}^2\sigma_{€}^2 + \rho_J^{\$\,2}\sigma_{¥}^2 + \sigma_a^2 - 2\rho_j^{\$}\alpha_{\$}\sigma_{€,¥} + 2\rho_j^{\$}\sigma_{a,¥} - 2\alpha_{\$}\sigma_{€,a}\right) \\
\Delta \text{costs}_{Jt}^{€} =& \alpha_{\$}\Delta e_t^{€/\$} - \Delta a_t + \rho_J^{€}\Delta e_t^{€/¥} + \Delta d_{Jt} \\
& - \frac{1}{2}\left((\alpha_{\$} + \rho_J^{€})^2\sigma_{€}^2 + \rho_J^{€2}\sigma_{¥}^2 + \alpha_{\$}^2\sigma_a^2 + 2(\alpha_{\$} + \rho_J^{€})\rho_J^{€}\sigma_{€,¥} - 2(\alpha_{\$} + \rho_J^{€})\sigma_{€,a} - 2\rho_J^{€}\sigma_{¥,a}\right)
\end{aligned}$$

Where $\sigma_{€}^2$, $\sigma_{¥}^2$, $\sigma_F^2$, $\sigma_J^2$, and $\sigma_a^2$ are the variances of the log shocks in euro per dollar exchange rate, yen per dollar exchange rate, French demand, Japanese demand, and French productivity, respectively. $\sigma_{i,j}$ is the covariance between the variable $i$ and $j$. The expressions above imply that the profit function can be rewritten as:

$$
\begin{aligned}
\Pi_t =&\mathbb{E}_{t-1}[\Pi_t] \\
&+ (\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] - \alpha_{\$}\mathbb{E}_{t-1}[\text{Costs}_t])\Delta e_t^{€/\$} \\
&- \rho_J^{\$}(\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}^{\$}_{Jt}])\Delta e_t^{¥/\$} + \rho_J^{€}(\mathbb{E}_{t-1}[\text{Rev.}^{€}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}^{€}_{Jt}])\Delta e_t^{€/¥} \\
&+ (\mathbb{E}_{t-1}[\text{Rev.}_{Ft}] - \mathbb{E}_{t-1}[\text{Costs}_{Ft}])\Delta d_{Ft} + (\mathbb{E}_{t-1}[\text{Rev.}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}_{Jt}])\Delta d_{Jt} \\
&+ \mathbb{E}_{t-1}[\text{Costs}_t]\Delta a_t \\
&+ \text{variance-covariance terms}
\end{aligned}
$$

The expression above coincides with equation (17) in the stylized model. Equation (17) is useful to understand a source of bias that can arise when estimating valuation effects only including an invoice-weighted index and a trade-weighted control (as in Columns 2, 5, and 8 of Table 6). Rewriting all the competition effects from Japanese sales as a function of bilateral euro-yen exchange rates, the profit function becomes

$$
\begin{aligned}
\Pi_t =&\mathbb{E}_{t-1}[\Pi_t] && (24)\\
&+ (\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] - \alpha_{\$}\mathbb{E}_{t-1}[\text{Costs}_t])\Delta e_t^{€/\$} && (25)\\
&+ \tilde{\rho}_J(\mathbb{E}_{t-1}[\text{Rev.}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}_{Jt}])\Delta e_t^{€/¥} && (26)\\
&- \rho_J^{\$}(\mathbb{E}_{t-1}[\text{Rev.}^{\$}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}^{\$}_{Jt}])\Delta e_t^{€/\$} && (27)\\
&+ (\mathbb{E}_{t-1}[\text{Rev.}_{Ft}] - \mathbb{E}_{t-1}[\text{Costs}_{Ft}])\Delta d_{Ft} + (\mathbb{E}_{t-1}[\text{Rev.}_{Jt}] - \mathbb{E}_{t-1}[\text{Costs}_{Jt}])\Delta d_{Jt} && (28)\\
&+ \mathbb{E}_{t-1}[\text{Costs}_t]\Delta a_t && (29)\\
&+ \text{covariance terms b/w shocks} && (30)
\end{aligned}
$$

where $\tilde{\rho}_J = \rho_J^{€} - \rho_J^{\$}$. The component in (25) represents the invoice-weighted index capturing invoice valuation effects. The component in (26) represents the trade-weighted exchange rate control. The component in (27) is not captured by either the invoice-weighted index (25) or the trade weighted index in (26). This unobserved component is likely to correlate with the invoice-weighted index and cause downward bias. This is why Columns 2, 5, and 8 of Table 6 are not the benchmark specification and I use the four different invoice-weighted indices in (4)-(7) as my benchmark specification.

## G.2 Equivalence of shift-share estimation with time-level IV estimation

Taking the definition of the dominant-weighted index estimator in equation (12) I can show that

$$\begin{aligned}\hat{\beta}^D =& \frac{\sum_{ft}^{TF} \widetilde{I}_{ft}^{D\perp} \widetilde{Y}_{ft}^{\perp}}{\sum_{ft}^{TF} \widetilde{I}_{ft}^{D\perp} \widetilde{I}_{ft}^{D\perp}} = \frac{\sum_{ft}^{TF} \widetilde{I}_{ft}^{D} \widetilde{Y}_{ft}^{\perp}}{\sum_{ft}^{TF} \widetilde{I}_{ft}^{D} \widetilde{I}_{ft}^{D\perp}} = \frac{\sum_t \sum_f s_f^D \Delta e_t^{€/\$} \widetilde{Y}_{ft}^{\perp}}{\sum_t \sum_f s_f^D \Delta e_t^{€/\$} \widetilde{I}_{ft}^{D\perp}} \\ =& \frac{\sum_t \Delta e_t^{€/\$} \sum_f s_f^D \widetilde{Y}_{ft}^{\perp}}{\sum_t \Delta e_t^{€/\$} \sum_f s_f^D \widetilde{I}_{ft}^{D\perp}} = \frac{\sum_t \Delta e_t^{€/\$} \widehat{\widetilde{Y}_t^{\perp}}}{\sum_t \Delta e_t^{€/\$} \widehat{\widetilde{I}_t^{D\perp}}}\end{aligned}$$

The last equality corresponds to an instrumental variable estimation where the second stage corresponds to projecting $\widehat{\widetilde{Y}_t^{\perp}}$ on $\widehat{\widetilde{I}_t^{D\perp}}$, and the instrument is $\Delta e_t^{€/\$}$.

# H Aggregate Dominant Invoicing Use over Time

The Dollar role into the denomination of bonds, loans, and trade transactions grew in the last two decades (Maggiori et al. 2019). This section shows how aggregate French trade is also shifting towards a wider use of the dollar. The factors explaining this growing dollar use can inform on the estimation validity and on the correct robustness checks to implement.

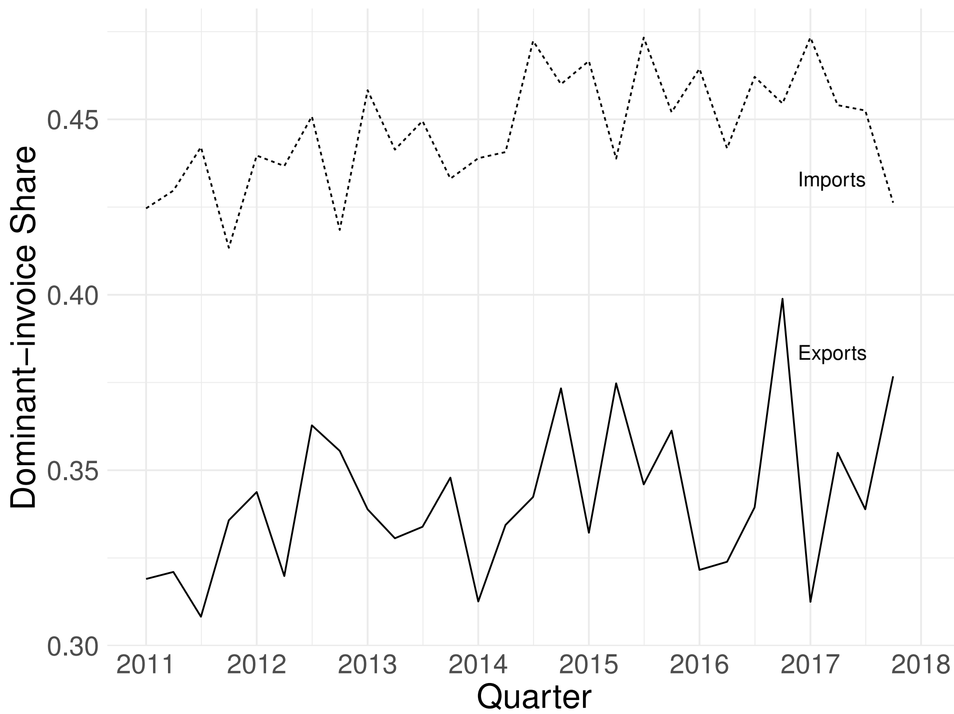
Figure H.1 shows the evolution of French dominant-invoiced manufacturing trade from 2011 until 2017. The dollar role as a trade invoice currency grew for both extra-EU exports and imports. The dollar share of non-US extra-EU imports grew from 42.8% in 2011 to 45.2% in 2017. The share of non-US extra-EU exports grew from 32.1% in 2011 to 34.8% in 2017.

