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Invoicing Currency and Financial Hedging*

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Abstract

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Keywords: Currency choice, Hedging, Survey data
JEL classification: F31, F41, G32

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1 Introduction

This paper investigates the link between the choice of an invoicing currency and exchange rate risk management by exporting firms. We find large firms are more likely to use hedging instruments against exchange rate fluctuations, and to invoice their exports in a foreign currency. We also present suggestive evidence that access to financial hedging increases the probability a firm exports in a foreign currency. We develop a general framework of currency choice with hedging consistent with these empirical findings. Under plausible conditions, some large firms that would have chosen to price in their own currency in the absence of hedging instruments choose to price in a foreign currency if they have access to such instruments.

The currency denomination of exports is the topic of a large literature in international macroeconomics starting from Betts & Devereux (1996). Whether firms price their exports in their own or in a foreign currency has key implications for the international transmission of shocks, the optimal monetary policy or the choice of an exchange rate regime.[1] Although the literature has studied several determinants of the currency denomination of exports such as the curvature of the demand function, the extent of price rigidities, or the structure of costs (see Burstein & Gopinath 2014, for a survey), the possibility of firms hedging against exchange rate risk has been neglected.[2]

Risk management, including foreign exchange risk, ranks among the most important objectives of firms' financial executives.[3,4] In 2016, daily trading in foreign exchange markets averaged $5.1 trillion (BIS 2016). The volume of trade in hedging instruments has strongly increased over the past decades, with firms accounting for most of this increase.[5] Accounting for these financial hedging instruments is important because they provide firms with

[1] See Corsetti & Pesenti (2009), Devereux & Engel (2003), or Corsetti & Pesenti (2005) on the implications of pricing in the producer's versus the importer's currency. More recently, Gopinath et al. (2016) study the implications of choosing a vehicule currency such as the dollar.

[2] A notable exception is Friberg (1998).

[3] Empirical studies document significant effects of exchange rate changes on firm cash flows, sales, and competitive positions in product markets (see, e.g., Hung 1992, Williamson 2001). See also Rawls & Smithson (1990) and Brealey & Myers (1981) for earlier studies.

[4] Hedging instruments such as forwards, futures, swaps, and options are prominent tools for managing such risks, used by 94% of the world's largest corporations (Nance et al. 1993, ISDA 2009).

[5] See `http://www.bis.org/statistics/about_derivatives_stats.htm`, and Stulz (2004) for a discussion.

the opportunity to price their exports in foreign currency without bearing the risk associated with such pricing strategy. From both an empirical and theoretical viewpoint, we study how hedging and the currency denomination of exports interact.

On the empirical side, we exploit survey data collected in 2010 on almost 15,000 firms located in the European Union. We restrict our attention to about 3,000 firms located in five eurozone countries that export outside of the euro area and thus face exchange rate risks. In this sample, we study the relationship between currency choice decisions and the use of hedging instruments. Whereas the recent empirical literature has extensively discussed the determinants of currency choices by exporting firms, a unique feature of this survey is to document firms' currency choices *and* their use of specific hedging instruments, such as derivatives. We use this information to investigate the interplay between hedging and invoice currency decisions.

Firms in the survey are asked whether they set their prices in euros or in another currency when exporting to foreign countries.[6] If firms set their prices in euro, they do producer currency pricing (PCP). If they don't, they either price in the currency of the trade partner (local currency pricing, LCP) or in a vehicle currency. The empirical results are thus about the use of the euro versus a foreign currency. In the theoretical section, we consider PCP and LCP strategies, and we discuss how the theoretical results generalize in presence of vehicle currency pricing (Goldberg & Tille 2008) or dominant currency pricing (Gopinath et al. 2016).

In our data, PCP is the main strategy used by the firms. Although around 90% of exporters declare pricing in euros when exporting outside of the EMU, only about 75% of the value of exports are priced in euros, because large exporters are more likely to price in another currency. Such heterogeneity is consistent with Goldberg & Tille (2016), who interpret the link between the currency of invoicing and the size of the transaction as a consequence of currency choices being influenced by the consumer's bargaining power. We further document that hedging instruments are mainly used by the largest firms, and that the prevalence of hedging is stronger among firms pricing in currencies other than the euro. Probit regressions reveal that firms using financial hedging are more likely to price in a foreign currency, controlling

[6]Unfortunately, the survey does not collect information on the currency denomination of exports, by destination country. We restrict the sample to firms that do export in non-euro countries, which are likely to report the currency denomination of their sales outside of the euro area. We also use a more restricted sample in which firms sell at least 15% of their exports outside of the euro area, and find results to go through. Based on this finding, we are confident that exposure to exchange rate risk in export markets is a relevant concern for the subsample of firms under study.

for other determinants of currency choices. To make progress regarding the causality of this relationship, we instrument the use of financial hedging by firms with a measure of access to risk management, and find the impact of hedging on the decision to price in a foreign currency is even stronger once we control for potential endogeneity. This finding suggests that large firms are more prone to price in a foreign currency *because* they have better access to financial hedging.[7]

We rationalize these findings using a model studying firms' invoicing decisions when they have the possibility to hedge against exchange rate risk. The model generalizes the analysis in Bacchetta & van Wincoop (2005) and Burstein & Gopinath (2014) to the case in which exporters can purchase exchange rate derivatives at a cost. In a one-period-ahead sticky-price environment with exchange rate uncertainty, the choice between pricing in domestic versus a foreign currency depends on the curvature of the demand function, the extent of returns to scale, and the sensitivity of marginal costs to the exchange rate. We depart from the usual framework by (i) assuming exporters risk averse[8] and (ii) enabling them to use financial instruments to hedge against exchange rate risk.[9] Using financial instruments, the firm can set prices in the importer's currency without having to bear the associated exchange rate risk. The menu of strategies offered to exporters is thus: to price in her own or in a foreign currency and to hedge or not against exchange risk.