Figure H.2 shows the dominant-invoiced trade share for the largest 100, 101 to 1000, and other trading French firms. The top 100 French exporters are the only drivers of the increase dollar intensity in French exports. All other exporters have low and unchanging share of dollar use. Small and medium-sized firms drive the increasing dollar use in French imports.

There can be different dynamics explaining the increasing importance of the dollar in French trade. First, the extensive margin: an increasing share of dollar-priced products entering international markets, or a larger exit of non-dollar-priced products. Second, the intensive margin: a widespread currency switch of existing products towards the dollar. Third, the size effect: a differential growth of dollar-priced products over the period.

The extensive margin is not playing a large role in this phenomenon. In fact, by keeping fixed the entry or exit of products in the whole sample I verified that all dynamics in Figures

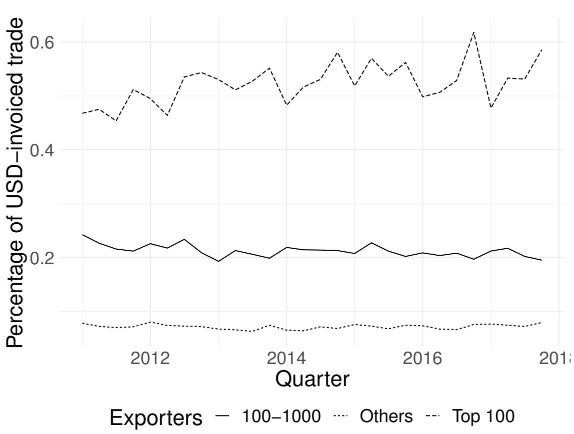
Figure H.1: Evolution over time of Dominant-invoice share



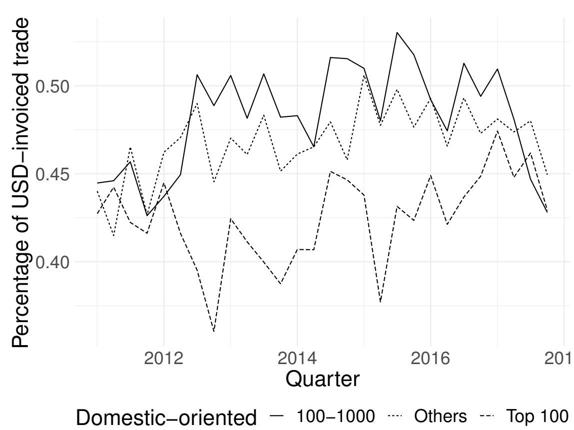

*Note*: French value share of extra-EU manufacturing imports and exports invoiced in $ when the partner country is not the United States.

Figure H.2: Dynamics of $-invoicing shares by kind of company

(a) Exports




(b) Imports




*Note*: French value share of extra-EU manufacturing imports and exports invoiced in $ when the partner country is not the United States. All shares are computed for the top 100, top 101 to 1000 and other firms, according to the size of their average gross trading activities.

H.1 and H.2 are mildly amplified.[39] Intuitively, new and old products in the period of interest

[39]Results available on request.

represent a small share of all French trade, hence they do not drive aggregate trends. Because the extensive margin does not drive the dollar use trend, and because the invoice-weighted index in section 5.1 is defined on the set of products surviving the whole sample, the rest of this section will focus on the sub-sample of products transacted every year. To investigate the contribution of the intensive margin vs. the size effects I decompose the changes in dominant-invoiced shares using a shift share decomposition akin to Fagerberg and Sollie (1987).

$$
\begin{aligned}
\Delta s_t^{\$} = \quad & \sum_c \sum_f s_{t-1}^c s_{t-1}^{fc} \Delta s_t^{fc,\$} && \textbf{\$ intensive margin} \qquad (31) \\
+ & \sum_c \sum_f s_{t-1}^c s_{t-1}^{fc,\$} \Delta s_t^{fc} && \textbf{\$ firm growth} \\
+ & \sum_c \sum_f s_{t-1}^c \Delta s_t^{fc,\$} \Delta s_t^{fc} && \textbf{int. margin - firm growth interaction} \\
+ & \sum_c s_{t-1}^{c,\$} \Delta s_t^c && \textbf{\$ country growth} \\
+ & \sum_c \Delta s_t^c \Delta s_t^{c,\$} && \textbf{int. margin - country interaction}
\end{aligned}
$$

Where $c$ is the partner country, and $f$ the firm identifier. $s_{t-1}^c$ represents the trade flow share of country $c$ at year $t-1$ over total trade. $s_{t-1}^{fc}$ represents the share of firm $f$ trade within the aggregate trade of France with country $c$. $s_{t-1}^{c,\$}$ represents the share of dominant invoicing use in trade with country $c$. $s_{t-1}^{fc,\$}$ represents the share of dominant invoicing use in trade of firm $f$ with country $c$. The share changes are defined as $\Delta s_t^j = s_t^j - s_{t-1}^j$.

The *$ intensive margin* contribution represents the increase in dollar use of a firm $f$ in trade with country $c$, keeping the growth of firm $f$ in country $c$ constant. The *$ firms growth* represents the contribution of each firm's growth, keeping fixed their initial dollar use intensity. *$ country growth* represents the contribution of each trade partner growth, keeping fixed their initial dollar use intensity. The other components represent the interaction between these forces. Table H.1 shows the contribution of the previous factors to the overall increase in aggregate dollar shares.

Table H.1 shows how the growth of partner countries trade and the growth of French firms' trade are the components mainly responsible for the observed increase in dollar use in exports. In other words, the exporters firms invoice decisions remained constant. What grew is the size of firms who invoiced in dollars the most at the beginning of the period. Table H.1 also shows that, for imports, the intensive margin is instead mainly responsible for the observed increase in dollar use. However, this does not mean that all imported products in France experienced an increase in dollar invoice use. As showed in Table I.3 90% of products

Table H.1: Contribution of $ share change

| **p.p. contribution** | **Exports** | **Imports** |
|---|---|---|
| $ intensive margin | -1.2 | 3.7 |
| $ firm growth | 1.9 | -0.3 |
| int. margin - firm growth interaction | 1.3 | 0.3 |
| $ country growth | 3.1 | -1.9 |
| int. margin - country interaction | 1.7 | -0.2 |
| Aggregate | 6.8 | 1.6 |

*Note*: Decomposition of yearly aggregate $ use share change between 2011 and 2017. The decomposition follows equation (31). The last row of the table correspond to the percentage point change in aggregate trade value invoiced in dollars over total trade, including only manufacturing products existing in both 2011 and 2017, excluding EU countries and the US.

never change their invoice currency specification. The 10% of products that change currency within the period of study are responsible for the increase in trend. It is therefore important to study the robustness of the estimates keeping constant the currency use at the beginning of the sample, as in Table I.13 and by carefully assessing the potential impact of trends in dollar use, as discussed in section 5.4. For transparency, Table H.2 shows the percentage of products changing currency share for each industry. There is no particular industry driving the trend. Moreover, for all kind of products a currency switch over 7 years is unlikely.

Table H.2: Products Never Changing Dominant Currency Use

| | **Exports** | | **Imports** | |
|---|---|---|---|---|
| | *% Products* | *% Trade* | *% Products* | *% Trade* |
| Food | 95% | 77% | 86% | 80% |
| Beverages | 98% | 91% | 85% | 79% |
| Tobacco | 88% | 51% | 90% | 92% |
| Textiles | 93% | 74% | 79% | 70% |
| Wearing Apparel | 95% | 95% | 78% | 65% |
| Leather | 94% | 93% | 77% | 73% |
| Wood | 98% | 97% | 84% | 69% |
| Paper | 92% | 84% | 82% | 80% |
| Printing | 100% | 100% | 100% | 100% |
| Oil Refinery | 87% | 36% | 67% | 30% |
| Chemistry | 87% | 71% | 81% | 79% |
| Basic Pharma | 89% | 76% | 77% | 90% |
| Rubber and Plastic | 94% | 89% | 75% | 73% |
| Other Mineral | 88% | 74% | 81% | 66% |
| Basic Metals | 85% | 65% | 84% | 90% |
| Fabricated Metals | 94% | 82% | 77% | 68% |
| Computer | 87% | 61% | 59% | 54% |
| Electrical Equip. | 88% | 78% | 67% | 78% |
| Machinery | 93% | 82% | 80% | 71% |
| Vehicles | 97% | 93% | 75% | 94% |
| Other transport | 73% | 93% | 63% | 60% |
| Furniture | 98% | 98% | 82% | 71% |
| Other Manuf. | 94% | 89% | 73% | 74% |

*Note*: Percentage of products never changing their value share invoiced in dollars from to 2011 to 2017, decomposed by 2-digit CPA manufacturing industry. *% Products* represents the number of products never changing the share of their value bought or sold invoiced in $. A product is defined as unique combination of firm identifier-8-digit industry code-country. *% Trade* represents the percentage of trade value accounted by products never changing the share of their value bought or sold invoiced in $.

# I Additional Tables and Figures

Table I.1: Variance of Currency Choice Explained by Fixed Effects

| | $R^2$ | |
|---|---|---|
| **Fixed Effects** | **Exports** | **Imports** |
| Product | 0.11 | 0.07 |
| Country | 0.13 | 0.19 |
| Company | 0.42 | 0.45 |
| Product + Country | 0.21 | 0.23 |
| Product + Company | 0.43 | 0.46 |
| Company + Country | 0.49 | 0.53 |
| Product + Company + Country | 0.50 | 0.54 |
| Product x Country | 0.37 | 0.30 |
| Product x Company | 0.45 | 0.62 |
| Company x Country | 0.79 | 0.65 |
| Product x Company x Country | 0.83 | 0.76 |
| Saturated | 0.89 | 0.87 |

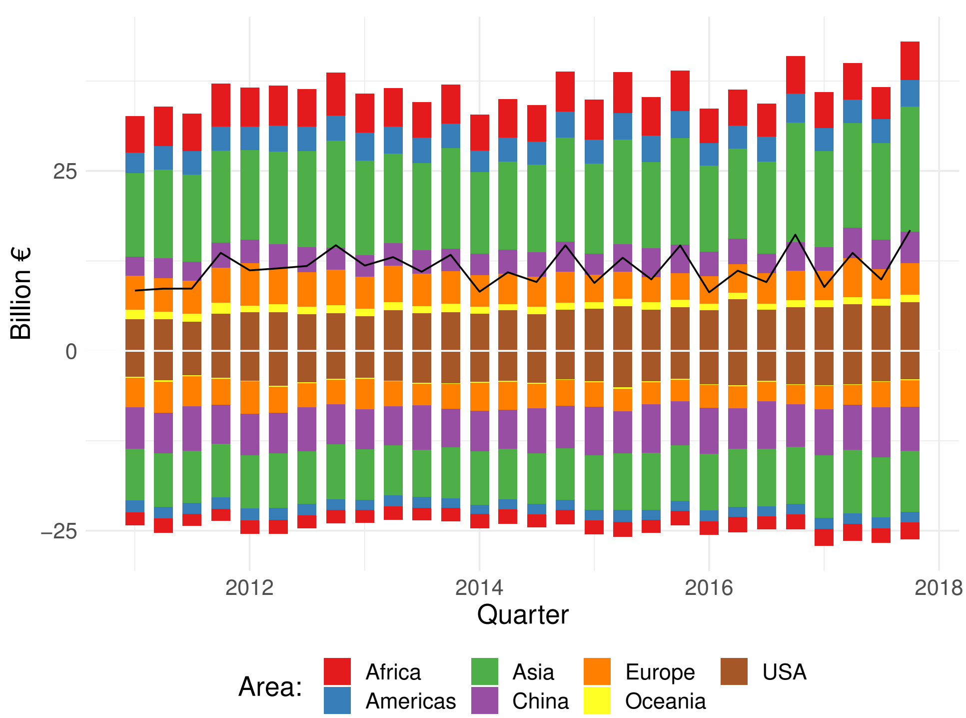
*Note*: This table shows the dimensions that explain the invoicing currency choice of observed monthly transactions. Similar to Amiti et al. (2018), I compare coefficients of determination of a Euro-invoicing dummy on a set of fixed effects. No single transaction characteristic explains invoice currency choice. The firm identifier is the most important explanatory variable, followed by partner country and 8-digit industry code. For exports, a combination of firm identifier and partner country explains almost 80% of choices. For imports, adding information on the kind of products improves the explanatory power. This table justifies my choice to compute the invoice-weighted exchange rate index taking all three dimensions into account. I can explain almost 90% of currency choices if the full model is saturated on all product characteristic dimensions except time, suggesting there is little invoice switching across months. $R^2$ coefficients of determination computed from the regression $\mathbb{1}(\text{EUR invoicing=1})_j = \alpha_i + \epsilon_j$ where $\mathbb{1}(\text{EUR invoicing=1})$ is a dummy specifying whether the transaction $j$ is invoiced in Euros, and $\alpha_i$ is the kind of fixed effect specified. Regression run separately for exports and imports of all monthly transactions from 2011 to 2017. The saturated fixed effect model includes the unique combination of 8 digit industry $\times$ country $\times$ company $\times$ insurance contract $\times$ transport mode.

Table I.2: Invoicing Transition Matrix - All Products

| | Euro | Partner | Dominant | Multiple |
|---|---|---|---|---|
| Euro | 91.77% | 2.07% | 2.21% | 3.94% |
| Partner | 0.77% | 97.48% | 0.54% | 1.22% |
| Dominant | 1.84% | 1.54% | 93.32% | 3.31% |
| Multiple | 20.743% | 18.779% | 18.747% | 41.730% |

*Note*: This table shows the yearly probability that a product switches from one type of invoicing currency to another. Products are defined as unique combinations of country × firm identifier × trade direction × eight-digit industry code × incoterm code × transport mode. This table includes all products, even those that use multiple currencies on the same date. A switch is counted if the *set* of currencies for a product is changed from one year to the other. I present switches between four main pricing regimes: *euro*, when a product is invoiced in the domestic currency, *partner* when a product is invoiced in the currency of the trading country, *dominant* when a product is invoiced in dollars but the partner country is not the US, and *multiple* when a product is invoiced in more than one of the previous regimes. Table I.2 together with Table I.3 in the main text make an important point. The probability of a product changing invoicing *at least once* in 6 years is approximately 10%. Note, however, that this probability hardly coincides with what can be inferred from the transition matrix in Table I.2. The average probability of changing invoicing currency set is 93%. This implies a probability of changing currency at least once from 2011 to 2017 of $1 - .93^6 = .35$, which is higher than 10%. This happens because only a minor subset of products actually change currency of invoicing, and these products do so very frequently, distorting the average probability estimation of change. In other words, the median probabilities of changing currency are much lower than that shown in the transition matrices in I.2 and 2.

Figure I.1: Geographical Composition of extra-EU French Trade by quarter




*Note*: Quarterly geographical composition of extra-EU French trade in manufacturing from 2011 to 2017. Positive values represent exports, negative values represent imports. The black line represents net nominal trade in manufacturing.

Table I.3: Products with a Stable Invoice Share

| | Products Never Changing Share | Trade Never Changing Share |
|---|---|---|
| *Exporters* | | |
| Top 100 | 89% | 80% |
| 100-1000 | 91% | 76% |
| Others | 97% | 90% |
| | | |
| *Domestic-oriented* | | |
| Top 100 | 85% | 69% |
| 100-1000 | 90% | 80% |
| Others | 95% | 84% |

*Note*: Analysis of invoice share stability for each product in the extra-EU customs dataset in the period 2011-2017. Products are defined as a unique combinations of country-firm identifier-trade flow-8-digit industry code-insurance contract-transport mode. The sample includes products invoiced in multiple currencies within the same year. Each invoice share is computed as a given year value of a product invoiced in a specific currency divided by the total value of the same product, regardless of the currencies it is invoiced on. Products invoiced in a single currency will have shares of 1. Multiple-currency products will have shares between 0 and 1. *Products Never Changing Share* represent the percentage of products whose invoice currency share fluctuates no more than one percentage point compared to the previous year. *Trade Never Changing Share* shows a trade-weighted version of the latter column and it represents the percentage of trade accounted by products that never change invoice currency share.