We study the determinants of this choice, as a function of the model's

[7]The size-hedging link is consistent with Dohring (2008), whose explanation is that hedging involves a fixed cost that large firms are more prone to pay. Our theoretical framework relies on the same argument. The result is also consistent with evidence in the finance literature that large firms hedge whereas small firms often do not conduct active risk management (see, e.g., Nance et al. 1993, Geczy et al. 1997, Rampini & Viswanathan 2013).

[8]According to the Modigliani and Miller theorem, risk management is irrelevant to the firm. Similarly, absent risk aversion, an exporter would not hedge exchange rate risk in equilibrium. However, Graham & Smith (2000), Graham & Harvey (2001), Graham & Rogers (2002*a*) provide empirical evidence that firm managers actively manage risks. Therefore, we depart from the Modigliani and Miller assumptions by modeling exporters' risk aversion as an outgrowth of managers' risk aversion (Stulz 1984). Exporters' risk aversion could also be due to convex tax schedules, or expected costs of financial distress (Smith & Stulz 1985). We discuss in Section 3.2 other rationales that can explain why firms optimally manage their risks, and argue they would not change our model's predictions.

[9]In our model, we allow the marginal production cost to depend on exchange rates, which can be a source of *operational* hedging against exchange rate fluctuations. However, we focus our analysis on *financial* hedging (i.e., using derivatives), which we implicitly assume to be the best hedging device. Indeed, financial hedging is cheaper than trying to borrow in the foreign currency or to accommodate exchange rate fluctuations by adjusting operational hedging continuously.

primitives. More specifically, we show the framework can provide theoretical grounds for the two facts uncovered in the empirical analysis. First, conditional on a currency choice, large firms are more likely to hedge against exchange rate risk. In our framework, this result rests on the assumption that a fixed component is present in the cost of hedging. The presence of a fixed cost is consistent with Niepmann & Schmidt-Eisenlohr (2014), who find that heterogeneity in firms' use of trade finance products is explained by substantial fixed costs, the latter reflecting the fees that banks charge on those products. Alternatively, we argue that a similar outcome could arise endogenously in the absence of fixed costs if small firms were more financially constrained as in Rampini & Viswanathan (2013). The fixed component can thus be viewed as a shortcut for this type of mechanism. In this simple framework, we can show analytically that the size threshold above which firms choose to hedge is higher for firms pricing in their own currency. These results are thus consistent with evidence that large firms are more likely to hedge, and that hedging is more prevalent among firms pricing in a foreign currency.

Our model can also account for the causal effect of hedging on currency invoicing. Namely, we show that some firms that would otherwise price in their own currency choose to price in a foreign currency and to hedge against exchange rate risk if they have access to hedging instruments. Large and more risk-averse firms are the most likely to switch from producer to foreign-currency pricing in this context. This finding is in line with our empirical finding that the access to hedging instruments is a significant determinant of exporters' invoicing-currency decisions.

Our paper contributes to the literature on the determinants of invoicing-currency choices. Within this literature, the heterogeneity in invoicing currency decisions along the distribution of firms' size is now well established. Goldberg & Tille (2016) find the invoicing currency depends on (i) macro determinants such as exchange rate volatility, (ii) product-level determinants such as market structure and product differentiation, and (iii) transaction-specific factors, namely, the size of the transaction. Devereux et al. (2017) also show evidence of the currency of invoicing being heterogeneous along the distribution of exporters' and importers' size. Finally, Amiti et al. (2019) show that large Belgian exporters are more likely to invoice exports outside the eurozone in a foreign currency. In comparison with these papers, our survey data do not allow for a structural analysis of the determinants of currency choices. Nevertheless, we are able to formally link currency choices with the use of hedging instruments at the firm level. The use of survey data is common in the literature. Using a survey on Swedish exporters, Friberg & Wilander (2008) show that a bargain between the seller and the buyer

determines the invoicing currency. Ito et al. (2016) use a survey of Japanese firms to document the correlation between firms' exchange rate exposure and their risk management strategy. They find the exposure to the YEN/USD exchange rate is positively correlated with the use of hedging instruments by Japanese firms that mainly price in USD. We make three contributions with respect to these papers. First, we are the first to document the invoicing currency of individual firms for a panel of eurozone countries. Because the euro is a vehicle currency, euro exporters mostly have to choose between pricing in euros or pricing in the importer's currency. Second, we highlight the link between firm size, financial hedging, and invoicing currency. Third, we identify a causal impact of access to hedging on the choice of the invoicing currency.

On the theoretical side, the literature has extensively examined the endogenous decision of an invoicing currency (see, e.g., Friberg 1998, Bacchetta & van Wincoop 2005, Devereux et al. 2004, Gopinath et al. 2010). Burstein & Gopinath (2014) propose a unified framework linking the different factors influencing this decision. We build on their framework and further allow firms to hedge against exchange rate risk at a cost (e.g., by using derivatives). Friberg (1998) also examines the choice of the price-setting currency in the presence of hedging options. In his setup, firms can freely access forward currency markets, returns to scale are decreasing, and marginal costs are independent of the exchange rate. In our model, we discuss firms' choice of an invoicing currency when firms can hedge against exchange rate fluctuations, under different possible assumptions for the demand and cost specifications, including when marginal costs depend on the exchange rate. We assume the use of financial instruments involves a fixed cost, which creates a link between firms' decision to use derivatives and their size.

The paper also contributes to the literature on exchange rate pass-through. Empirical differences in the choice of an invoicing currency by individual exporters relate to recent evidence on the heterogeneity in pass-through behaviors across exporters (see Berman et al. 2012, Fitzgerald & Haller 2014, Amiti et al. 2014, Auer & Schoenle 2016, Garetto 2016). These papers offer several explanations for the link between firms' size and the degree of pass-through: additive trade costs, import intensity, market power, and incomplete information. We point to an alternative mechanism linking firm size and pass-through, that involves the use of hedging instruments. As large firms are more likely to hedge against exchange risk and price in foreign currency, we expect their local prices to be only somewhat responsive to exchange rate fluctuations. This is consistent with Berman et al. (2012) and Amiti et al. (2014) but differs from Auer & Schoenle (2016), Garetto (2016), or Devereux et al. (2017), who find a U-shaped relationship between

pass-through and size.[10] Heterogeneity in invoicing currency driven by firms' decisions to hedge using financial instruments provides a complementary explanation for the heterogeneity in pass-through rates observed in the data. Compared with existing explanations put forward in the literature, ours is conceptually different because it implies the exchange rate risk is passed onto financial markets, whereas the literature has mostly discussed the identity of who is bearing the risk: the importer or the exporter. What we argue is that zero pass-through does not imply the exporter bears the risk of exchange rate fluctuations, although passing this risk onto financial markets incurs a cost.