Table I.4: Testing Price Stability in Units of Invoicing Currency

| | *Dependent variable:* $\Delta$Price$^{€}$ | | | | | |
|---|---|---|---|---|---|---|
| | **Exports** | | | **Imports** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Euro $\times \Delta e$(€/ Partn.) | 0.088$^{***}$ | | 0.069$^{***}$ | 0.276$^{***}$ | | 0.133$^{***}$ |
| | (0.031) | | (0.023) | (0.049) | | (0.046) |
| Euro $\times \Delta e$(€/ \$) | | 0.088$^{***}$ | 0.019 | | 0.276$^{***}$ | 0.143$^{***}$ |
| | | (0.031) | (0.020) | | (0.049) | (0.049) |
| Euro $\times \Delta e$(Partn. / \$) | 0.019 | $-$0.069$^{***}$ | | 0.143$^{***}$ | $-$0.133$^{***}$ | |
| | (0.020) | (0.023) | | (0.049) | (0.046) | |
| Partner $\times \Delta e$(€/ Partn.) | 0.631$^{***}$ | | | 0.930$^{***}$ | | 0.923$^{***}$ |
| | (0.057) | | (0.000) | (0.045) | | (0.079) |
| Partner $\times \Delta e$(€/ \$) | | 0.631$^{***}$ | 0.631$^{***}$ | | 0.930$^{***}$ | 0.007 |
| | | (0.057) | (0.057) | | (0.045) | (0.086) |
| Partner $\times \Delta e$(Partn. / \$) | | | | 0.007 | $-$0.923$^{***}$ | |
| | (0.000) | (0.000) | | (0.086) | (0.079) | |
| Dominant $\times \Delta e$(€/ Partn.) | 0.788$^{***}$ | | 0.070 | 0.882$^{***}$ | | 0.081 |
| | (0.040) | | (0.052) | (0.029) | | (0.054) |
| Dominant $\times \Delta e$(€/ \$) | | 0.788$^{***}$ | 0.718$^{***}$ | | 0.882$^{***}$ | 0.801$^{***}$ |
| | | (0.040) | (0.050) | | (0.029) | (0.058) |
| Dominant $\times \Delta e$(Partn. / \$) | 0.718$^{***}$ | $-$0.070 | | 0.801$^{***}$ | $-$0.081 | |
| | (0.050) | (0.052) | | (0.058) | (0.054) | |
| Observations | 1,647,381 | 1,647,381 | 1,647,381 | 1,096,256 | 1,096,256 | 1,096,256 |
| $R^2$ | 0.368 | 0.368 | 0.368 | 0.425 | 0.425 | 0.425 |

*Note*: This table shows yearly exchange rate sensitivity regressions estimated similarly to specification (1) on unbalanced panel of transactions from 2011 to 2017. $\Delta$ is defined as the period between two transactions and often but not always coinciding with one year. Controls include partner GDP and CPI inflation, firm $\times$ industry $\times$ country $\times$ invoicing fixed effect. Price is defined as unit values in euro terms. Standard errors are clustered by country $\times$ year. I can cleanly test price stability in the invoice currency's units using the exchange rate decomposition (15) on dominant-priced goods. Controlling for $\Delta e$(Partner/\$) identifies a uniform euro depreciation event, because I am keeping fixed partner-dollar currency values for all currencies except the euro. Controlling for $\Delta e$(€/Partner) identifies a uniform dollar depreciation. Controlling for $\Delta e$(€/\$) identifies a uniform partner currency depreciation. If dominant-priced goods are stable in dollar terms, only uniform euro and dollar depreciation events should affect euro-converted prices. If partners' currencies depreciations affect euro prices, either prices are unstable in dollar terms or unobserved price drivers correlate with the partner's currency value. The table confirms that only euro and dollar depreciation events generate valuation effects in dollar-invoiced prices. This is a consequence of price stability of dollar-priced goods in dollar terms. The results also confirm invoice currency price stability because euro-priced goods are virtually unresponsive to any kind of depreciation event. Partner invoiced goods are sensitive only to euro and partner currency depreciations.

Table I.5: Yearly Differential Sensitivities to a 1% Euro Depreciation

| | **Exports** | | | **Imports** | | |
|---|---|---|---|---|---|---|
| | $\Delta$ Price$^{€}$ | $\Delta$ Volume | $\Delta$ Value$^{€}$ | $\Delta$ Price$^{€}$ | $\Delta$ Volume | $\Delta$ Value$^{€}$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta e$(€/ Partn.) | 0.062$^{***}$ | 0.250$^{***}$ | 0.318$^{***}$ | 0.160$^{***}$ | $-0.038$ | 0.167 |
| | (0.022) | (0.080) | (0.082) | (0.043) | (0.130) | (0.169) |
| Partner $\times \Delta e$(€/ Partn.) | 0.608$^{***}$ | $-0.328^{***}$ | 0.212 | 0.676$^{***}$ | $-0.010$ | 0.716$^{***}$ |
| | (0.055) | (0.118) | (0.133) | (0.075) | (0.140) | (0.190) |
| Dominant $\times \Delta e$(€/ Partn.) | 0.696$^{***}$ | $-0.285^{**}$ | 0.328$^{***}$ | 0.606$^{***}$ | $-0.056$ | 0.627$^{***}$ |
| | (0.045) | (0.123) | (0.122) | (0.048) | (0.130) | (0.183) |
| Observations | 1,676,714 | 1,576,524 | 1,967,619 | 1,083,267 | 1,006,145 | 1,374,880 |
| $R^2$ | 0.368 | 0.353 | 0.326 | 0.425 | 0.403 | 0.360 |

*Note*: Benchmark transaction-level sensitivity estimation, computed as a difference from euro-priced sensitivities. The specification to estimate this table is:

$$\Delta y_{jt} = \sum_l \tilde{\beta}_l \cdot \Delta e^{€/p}_{t-l} + \tilde{\beta}^P_l \, D^P_j \cdot \Delta e^{€/p}_{t-l} + \tilde{\beta}^D_l \, D^D_j \cdot \Delta e^{€/\$}_{t-l} + \tilde{\gamma}^D_l \, D^D_j \cdot \Delta e^{\$/p}_{t-l} + \phi x_{jt} + \alpha_j + \delta_t + \epsilon_{jt}$$

Where the lags $l \in \{0, 1\}$ and the table only shows the contemporaneous effects. Controls include partern country GDP growth and CPI inflation, product and year $\times \Delta$ fixed effects. A product is defined as a unique combination of 8-digit industry code-firm identifier-partner country-invoice currency. The sample includes all yearly extra-EU transactions from 2011 to 2017. Standard errors clustered by year $\times$ country.

Table I.6: Extension of Product-level and Firm-level Pass-through estimates

| | *Dependent variable:* $\Delta$ Value$^{€}$ | | | | | |
|---|---|---|---|---|---|---|
| | **Non-weighted** | | **Weight Within-Firm** | | **Core Firm $\Delta$Value** | |
| | Exports | Imports | Exports | Imports | Exports | Imports |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta$ Euro-weighted | 0.379$^{***}$ | 0.004 | 0.500$^{***}$ | 0.021 | 0.456$^{***}$ | $-0.111$ |
| | (0.036) | (0.131) | (0.109) | (0.137) | (0.098) | (0.163) |
| $\Delta$ Partner-weighted | 0.930$^{***}$ | 1.084$^{***}$ | 1.041$^{***}$ | 1.025$^{***}$ | 1.011$^{***}$ | 1.124$^{***}$ |
| | (0.171) | (0.122) | (0.140) | (0.115) | (0.250) | (0.153) |
| $\Delta$ Dominant-weighted | 0.780$^{***}$ | 0.606$^{***}$ | 0.841$^{***}$ | 0.590$^{***}$ | 0.682 | 0.642$^{***}$ |
| | (0.097) | (0.120) | (0.136) | (0.179) | (0.513) | (0.229) |
| Observations | 1,270,192 | 551,481 | 1,270,192 | 551,481 | 183,496 | 128,527 |
| $R^2$ | 0.075 | 0.080 | 0.068 | 0.067 | 0.043 | 0.046 |

*Note*: This table shows the stability of exchange rate sensitivity estimates when aggregating the dataset from the product-level to the firm-level. This table helps excluding heterogeneity or aggregating effects as causes for the loss of firm-level sensitivity observed in Table E.1, in the main text. Columns 1 and 2 replicate the product-level estimation in Columns 1 and 2 of Table E.1. The dependent variable for Columns 1 and 2 is defined as the log-difference between year $t$ and the period of the last transaction of the product value. A product is defined as a unique combination of 6-digit industry code-firm identifier-partner country. All variables winsorized yearly at the 1st and 99th percentile. The covariates are product-level invoice-weighted indices, as defined in the Glossary. Columns 3–4 run exactly the same specification in columns 1–2, with weights representing the relative average size of the product within each firm total gross value. Columns 5–6 run exactly the same estimation in Columns 3–4 of Table E.1, except that the total firm-level percentage change in trade value is computed only considering *core* products. That is the products that are actively transacted from 2000 to 2016, and constitute the activities used to compute the firm-level invoice-weighted indices. Controls include trade-weighted indices of partner country GDP, and inflation, product, firm, and year fixed effects. Standard errors clustered by year $\times$ country for columns 1–4, and double clustered by year and firm in Columns 5–6.

Table I.7: Stability to Fixed Effects Inclusion for Dominant-weighted Index

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| ***Cash Flows*** | | | | | | |
| Dominant-weighted | 1.449* | 0.245* | 0.532*** | 0.478*** | 0.442*** | 0.447*** |
| | (0.770) | (0.128) | (0.149) | (0.138) | (0.128) | (0.132) |
| Observations | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 |
| $R^2$ | 0.012 | 0.581 | 0.653 | 0.656 | 0.658 | 0.659 |
| ***Tangible Capital Expenditure*** | | | | | | |
| Dominant-weighted | 0.057*** | 0.043** | 0.049*** | 0.036*** | 0.032*** | 0.033*** |
| | (0.021) | (0.019) | (0.016) | (0.012) | (0.010) | (0.011) |
| Observations | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 |
| $R^2$ | 0.002 | 0.011 | 0.114 | 0.121 | 0.125 | 0.127 |
| ***Tangible Acquisitions*** | | | | | | |
| Dominant-weighted | 0.067** | 0.043** | 0.049*** | 0.034*** | 0.030*** | 0.031*** |
| | (0.026) | (0.017) | (0.014) | (0.010) | (0.009) | (0.009) |
| Observations | 214,865 | 214,865 | 214,865 | 214,865 | 214,865 | 214,865 |
| $R^2$ | 0.003 | 0.059 | 0.197 | 0.209 | 0.211 | 0.213 |
| ***Salaries*** | | | | | | |
| Dominant-weighted | 0.835 | -0.019 | 0.162*** | 0.134** | 0.127** | 0.129** |
| | (0.595) | (0.016) | (0.056) | (0.053) | (0.051) | (0.052) |
| Observations | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 | 250,734 |
| $R^2$ | 0.004 | 0.797 | 0.835 | 0.836 | 0.836 | 0.837 |
| ***Employment*** | | | | | | |
| Dominant-weighted | 0.135* | 0.199*** | 0.223*** | 0.159*** | 0.131*** | 0.163*** |
| | (0.079) | (0.069) | (0.067) | (0.030) | (0.019) | (0.024) |
| Observations | 217,325 | 217,325 | 217,325 | 217,325 | 217,325 | 217,325 |
| $R^2$ | 0.000 | 0.020 | 0.130 | 0.148 | 0.156 | 0.159 |
| Std Controls | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Firm | | | ✓ | ✓ | ✓ | ✓ |
| Year | | | | ✓ | ✓ | ✓ |
| Industry × Year | | | | | ✓ | ✓ |
| Trade × Year | | | | | | ✓ |

*Note*: Stability of dominant-weighted invoice valuation effects to incremental inclusion of controls. The specification follows the one in equation (8). Column 1 has no controls at all except an intercept and the contemporaneous invoice-weighted indices defined in equations (4)-(7). Column 2 includes as controls the lagged dependent variable, lagged productivity, and lagged sales growth. Column 3 adds firm identifier fixed effects. Column 4 adds year fixed effects. Column 5 adds 3-digit industry code-by-year fixed effects. Column 6 adds trade exposure in all countries-by-time fixed effects. I show only the coefficient of the dominant-weighted index. All variables are normalized by total capital stock at the beginning of the period, except the effects on employment which are normalized by the total number of employees and divided by 100,000. The coefficients on cash flows, tangible capital expenditure, tangible capital acquisition, and salaris are interpreted as euro on euro. The coefficient on employment is interpreted as $\beta^D$ new employees after €100,000 of invoice valuation income. All variables are winsorized at the 1st and 99th percentile. Standard errors in parenthesis are double clustered by firm identifier and year.

Table I.8: Liquidity of All French Public Companies vs. Public Companies in my Sample

| | **All Public Companies** | | | **Public Companies in the Sample** | | |
|---|---|---|---|---|---|---|
| | Mean | Median | Std Dev. | Mean | Median | Std Dev. |
| Cash Flow | 80.74 | 1.17 | 322.77 | 627.35 | 64.05 | 937.31 |
| Assets | 2012.37 | 38.65 | 6206.32 | 7507.89 | 697.67 | 11793.78 |
| Capital | 689.70 | 27.43 | 2663.98 | 4624.42 | 523.62 | 7091.54 |
| Sales Growth | 0.09 | 0.06 | 0.25 | 0.05 | 0.04 | 0.17 |
| Cash Flow over Assets | -0.00 | 0.05 | 0.17 | 0.08 | 0.09 | 0.09 |
| Cash over Assets | 0.15 | 0.10 | 0.16 | 0.11 | 0.09 | 0.09 |
| Dividends over Assets | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 |
| Debt over Equity | 0.68 | 0.35 | 0.84 | 0.72 | 0.55 | 0.66 |
| Cash Flow over Interest Expense | 12.93 | 5.63 | 74.64 | 25.93 | 10.40 | 52.17 |
| Z-score | 2.20 | 1.88 | 2.16 | 2.42 | 2.12 | 1.46 |
| Tobin Q | 1.75 | 1.21 | 1.43 | 1.44 | 1.17 | 0.94 |

*Note*: Descriptive statistics comparing liquidity of all French public companies and public companies in the sample used for this paper. The scope of this table is to verify that the largest companies in the sample of interest are more liquid than the average public company included in other studies. This provides an explanation behind the lack of significant pass-through of invoice valuations into real variables of the largest firms in the sample. The source of the data is S&P Capital IQ, which include publicly available information on the financials of several public and private companies. All financials in this company correspond to the consolidated financials of either all French public companies or the financials of the public ultimate parent of companies included in the sample of this paper. I follow the Capital IQ definition of the country of residence of each ultimate parent. This assignment does not necessarily correspond to the country of incorporation or the country where the headquarters are. Cash flows, assets, and capital are in million euros and all statistics are computed from firm-by-year level data in the sample 2004-2016. All variables are winsorized at the 1st and 99th percentile.

Table I.9: Firm-level Pass-through Replication on S&P Capital-IQ Sample

| | **Cash Flows** | **Long-term Investments** | **Salaries** |
|---|---|---|---|
| | (1) | (2) | (3) |
| ***Panel A - Subsidiary Level*** | | | |
| Dominant-Pricing | 0.515** | 0.044 | 0.110 |
| | (0.167) | (0.050) | (0.162) |
| Observations | 19,644 | 15,766 | 16,319 |
| $R^2$ | 0.712 | 0.195 | 0.884 |
| ***Panel B - Subsidiary Country*** | | | |
| Dominant-Pricing x Foreign | 0.888 | -0.004 | 1.248 |
| | (0.983) | (0.844) | (1.127) |
| Dominant-Pricing x French | 0.507** | 0.051 | 0.050 |
| | (0.166) | (0.049) | (0.149) |
| Observations | 19,644 | 15,766 | 16,319 |
| $R^2$ | 0.712 | 0.196 | 0.884 |
| ***Panel C - Ultimate Parent Country*** | | | |
| Dominant-Pricing x Foreign Parent | 0.469 | 0.016 | 0.252 |
| | (0.337) | (0.095) | (0.322) |
| Dominant-Pricing x French Parent | 0.535** | 0.056 | 0.053 |
| | (0.227) | (0.063) | (0.140) |
| Observations | 19,644 | 15,766 | 16,319 |
| $R^2$ | 0.712 | 0.195 | 0.884 |
| ***Panel D - Consolidated Ultimate Parent*** | | | |
| Dominant-Pricing | 0.643 | 0.080 | 0.214 |
| | (0.411) | (0.175) | (0.199) |
| Observations | 10,850 | 9,988 | 10,137 |
| $R^2$ | 0.665 | 0.868 | 0.894 |

*Note*: Replication of the firm-level pass-through estimation of €1 dominant-priced income on the sample of French firms included in S&P Capital IQ. The specification follows the one in equation (8). I match by name all the companies included in the S&P Capital IQ database with the firms included in the customs dataset. The match includes 1796 companies in the Capital IQ sample with full financial data in each year between 2004 and 2017. Beside being able to compare the benchmark results with a secondary external source, this exercise allows me to split the sample between companies with foreign vs. French ultimate parent, and to estimate invoice valuation pass-through at the consolidated budget level of each company's ultimate parent (information not present in FARE, FICUS or LIFI). Panel A replicates the benchmark average results at the level of each matched private company or subsidiary. Panel B investigate heterogeneous effects by country of residence assigned to each Capital IQ firm in the sample. Panel C investigate heterogeneous effects by country of residence assigned to the ultimate parent of each firm in the sample. Panel D runs the regression at the consolidated level of the ultimate parent of each trading firms in France, when the ultimate parent is French. In case of multiple subsidiaries owned by the same ultimate parent, I aggregate the invoice exposure at the level of the ultimate parent. While the estimates are more noisy due to shorter time span and absence of small domestic-oriented companies, the point estimates are virtually the same as the benchmark results. Cash Flows are defined as EBITDA. Long term investment are used as proxy for tangible CAPEX because the latter variable has poor coverage in Capital IQ for private firms. All variables are winsorized at the 1st and 99th percentile. Standard errors in parenthesis are double clustered by firm identifier and year.