The rest of the paper is organized as follows. Section 2 studies the link between currency choices and hedging, using survey data on European exporters. Section 3 proposes a simple model to rationalize the evidence. Section 4 concludes.

2 Empirical evidence

2.1 Data

The data consist of a survey conducted by the European Firms in a Global Economy (EFIGE) project. A representative sample of approximately 15,000 firms of more than 10 employees from 7 countries (Austria, France, Germany, Hungary, Italy, Spain, and UK) were surveyed in 2010. More than 150 items provide information on the structure of the firm, its workforce, market environment, pricing decisions, internationalization, investment, and innovation policies. Items of particular interest to us are listed in Table 1. We construct a set of firm-level control variables regarding the firm's 4-digit industry, ownership structure, turnover, the share of foreign markets in sales, the number of destination markets served, and the distribution of exports across eight areas (EU15, rest of EU, non-EU European countries, China and India, other Asian countries, USA and Canada, rest of America, and the rest of the world). We keep firms that (i) declare exporting, (ii) report an export share lower than 100%, and (iii) are located in the EMU.

We are interested in firms' risk management practices. We therefore use firms' answer to the question "How do you deal with the exchange rate risk?" to reduce our sample to firms that are exposed to exchange rate (henceforth ER) risk. As shown in Figure 1, 50% to 60% of exporters report this question is not applicable: the geography of their sales does not expose

[10] One potential explanation for the monotic relationship we uncover is that the survey does not cover enough large firms to identify the upward-sloping part of the firm size–PCP relationship.

them to such risk. Large exporters are more likely to be exposed to exchange rate risk because they are more prone to exporting outside of the EMU. As a consequence, exporters that are not exposed to ER risk represent less than 40% of aggregate sales (see the comparison of the black and grey bars in Figure 1). Once we drop firms that declare they have not been exposed to ER risk, our sample consists of 3,013 EMU firms exporting outside of the euro area and exposed to ER fluctuations. Ninety-nine of these firms are located in Austria, 770 in France, 630 in Germany, 844 in Italy, and 670 in Spain.

The use of survey data can raise concerns about sample representativeness. To address this concern, we use available information on a measure of the probability of each firm being sampled. In the EFIGE survey, firms are split into categories and firm categories are split into strata, where firms' strata are defined by country, class size (10-49, 49-249, more than 249 employees), and NACE 1-digit sector. The sample weights are computed by strata, as the ratio of the number of firms in a stratum over the number of firms in the same category in the survey. These sample weights allow us to document the behavior of the "representative firm" in each country.

We consider two alternative weighting schemes to account for potential heterogeneity in the behavior of small versus large firms. First, we rescale the sample weights using data on firms' mean turnover in each strata. Thus, we obtain statistics that account for the relative weight of each firm in total sales. Second, we present statistics on each firm's weight in total exports using sample weights rescaled by each firm's exports. Statistics obtained for the representative firm and for size-weighted firms allow us to compare the behavior of small and large firms. In the econometric analysis, all regressions are weighted by the inverse of the sampling probability.

The core of our analysis exploits information on firms' currency choice when selling goods outside of the euro area. We use answers to the question "In which currency do you set prices in foreign countries?" to identify a PCP strategy whenever the answer is euro. Figure 2 summarizes the results for our sample of firms. Whatever their country of origin, a vast majority of firms - from 88% in Austria to 95% in France - declare setting their prices in euro (black bars in Figure 2). The use of PCP is thus prevalent, though less pronounced when weighting observations by the firms' size (light and medium grey bars in Figure 2). Large firms are less likely to price in PCP.

How do these findings compare with previous studies of currency choices? Kamps (2006) reports that only 60% of EMU exports were invoiced in euros as of 2004. In the ECB (2011) report on the internationalization of the euro, this proportion reaches 68% for EMU exports to non-eurozone countries. These figures are aggregate. As such, one should therefore compare

them with our size-weighted statistics. Once firm size is taken into account, around 75% of exports are found to be invoiced in euros (70% for Italy, 82% for Germany).[11] In unreported results, we compare currency choices in different subsamples of firms constructed based on the geography of their sales, their sector, or the nationality of their main competitor. We found the use of the euro is relatively more prevalent for firms mostly exporting to the European Union and slightly less common for firms in the textile and leather industries. The nationality of the firm's main competitor does not appear to be correlated with invoicing-currency choices. Although the results here are not especially conclusive, we use these variables as controls in the empirical framework. Indeed, they represent the best available proxies for the determinants of currency choices identified in the existing literature.

We complement information on currency choices with variables measuring firms' risk management strategy. Our primary measure of financial hedging uses answers to the question "How do you deal with the exchange rate risk?" We identify firms as using financial hedging whenever they answer that they use a foreign-exchange-risk protection. We also use detailed information on whether firms are covered by trade insurance products, use financial derivatives, or rely on trade credit for their exports.

Figure 3 gives the proportion of firms using one of these instruments and the relative propensity of large firms using them. Hedging seems widespread in EMU countries: Between 25% and 50% of firms claim they hedge against exchange rate risk. A substantial share of firms use trade insurance, from 25% in Italy to 40% in Austria. The use of derivatives and trade credits is much less developed: less than 5% of firms declare using them, with notable exceptions in Spain and Italy, where 20% of firms use them. Those instruments - in particular, hedging and trade insurance - are used relatively more by larger exporters.