Table I.10: Partial Equilibrium Aggregate Valuation Effects of a 10% Euro Depreciation

| | $\Delta$ **Cash Flows** | $\Delta$ **Tangible Expenditure** | $\Delta$ **Salaries** |
|---|---|---|---|
| **Average Estimates of Euro, Partner, and Dominant Effects** | | | |
| Exporters | 1.62% | 0.73% | 1.03% |
| Domestic-oriented | -1.60% | -0.59% | -0.84% |
| All | 0.01% | 0.14% | 0.19% |
| **Valuation Effects of Heterogeneous Estimates** | | | |
| Exporters | 2.02% | 0.98% | -0.25% |
| Domestic-oriented | -1.00% | -0.13% | -0.09% |
| All | 1.02% | 0.85% | -0.34% |
| **Valuation Effects of Significant Heterogeneous Estimates** | | | |
| Exporters | 2.02% | 0.00% | 0.00% |
| Domestic-oriented | -1.00% | 0.00% | 0.00% |
| All | 1.02% | 0.00% | 0.00% |

*Note*: The first set of estimates represent the aggregate effects of euro-, partner-, and dominant- weighted exchange rates, taking as a reference the estimates in column (3), (6), and (9) of Table 6. To simulate one standard deviation shock to all currencies I exploit the variance-covariance structure of bilateral exchange rates between 2000 and 2016. I order all bilateral exchange rates by size of trade in the country's currency and then I apply a Cholesnky decomposition on the estimated covariance matrix. I then use the structure of the Cholesnky coefficient to simulate a standard deviation shock to all variables, which in turns triggers cross sectional instantaneous correlations. I then multiply the average (2011-2017) traded amount by firm $f$ invoiced in one of the three pricing regimes, by the simulated exchange rate depreciation, the relevant firm-level pass-through estimate, and the inverse of the total amount of the variable of interest at the beginning of the sample. This way, the effect is interpretable as marginal percentage change of total cash flows, investment, and payroll of French firms trading outside the European Union. The formula for the computation of the first set of results is:

$$\text{Overall Macro Impact} = \sum_f \sum_c (V_f^{€} \Delta e^{€/c} \beta^{€} + V_f^c \Delta e^{€/c} \beta^c + V_f^D \Delta e^{€/\$} \beta^D + V_f^D \Delta e^{c/\$} \beta^{D_c}) \cdot \frac{1}{\text{Tot}_y}$$

The second and third set of results only take into account the valuation effect generated by a 10% Euro depreciation on dominant-priced exposure. However, it exploits the heterogeneous effects shown in Figure 4 to compute the aggregate effects. In other words, I multiply the average trade invoiced in dominant invoicing by the estimate relative to the size-specific and type-specific bin that each firm belongs too. The third set of estimates differs from the second set only by zeroing the effects of those coefficients that are not significant. Note that because the real effects on large firms are not significant, and large firms drive most movements in aggregate trade, investment, and employment, the aggregate effects are virtually zero in the third estimate.

Table I.11: Extensive Margin Response to Depreciation - Probit Estimation

| | **Exports** | | **Imports** | |
|---|---|---|---|---|
| | Entry | Exit | Entry | Exit |
| | (1) | (2) | (3) | (4) |
| Euro $\times \Delta e$(€/ Partn.) | 0.014$^{***}$ | -0.034 | -0.034$^{***}$ | 0.004 |
| | (0.003) | (0.025) | (0.005) | (0.014) |
| Dominant $\times \Delta e$(€/ \$) | 0.040$^{***}$ | -0.051 | 0.058$^{***}$ | -0.040 |
| | (0.007) | (0.041) | (0.007) | (0.035) |
| Dominant $\times \Delta e$(Partn. / \$) | -0.015$^{**}$ | 0.056 | 0.126$^{***}$ | 0.018 |
| | (0.007) | (0.045) | (0.013) | (0.022) |
| Observations | 15.5M | 2.4M | 11.5M | 1.5M |

*Note*: Replication of Table 10 with Probit estimation and reported as average marginal effects. This table studies the extensive margin response to a euro depreciation from 2011 to 2017. I show the estimates of a Probit model for product entry $\mathbb{P}(\text{Entered}_t = 1 \,|\, \text{Entered}_{t-1} = 0)$, or exit $\mathbb{P}(\text{Entered}_t = 0 \,|\, \text{Entered}_{t-1} = 1)$ in the extra-EU trading market. A product is defined as a unique combination of firm identifier-8-digit industry code-country-invoice currency. I estimate separate probability of entry and exit for dominant-priced and euro-priced products. Partner-pricing cannot be estimated due to the low rates of entry and exit observed for this pricing regime. Controls include partner country GDP and CPI inflation, with product, and year fixed effects. Standard errors clustered by year.

Table I.12: Extensive Margin Response to Depreciation of Highly-Exposed Firms

| | Exports | | Imports | |
|---|---|---|---|---|
| | Entry | Exit | Entry | Exit |
| | (1) | (2) | (3) | (4) |
| Euro × Exporter × Low Exposure $\times\Delta e$(€/ Partn.) | -0.014 | 0.002 | | |
| | (0.044) | (0.003) | | |
| Euro × Exporter × Mid Exposure $\times\Delta e$(€/ Partn.) | 0.020 | 0.001 | | |
| | (0.039) | (0.002) | | |
| Euro × Exporter × High Exposure $\times\Delta e$(€/ Partn.) | 0.031 | -0.003 | | |
| | (0.044) | (0.003) | | |
| Dominant × Exporter × Low Exposure $\times\Delta e$(€/ \$) | 0.009 | 0.012 | | |
| | (0.196) | (0.019) | | |
| Dominant × Exporter × Mid Exposure $\times\Delta e$(€/ \$) | -0.009 | 0.011 | | |
| | (0.101) | (0.007) | | |
| Dominant × Exporter × High Exposure $\times\Delta e$(€/ \$) | -0.058 | 0.001 | | |
| | (0.107) | (0.005) | | |
| Euro × Dom.-oriented × Low Exposure $\times\Delta e$(€/ Partn.) | | | -0.089 | 0.002 |
| | | | (0.203) | (0.002) |
| Euro × Dom.-oriented × Mid Exposure $\times\Delta e$(€/ Partn.) | | | 0.098 | 0.006 |
| | | | (0.184) | (0.004) |
| Euro × Dom.-oriented × High Exposure $\times\Delta e$(€/ Partn.) | | | 0.159 | 0.001 |
| | | | (0.178) | (0.002) |
| Dominant × Dom.-oriented × Low Exposure $\times\Delta e$(€/ \$) | | | 0.220 | -0.002 |
| | | | (0.200) | (0.005) |
| Dominant × Dom.-oriented × Mid Exposure $\times\Delta e$(€/ \$) | | | 0.212 | -0.001 |
| | | | (0.194) | (0.003) |
| Dominant × Dom.-oriented × High Exposure $\times\Delta e$(€/ \$) | | | 0.187 | 0.0000 |
| | | | (0.202) | (0.003) |
| Observations | 3.5M | 2.8M | 2.2M | 1.7M |
| $R^2$ | 0.905 | 0.697 | 0.901 | 0.711 |

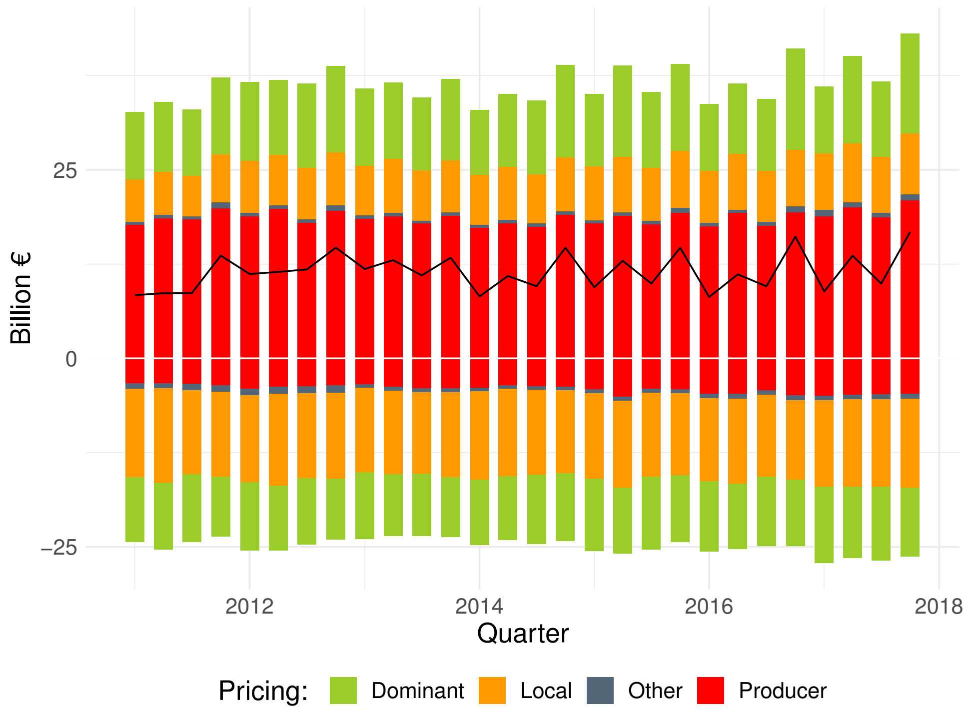
*Note*: Study of heterogeneous extensive margin response to depreciations. This Table tests whether different firms have heterogeneous product-level extensive margin response after depreciations. The firm-level heterogeneities under investigation are the status of a firm as an exporter or importer, and whether the firm is highly exposed to operations invoiced in dollars. Exporter and domestic-oriented firms are assigned to the three quantile bins of exposures according to their 2011 dominant-priced exposure over gross trade. Controls include partner-dollar depreciations for dominant-priced goods, GDP and CPI growth of partner countries, product and year fixed effects. A product is defined as a unique combination of 8-digit industry code-firm identifier-partner country-invoice currency. Standard errors clustered by year × country. The aim of this analysis is understanding whether the firm-level sensitivities to dollar appreciations may be biased by unobserved extensive margin responses. For instance, if highly dollar exposed firms respond more than others to dollar depreciations by entering new markets (and thus boosting their investments) there is an unobserved pattern violating the exclusion restriction. None of the coefficients are significantly different from zero. The magnitude of the coefficients suggest that, if anything, there may be a downward bias on exporter firms estimates. For domestic-oriented firms there is no clear differential entry or exit rate after dollar depreciations.

Table I.13: Transaction Sensitivity Robustness to Currency Switches

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | $\Delta$Price$^{€}$ | $\Delta$Volume | $\Delta$Value$^{€}$ | $\Delta$Price$^{€}$ | $\Delta$Volume | $\Delta$Value$^{€}$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\Delta$ Euro-weighted | 0.026 | 0.201$^{***}$ | 0.208$^{***}$ | 0.136$^{***}$ | -0.037 | 0.088 |
| | (0.021) | (0.060) | (0.072) | (0.040) | (0.105) | (0.125) |
| $\Delta$ Partner-weighted | 0.517$^{***}$ | 0.027 | 0.459$^{***}$ | 0.798$^{***}$ | -0.207$^{*}$ | 0.668$^{***}$ |
| | (0.066) | (0.142) | (0.151) | (0.062) | (0.124) | (0.159) |
| $\Delta$ Dominant-weighted $\times e$(€/ \$) | 0.589$^{***}$ | 0.077 | 0.742$^{***}$ | 0.674$^{***}$ | -0.158 | 0.550$^{***}$ |
| | (0.053) | (0.111) | (0.124) | (0.052) | (0.119) | (0.152) |
| $\Delta$ Dominant-weighted $\times e$(Partn. / \$) | -0.144$^{***}$ | -0.129 | -0.272$^{***}$ | -0.143$^{***}$ | 0.172$^{**}$ | -0.004 |
| | (0.036) | (0.087) | (0.095) | (0.046) | (0.086) | (0.088) |
| Observations | 1.7M | 1.6M | 2M | 1M | 941K | 1.3M |
| $R^2$ | 0.235 | 0.226 | 0.213 | 0.295 | 0.290 | 0.237 |

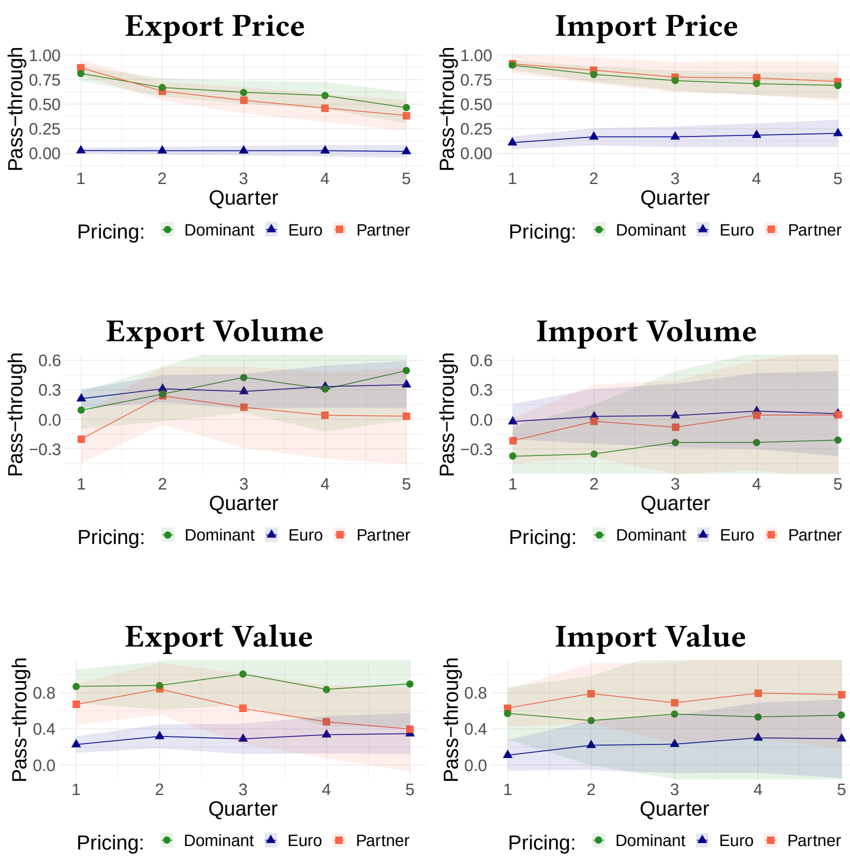
*Note*: This Table shows the exchange rate transaction sensitivity estimates conditional on each product's 2011 initial invoice currency. The estimates show only marginal differences from the benchmark Table 3. This confirms that keeping fixed each product's invoice currency in specification (1) does not introduce any significant attrition bias. In particular, the main evidence of higher sensitivity of dominant-priced products with respect to euro-priced products, remains robust. A product is defined as a unique combination of 6-digit industry code-firm identifier-partner country. The euro-, partner-, and dominant-weighted indices for the estimations are defined at the product-level and they are akin to an exchange rate shock interacted by a dummy for euro-pricing, partner-pricing or dominant-pricing. The definition of the invoice-weighted indices follows the one specified in the Glossary, except that each product's invoice share is kept fixed at its 2011 value. The sample includes all French manufacturing products traded between 2011 to 2017 outside of the European Union. The specification follows equation (1). The sample is Winsorized at the 1st and 99th percentile. Standard errors clustered by year $\times$ country.

Figure I.2: Extra-EU French Trade in Manufacturing by PCP, LCP,and DCP Decomposition



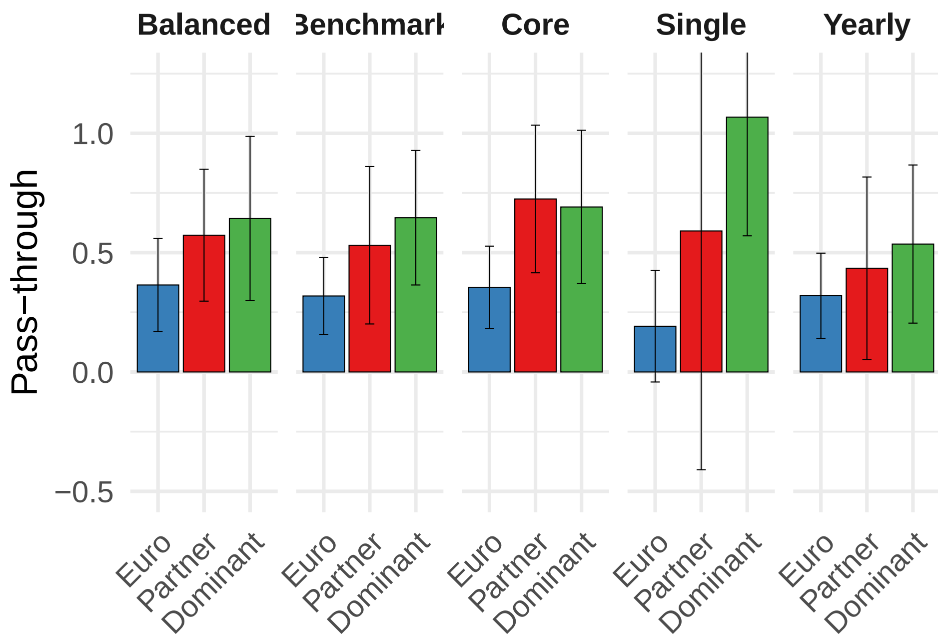

*Note*: Quarterly pricing composition of extra-EU French trade in manufacturing from 2011 to 2017. Positive values represent exports, negative values represent imports. The black line represents net nominal trade in manufacturing. Producer currency pricing represents all transactions invoiced in the currency of the producer (euro for French exports, and partner currency for imports). Local currency represents all transactions invoiced in the currency of the customer (euro for French imports, and partner currency for exports). Dominant currency represents all transactions invoiced in US dollars when the trading partner is not the United States. Other transactions represent all those cases in which a vehicular currency different from the dollar is used.