Our hypothesis in this section is that currency choices and hedging strategies are complementary from the exporter's point of view. Figure 4 shows statistics consistent with this view. The propensity of firms to use various hedging instruments is measured in the subsample of PCP firms ("PCP" bars) and in the subsample of firms using a foreign currency ("non-PCP" bars). Large firms appear to be more likely to hedge against exchange rate risk, and PCP firms tend to rely less on hedging instruments. In the next subsection, we investigate the statistical significance of this result and ask whether it can be interpreted in a causal way.

[11] Note the weighting procedure is based on firms' size and total exports, whereas ECB figures are based on exports to non-eurozone countries. Because large firms probably export relatively more to non-euro countries, the weight on those firms should be *relatively* larger for our results to be comparable with the ECB statistics.

2.2 Determinants of currency choice

Heterogeneity in currency choices is a key feature of the stylized facts presented in section 2.1. In particular, large firms invoice their exports in a foreign currency more often than smaller ones. Moreover, currency-choice decisions seem to be correlated with an active risk management strategy. In this section, we use probit regressions to study the statistical significance of these patterns. The benchmark regression takes the following form:

$$\mathbb{P}(PCP_f = 1|X_f) = \mathbb{P}(PCP_f^* > 0|X_f) = \Phi(X_f'\beta)$$

, where $\mathbb{P}(PCP_f = 1|X_f)$ is the probability that firm f set prices in euros, PCP_f^* is the unobserved latent variable, and X_f is a vector of explanatory variables. We control for potential determinants of invoicing strategies identified in the existing literature: various measures of the firm's size, the share of exports in sales, and the geographic composition of exports. All regressions also control for the firm's country of origin and its 4-digit sector of activity. Finally, we depart from the existing literature and also include proxies for the firm's hedging strategy.

We first study the correlation between firms' size and currency choices. To this aim, we control for different measures of size based on the firm's turnover or sales. Results are summarized in Figure 5, where we report the coefficients estimated on each size interval, taking firms in the first interval as a benchmark.[12] As expected, results show the probability of choosing a PCP strategy is decreasing in firm size. Moreover, the difference is significant for firms above a threshold, namely, for firms with more than €50 million sales or 50 employees. This result is consistent with previous evidence that firms of heterogeneous size make different currency choices. Based on these non-parametric results, we systematically control for firm size in the rest of the analysis. To limit the number of estimated coefficients, we account for firm size with a dummy variable equal to 1 for firms with a turnover above €50 million.

Table 2 presents a set of benchmark regressions that test standard determinants of currency choices. We control for firm size and various measures of exposure to exchange rate risk, the share of exports in sales, the number of destination markets served, and the share of different destinations in export sales.[13] Finally, firms were asked how they decide on their price in their do-

[12]The corresponding regressions also control for the exporter's country of origin and the sector of activity.

[13]The number of destination markets is a proxy for whether the composition of the firm's export sales offers a natural diversification mechanism against exchange rate risks. Previous literature has shown the use of foreign currencies is systematically larger toward

mestic market. One possible answer is that the price is fixed by the market; that is, the firm does not have any market power. We construct a dummy variable that identifies firms without market power, based on the idea that lack of market power is likely to push firms to choose a foreign currency to stick to the market price. We use this dummy to control for firms' market power in column (4).

Results are broadly in line with expectations. The probability that a firm sets export prices in a foreign currency is increasing in the firm's export share. Firms selling more in Asia and America are also less likely to adopt PCP strategies than firms mostly exposed to European and African markets. Finally, having no pricing power is also a significant predictor of the firm's propensity to set prices in the importer's currency. Overall, these results are consistent with the view that currency choices depend on the firm's exposure to exchange rate risk and bargaining power in export markets.

In Table 3, we investigate the correlation between hedging and currency choices. We start from the benchmark regression displayed in column (4) of Table 2 and add each of the four measures of firms' risk management available in the survey. Firms reporting that they hedge against exchange rate risk are less likely to choose PCP (column (1)), as are firms reporting that they use derivatives (column (2)). On the other hand, neither the dummy for firms using trade credit nor the subscription of trade insurances have an impact on currency choices (columns (3) and (4)). These results continue to hold when all four measures are introduced simultaneously in column (5).

The correlation between hedging strategies and currency choices in Table 3 is difficult to interpret in a causal way due to potential reverse causality. Indeed, the firm's decision to price in the local currency de facto creates exposure to exchange rate risks, inducing a need for financial hedging. Because the endogenous variable is binary, one cannot use a standard IV strategy. To treat the reverse-causality problem, we thus estimate a bivariate probit model (see Wooldridge 2001, section 15.7.3, p. 477). Formally, we estimate

$$\mathbb{P}(PCP_f = 1|\delta_1, HEDG_f) = \mathbb{P}[z_1\delta_1 + mc_S HEDG_f + \epsilon_1 > 0]$$
$$\mathbb{P}(HEDG_f = 1|\delta_1, \delta_2) = \mathbb{P}[z_1\delta_1 + z_2\delta_2 + \epsilon_2 > 0],$$

where $HEDG_f$ is a binary variable equal to 1 if the firm chooses to use a hedging strategy, z_1 is a vector of variables affecting both the decision to hedge and the invoicing currency choice, and z_2 is a vector of variables affecting the decision to hedge, which is orthogonal to the invoicing-currency

some destinations, notably the United States.

choice. δ_1, δ_2, and mc_S are vectors of coefficients to estimate. In our baseline specification, we assume the correlation between ϵ_1 and ϵ_2 is nil. If the correlation is not nil, hedging is an endogenous variable in the currency equation. To have a consistent estimate of mc_S, we have to find a set of variables correlated with the hedging decision but uncorrelated with ϵ_1.

Table 4 reports the results. Columns (2)-(3) report estimation results when hedging is instrumented by a dummy equal to 1 if the firm has subscribed to a trade insurance, and a dummy equal to 1 if the firm reports it lacks organizational or managerial resources for further growth. The use of the trade-insurance dummy as an instrument for hedging is justified on the grounds of external evidence for France showing that firms subscribing to trade insurance are often offered hedging instruments against ER risk in the same package.[14] We use our second instrument based on the assumption that firms with management issues probably have fewer resources for performing active risk management. As shown in column (1), none of the variables directly affect currency choices. This observation is consistent with the required assumption that $corr(\epsilon_1, z_2) = 0$. They, however, affect hedging decisions (column (3)), which suggests that instruments are not weak. As expected, the use of hedging instruments is more prevalent among firms covered by trade insurance but less common in firms with organizational issues. Importantly, the impact of hedging remains significant and negative in the second-stage regression (column (2)) when hedging is instrumented by these two variables. These results suggest hedging decisions are a causal determinant of currency choice. Compared with the probit regression, the marginal impact of hedging on invoicing choice is higher. On the contrary, the impact of firms' size is reduced and no longer significant at 10%. This finding is consistent with the view that part of the reason large firms are more likely to use foreign currencies is that they have better access to financial hedging, which allows them to reduce their exposure to exchange rate fluctuations under foreign currency pricing.

We estimate a second bivariate probit regression in which we augment the hedging regression with two additional instruments: a dummy for firms covered by trade credits and the log of the number of destinations served. The results are presented in columns (4)-(5) of Table 4. Consistent with Froot et al. (1993), results show firms financing part of their exports using a trade credit (i.e., financially constrained firms) are more likely to hedge against their exchange rate risk. Moreover, hedging is positively correlated with the number of destinations served, a result consistent with Allayannis et al. (2001). Once again, we find a negative and significant causal impact

[14] See www.coface.fr.

of hedging on the decision to choose PCP, once endogeneity is taken into account. Note that in these regressions, we can use the correlation between the error terms ($corr(\epsilon_1, \epsilon_2)$) to test for the endogeneity of a variable (this procedure is equivalent to an Hausman endogeneity test as shown by Knapp & Seaks 1998). Such correlation is .37 in the estimation results reported in columns (2) and (3) and .48 in the results reported in columns (4) and (5). A correlation of zero means that hedging is exogenous. A Wald test rejects the null hypothesis at 24% in the first system and 11% in the second system. This finding suggests endogeneity is a moderate issue here.

These results point out that, controlling for size, firms with better access to hedging instruments are less likely to choose PCP. Because large firms are also more likely to hedge against exchange rate risk, this relationship may be at the origin of the link between a firm's size and its invoicing strategy. Indeed, once hedging is taken into account, the coefficient on the firm's size decreases in absolute value (compare Tables 2 and 3). The size-invoicing relationship is therefore explained by large firms having better access to financial hedging. The opportunity to hedge against exchange rate risk enables firms to invoice in the local currency without facing a risk on their marginal revenue.

Finally, note that all regressions account for the geographical composition of exports. However, one may still worry that some firms mostly export to the euro area, which makes their answer to the question about invoicing currency difficult to interpret in terms of PCP versus LCP. These firms may indeed answer that they do face exchange rate risk (a condition for being part of the estimation sample), but report invoicing in euros based on their invoicing strategy with respect to their euro partners. As an alternative to controlling for the geographical composition of exports, we tested an alternative strategy imposing further restrictions on the estimation sample. Results are reported in Table 5. The restricted sample is constructed based on information about the location of the firm's three main trade partners and their contribution to overall exports. We impose that (i) at least one of the firm's main partners is located outside of the euro area and in a country in which money is not pegged to the euro, and (ii) this partner accounts for at least 15% of the firm's exports. These restrictions are meant to further focus on those firms that we are sure face substantial exchange rate risk through their export activity, and are thus likely to define their invoicing strategy taking into account this risk. Results presented in Table 5 are consistent with previous findings. They confirm and suggest our results are not driven by a composition effect.

Having established the robustness of the relationship between invoicing strategies and hedging decisions, we now discuss the theoretical mechanisms that might explain the evidence.

3 A model of currency choice and hedging

We model the invoicing-currency choice of an exporting firm facing the possibility of hedging against exchange rate risk. We build on Burstein & Gopinath (2014), who use a one-period-ahead sticky-price environment and consider the invoicing-currency choice in partial equilibrium. In this setup, the optimal invoicing strategy depends on the curvature of the profit function with respect to exchange rates at the pre-set optimal price, itself determined by the demand function, the extent of returns to scale, and the sensitivity of marginal costs to exchange rate variations. We then generalize the analysis to the case in which the exporting firm can purchase derivatives to hedge against exchange rate risk. The augmented setup allows us to discuss and theoretically rationalize the evidence in Section 2.

In our model, an exporting firm chooses whether to set its price in domestic currency ("Producer Currency Pricing", PCP) or in the importer's ("Local Currency Pricing", LCP). We thus neglect the possibility of the firm pricing in a third currency. The qualitative results would generalize to PCP versus VCP ("Vehicle Currency Pricing"), although the exact conditions determining which strategy the exporter chooses in equilibrium would be slightly different. Profits under VCP indeed depend on the exchange rate between the producer's and the vehicle currencies as well as the exchange rate between the vehicle currency and the currency of the importer (Chen et al. 2018). This is true as long as the third currency is not a "dominant" currency. Under a dominant currency, the importer's costs and revenues are in the third currency (Gopinath & Stein 2018). The problem of the exporter becomes isomorphic to the case of LCP, although the relevant uncertainty is over fluctuations in the exchange rate between the producer's and the dominant currency.

3.1 Optimal invoicing strategy without hedging

We consider an exporting firm's choice of invoicing strategy when the exchange rate is the only source of uncertainty in the economy. For clarity, we first look at the firm's choice in the absence of hedging. We assume markets are perfectly segmented so that the firm can adopt a different strategy in each export destination. The optimal invoicing choice depends on the uncertainty about the firm's destination-specific expected profit under alternative invoicing strategies.