Figure I.3: Quarterly Impulse Response Pass-through of a 1% Euro Depreciation

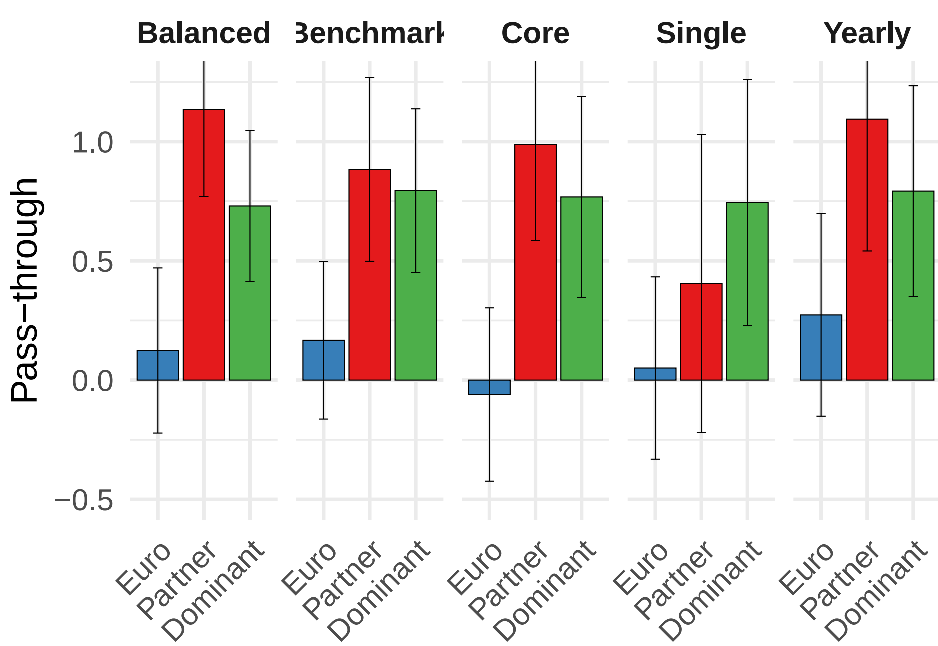



*Note*: This figure replicates estimation (1) at a quarterly frequency. It represents the cumulated quarterly response of changes in prices (in euros), volumes, and values (in euros) after a 1% euro depreciation. 95 % confidence intervals computed from standard errors clustered by year × country.

**Samples - Exports**

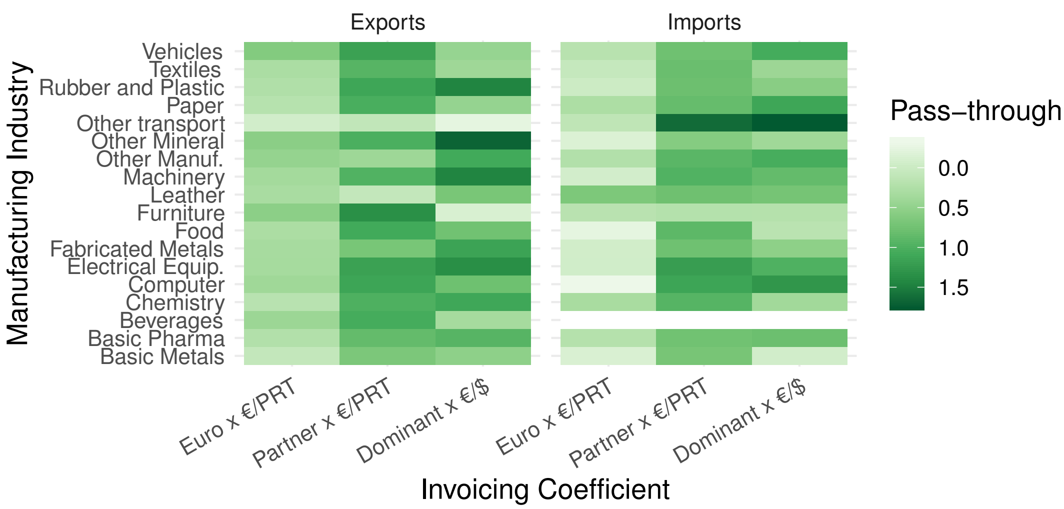



**Samples - Imports**



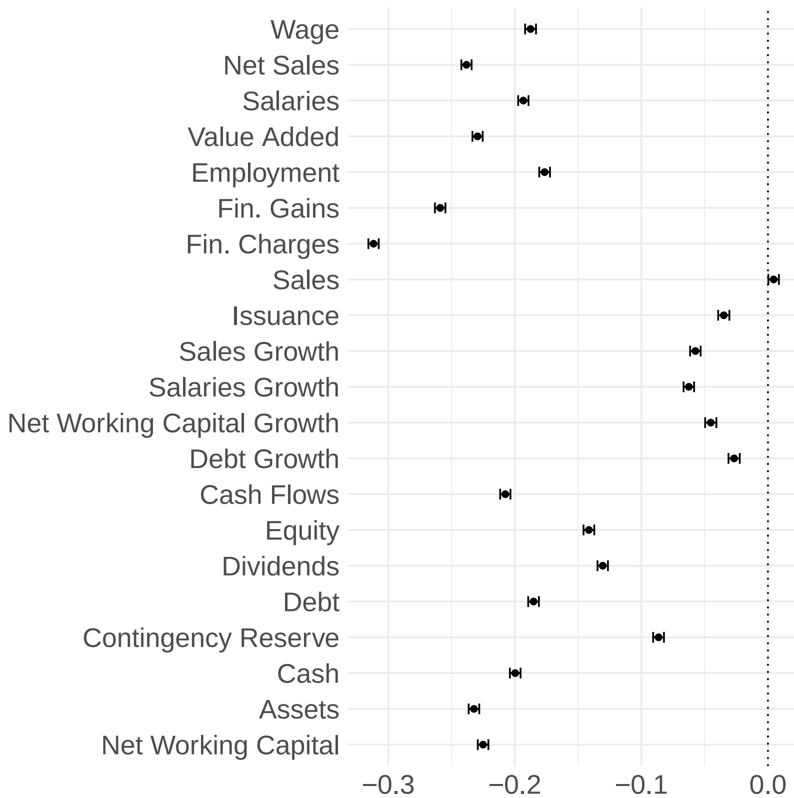

*Note*: Robustness of transaction-level sensitivity results to different definitions of the product sample. I show the main sensitivity estimates for euro-priced products, partner-priced products, and dominant-priced products. All controls are exactly the same as in Table 3. The *Balanced* sample considers only those products transacted every single year. The *Benchmark* sample corresponds to the benchmark estimates. The *core* sample considers only the largest (in terms of value) product that each firm sells or buys in a particular location (definition similar to Berman et al. (2012)). The *Single* samples considers only those 8-digit industry code that are uniquely sold or bought in a location (definition similar to Berman et al. (2012)). The *Yearly* sample considers only transaction lengths $\Delta$ of 1 year. 95% confidence intervals computed from clustered standard errors by year $\times$ country.

Figure I.5: Value Pass-through by Manufacturing Industry




*Note*: Transaction value sensitivities computed as in specification (1) from separate regressions of 2-digit manufacturing industry codes. The figure shows that dollar and partner-priced products are more sensitive to euro-priced products almost across all industries.

Figure I.6: Cross-sectional Dominant-pricing Exposure Correlations




*Note*: Cross sectional correlation of dollar-pricing exposure and average balance sheet variables of each firm in the balanced firm-level sample. The dollar-pricing exposure is computed as imputed net dominant-pricing exposure in 2000 over total capital stock net of depreciation in 2000. The average balance sheet variables are computed in the period 2000 to 2016.