The exporting firm faces a demand function $D(p^*)$ in each destination, where p^* is the price faced by the importer. It has a cost function $C(q, w(S))$, which depends on the level q of output, as well as the vector of input prices

$w(S)$, which we assume is linear in S. This dependence is meant to capture the possibility that the firm imports some of its inputs from the foreign country, in which case, a form of operational hedging occurs as the effect of exchange rate variations on export revenues is to some extent compensated by its impact on costs.[15] We denote $mc \equiv \frac{\partial C(q,w(S))}{\partial q}$ as the firm's marginal cost of production, and $mc_S \equiv \frac{\partial \ln mc(.)}{\partial \ln S}$ and $mc_q \equiv \frac{\partial \ln mc(.)}{\partial \ln q}$ as the partial elasticities of its marginal cost with respect to the exchange rate and the quantity produced, respectively. Finally, $\eta \equiv -\frac{d \ln D(p^*)}{d \ln p^*}$ denotes the price elasticity of demand.

Before the exchange rate is realized, the firm chooses whether to set its price in domestic currency (PCP) or in the importer's (LCP). The firm's manager makes a choice between PCP and LCP to maximize her expected utility:

$$\max_{PCP,LCP} \left\{ \mathbb{E}\left[u\left(\pi^{PCP}(S)\right)\right], \mathbb{E}\left[u\left(\pi^{LCP}(S)\right)\right] \right\},$$

where $\mathbb{E}[.]$ is the manager's expectation, $u(.)$ is her utility function, which we assume is increasing in profits ($du(\pi^i)/\pi^i > 0$), and $\pi^i(S)$ is the equilibrium profit under strategy $i = \{PCP, LCP\}$, as a function of the exchange rate:[16]

$$\pi^{PCP}(S) = p^{PCP} D\left(\frac{p^{PCP}}{S}\right) - C\left[D\left(\frac{p^{PCP}}{S}\right), w(S)\right],$$
$$\pi^{LCP}(S) = S p^{LCP} D\left(p^{LCP}\right) - C\left[D\left(p^{LCP}\right), w(S)\right].$$

Both under LCP and PCP, the firm's profit is subject to exchange rate risk. First, under LCP, exchange rate fluctuations create uncertainty about the unit revenue denominated in the exporter's currency Sp^{LCP}. Second, under PCP, exchange rate fluctuations affect the local currency price p^{PCP}/S; hence, exporters face uncertainty about demand $D(p^{PCP}/S)$. Third, exchange rate fluctuations can affect the firm's cost, under PCP and LCP, through foreign input prices. Following the literature, we assume $\pi^{PCP}(\mathbb{E}[S]) = \pi^{LCP}(\mathbb{E}[S])$; that is, the invoicing strategy is irrelevant at the expected exchange rate.[17] Under these conditions, Proposition 3.1 summarizes the de-

[15] We define bilateral exchange rates such that one unit of foreign currency is worth S units of domestic currency. Part of the exporter's inputs can be imported, in which case, marginal costs are increasing in the exchange rate S.

[16] Note these profit functions are evaluated at the equilibrium, that is, for optimal values of p^{PCP} and p^{LCP}.

[17] Intuitively, this means that if prices could be immediately adjusted to the exchange rate, both price-setting currencies would yield the same profit. Burstein & Gopinath (2014) also assume that flexible price profits are the same regardless of the invoicing currency, and Bacchetta & van Wincoop (2005) and Friberg & Wilander (2008) make similar assumptions

terminants of the firm's choice between LCP and PCP.

Proposition 3.1. *LCP (resp. PCP) is preferred when $\pi^{PCP}(S)$ is a concave (resp. convex) function of S, which implies LCP is the optimal strategy if*

$$\eta - 1 - \frac{d\ln\eta}{d\ln\frac{p^{PCP}}{S}} < \frac{mc\left(\eta mc_q + mc_S\right)}{p^{PCP} - mc}, \tag{1}$$

where $\eta \equiv -\frac{d\ln D(p^*)}{d\ln p^*}$ and $mc \equiv \frac{\partial C(q,w(S))}{\partial q}$, respectively, denote the price elasticity of demand and the marginal cost of producing. $mc_S \equiv \frac{\partial \ln mc}{\partial \ln S}$ and $mc_q \equiv \frac{\partial \ln mc}{\partial \ln q}$ are the partial elasticities of the firm's marginal cost with respect to the exchange rate and the quantity produced.

Proof. LCP is preferred whenever $\mathbb{E}\left[u\left(\pi^{PCP}(S)\right)\right] < \mathbb{E}\left[u\left(\pi^{LCP}(S)\right)\right]$, that is, $\mathbb{E}\left[\pi^{PCP}(S)\right] < \mathbb{E}\left[\pi^{LCP}(S)\right]$. Note $\mathbb{E}\left[\pi^{LCP}(S)\right] = \pi^{LCP}(\mathbb{E}\left[S\right]) = \pi^{PCP}(\mathbb{E}\left[S\right])$. It follows that LCP is the optimal strategy whenever $\mathbb{E}\left[\pi^{PCP}(S)\right] < \pi^{PCP}(\mathbb{E}\left[S\right])$, which holds if $\pi^{PCP}(S)$ is a concave function of S. See Appendix A.1 for the derivation of equation (1). □

Proposition 3.1 summarizes previous findings in the literature, discussed in Burstein & Gopinath (2014). The condition captures the three main elements determining the choice between LCP and PCP. The first component is the convexity of the demand function, determining $d\ln\eta/d\ln\frac{p^{PCP}}{S}$, which is a well-known determinant of optimal incomplete pass-through (Krugman 1987, Berman et al. 2012). The second component is the cost function, namely, the extent of returns to scale mc_q (Bacchetta & van Wincoop 2005), and of operational hedging, measured by mc_S.The third component is the perceived elasticity of demand η, which also affects the firm's market power $(p^{PCP} - mc)/mc$. Under plausible parameter values, firms facing a higher demand elasticity choose an LCP strategy.[18]

they dub "monetary neutrality." Even absent this assumption, the intuitions from lemma 3.1 remain valid, as long as the difference between $\pi^{PCP}(\mathbb{E}[S])$ and $\pi^{LCP}(\mathbb{E}[S])$ does not exactly offset the differences in profits under every possible realization of the exchange rate S.

[18]Using the markup rule $p^{PCP} = \frac{\eta}{\eta-1}mc$, condition (1) rewrites:

$$(\eta - 1)\left(mc_s + \eta mc_q - 1\right) + \frac{d\ln\eta}{d\ln p^{PCP}/S} > 0,$$

where the euro marginal cost is decreasing in S, that is, $mc_S \leq 0$ and typically, $\frac{d\ln\eta}{d\ln\frac{p^{PCP}}{S}} > 0$. Constant and decreasing returns to scale ($mc_q \geq 0$) then imply that LCP is chosen by high-η firms. By contrast, increasing returns to scale then imply low-η firms choose LCP.

Finally, note the benefits of LCP are increasing in the amount of exchange rate uncertainty, illustrating another intuitive and well-known result that invoicing strategies matter more when exchange rates are more volatile. On the other hand, the invoicing-currency choice does not depend on the manager's risk aversion (see Bacchetta & van Wincoop 2005), because profits are equal at the expected exchange rate, so that the invoicing currency only matters through its impact on the expected profit at pre-set prices. Whether LCP or PCP is chosen depends solely on the relative convexity of the PCP and LCP profit functions with respect to the exchange rate, which depends on the sign of the condition in equation (1).

Although the results summarized in Proposition 3.1 are not novel, they neglect an important dimension of the invoicing-currency problem: the possibility for firms to hedge against exchange rate risk. So far, we have implicitly assumed the exporter has no choice but to bear the exchange rate risk. It then must either face demand uncertainty (under PCP) or unit revenue uncertainty (under LCP). We now consider the possibility for the firm to use financial derivatives and hedge against exchange rate risk.

3.2 Optimal hedging strategy

We now allow the firm to hedge against exchange rate risk by purchasing foreign exchange derivatives. We consider the firm's choice between PCP and LCP, jointly with the option to hedge against exchange rate risk. We assume firms hedge through the forward currency market.

The firm's optimal invoicing and hedging choice stems from the comparison between the manager's expected utility under PCP and LCP, both when the exchange rate risk is hedged and when it is not. We use the superscript HPCP (respectively, HLCP) for the choice variables under *hedged* producer (local) currency pricing. The exporting firm's profits under HPCP and HLCP are

$$\pi^{HPCP}(S) = p^{HPCP} D\left(\frac{p^{HPCP}}{S}\right) - C\left[D\left(\frac{p^{HPCP}}{S}\right), w(S)\right] - h(S-f) - HC[h,f]$$
$$\pi^{HLCP}(S) = S p^{HLCP} D\left(p^{HLCP}\right) - C\left[D\left(p^{HLCP}\right), w(S)\right] - h(S-f) - HC[h,f],$$

where $h \in [0, p^i D(p^i)]$ $(i = \{PCP, LCP\})$ is the transaction amount hedged against exchange rate changes under invoicing strategy i. f denotes the forward exchange rate, so that $(f - S)$ is the ex-post benefit of hedging on each unit of export revenue. We assume international financial markets are efficient so that the forward rate is equal to the expected spot rate, $f = \mathbb{E}(S)$. The benefit of hedging is therefore zero in expectation. Hedging

stabilizes export profits around their expected value. Finally, $HC[h, f]$ is the hedging cost. Because the use of derivatives necessitates some form of knowledge (see, e.g., Brealey & Myers 1981), we assume hedging costs entail a fixed component F that represents investment in the knowledge necessary to design and buy the proper set of derivative instruments to hedge a firm's exchange rate exposure. For simplicity, we assume no variable component; that is, $HC[h, f] = F$.[19]

The firm's expected utility maximization problem yields the following lemma.

Lemma 3.2. *The exporting firm chooses the maximum amount of hedging. Under HLCP, the firm is hedged fully and uncertainty is removed. Under HPCP, profits are not linear in exchange rate surprises and some exchange rate uncertainty remains.*

Proof. Maximization of the manager's expected utility with respect to h^i yields the first-order condition $\mathbb{E}\left[\frac{du(\pi^i(S))}{d\pi^i(S)}(-S+f)\right] = 0$. Together with $f = \mathbb{E}(S)$, this condition implies $\text{Cov}\left[\frac{du(\pi^i(S))}{d\pi^i(S)}, S\right] = 0$. Under HLCP, profits are linear in exchange rate surprises and the firm hedges fully, that is, $h^{*,HLCP} = p^{HLCP}D\left(p^{HLCP}\right)$. Under HPCP, profits are not linear in exchange rate surprises when (3.1) does not hold with equality. Therefore, under HPCP, the firm chooses the maximum amount of hedging but remains exposed to some exchange rate uncertainty. □

The findings in Section 3.1 did not rely on firms' valuation of the stabilization of their export revenues, whether from unit revenue (under LCP) or from demand stabilization (under PCP). By contrast, firms only value the benefit from hedging if they find it optimal to stabilize export revenues. In line with the risk management literature, we assume the exporting firm's manager is risk averse; that is, $\frac{d^2u(\pi^i)}{d\,\pi^{i\,2}} < 0$.[20] Unlike a risk-neutral manager, a risk-averse manager values the benefit of stabilizing her export revenues, and trades off this benefit against the hedging cost.

Proposition 3.3 summarizes the conditions under which an exporting firm chooses to hedge.

[19] In Appendix A.3, we study the case in which hedging costs also entail a variable component that depends on the amount hedged. We show our qualitative results are unchanged.

[20] Managers' risk aversion has been shown to explain why firms optimally manage their risks (see, e.g., Geczy et al. 1997). We discuss below other rationales that can explain why firms optimally manage their risks, and argue they would not change our model's predictions.

Proposition 3.3. *An exporting firm pricing in LCP chooses to hedge against exchange rate risk whenever the following inequality is satisfied:*

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] - \mathbb{E}\left[u\left(\pi^{LCP}(S)\right)\right] > 0,$$

which rewrites as

$$u\left[\pi^{LCP}\left(\mathbb{E}\left[S\right]\right)\right] - \mathbb{E}\left[u\left(\pi^{LCP}(S)\right]\right] > \frac{du(\pi^{LCP}(S))}{d\pi^{LCP}(S)}F. \tag{2}$$

The mirror condition for a PCP firm to hedge is

$$u\left[\pi^{PCP}\left(\mathbb{E}\left[S\right]\right)\right] - \mathbb{E}\left[u\left(\pi^{PCP}(S)\right)\right] > \frac{du(\pi^{PCP}(S))}{d\pi^{PCP}(S)}F + \Delta(S), \tag{3}$$

where $\Delta(S)$ is higher the more risk averse the firm's manager, and the sign of $\Delta(S)$ depends on condition (1). Condition (3) is more stringent than (2) if condition (1) is satisfied, or if the coefficient of absolute risk aversion is large enough.

Proof. See Appendix A.2. □

When choosing whether to hedge against exchange rate risk, an exporting firm faces the following trade-off. On the one hand, the benefit from hedging is to remove the uncertainty associated with exchange rate risk. This benefit is represented by the left-hand side of inequality (2). It is positive when the manager is risk-averse, and increases as $d^2u(\pi^i)/d\,{\pi^i}^2$ becomes more negative. On the other hand, the hedging cost reduces the manager's utility. This cost is represented by the right-hand side of inequality (2). An exporting firm pricing in PCP faces a similar trade-off (see Appendix A.2).

We find that high-profit firms are more likely to hedge; that is, inequality (2) is more likely to hold for high-profit firms. Indeed, high-profit firms can spread the fixed hedging cost over more units of revenue, so that the right-hand side of (2) is decreasing in firms' profit. In Appendix A.3, we show this conclusion is robust to the introduction of variable hedging costs, as long as the variable component of the hedging cost is not too convex in the quantity hedged. Given that larger firms typically have higher profits, we find they are more likely to hedge, both under LCP and PCP. This finding is in line with the empirical evidence in Section 2.2.

Our model relies on two key assumptions to explain why larger firms are more likely to hedge against exchange rate risk. First, we assume managers are risk averse, thereby explaining why firms optimally hedge against exchange rate risk. Without risk aversion, managers would not find it profitable

to reduce profit uncertainty, and the left-hand side of inequality (2) would be equal to zero. Managers would then not value the revenue stabilization due to hedging. Second, we assume hedging costs entail a fixed component. Therefore, even if all firms would value the benefit from hedging, larger firms will find it more profitable as explained before.

The risk management literature provides support for our assumption that hedging can be an outgrowth of managers' risk aversion (Stulz 1984, Smith & Stulz 1985). However, many other rationales have also been shown to be consistent with firms' optimal management of risk.[21] We view our assumption of managerial risk aversion as a simple modeling shortcut, and we acknowledge that firms' risk aversion could also stem from other factors. As long as those other factors affect small and large firms indifferently, our model's predictions are unchanged.

Finally, we show in Appendix A.3 that our results are robust to a more general hedging cost with a variable component. However, the presence of a fixed cost of hedging remains key in explaining why only larger firms choose to hedge. The following complementary explanation is proposed by Rampini & Viswanathan (2010, 2013). When promises to both financiers and hedging counterparties need to be collateralized, both financing and risk management require net worth. Therefore, more constrained firms have a higher opportunity cost of hedging. As a result, even without a fixed hedging cost, larger firms might find it optimal to hedge, and not smaller firms. The survey includes questions regarding firms' financial constraints, although with limited coverage. Based on these questions, we find some evidence consistent with the fact that financially constrained firms are less likely to use hedging instruments.[22] Because the evidence is not very robust and the modelization based on a fixed hedging cost is substantially simpler, we stick to this assumption in the analysis.

[21] The main theories of why firms hedge fall into two broad categories. The first category is market frictions (see, e.g., Smith et al. 1990, Stulz 1990, Froot et al. 1993, Smith & Stulz 1985). The second category is agency costs (see, e.g., Stulz 1984, Breeden & Viswanathan 1990, Stulz 1990, DeMarzo & Duffie 1991). Empirical tests of these theories are conducted in Nance et al. (1993), Tufano (1996), Geczy et al. (1997), Graham & Rogers (2002*b*).

[22] Our measure of financial constraints is based on the survey's question "What are the factors preventing growth?". A firm is said to be financially constrained if the answer is "financial constraints." The unconditional correlation between this variable and the hedging dummy is negative and highly significant. In a probit explaining hedging by financial constraints and all the controls included in the baseline regressions but the sector fixed effects, the coefficient remains negative and highly significant. The coefficient loses significance once one controls for sector fixed effects, suggesting our data on financial constraints primarily capture cross-sectorial differences.

3.3 Optimal invoicing strategy with hedging

Our model studies an exporting firm's choice of invoicing currency, jointly with the possibility of hedging against exchange rate risk. We now discuss how this joint choice can help rationalize the findings in Section 2.2.

First, Proposition 3.1 explains firms' choice between PCP and LCP. This choice depends on the curvature of the profit function, as discussed in Section 3.1. Second, in Section 3.2, we explain why some firms choose to hedge against exchange rate risk and some don't. We show that a risk-neutral firm does not value the benefits from hedging exchange rate risk and therefore it chooses not to hedge. A risk-averse exporter, instead, trades off the benefit of stabilizing its export revenues against the cost of hedging. In Proposition 3.3, we show that when hedging costs entail a fixed component, larger firms enjoy a higher benefit from hedging and lower unitary costs than smaller firms. If a firm is large enough for hedging benefits to outweigh the costs, it hedges fully as shown in Lemma 3.2. Firm size therefore plays a crucial role in determining which firms choose to hedge.

These results are consistent with our empirical findings, illustrated in Figure 4, that large eurozone firms are more likely to use financial hedging instruments, under both LCP and PCP. We now introduce Proposition 3.4 to explain the main finding in Section 2.2, that is, that large Eurozone firms are more likely to choose LCP and hedge, whereas small eurozone firms are more likely to choose PCP and not hedge.

Proposition 3.4. *Under sufficiently high managerial risk aversion and efficient forward currency markets, if an exporting firm is large enough for condition (2) to be met, the firm (i) invoices its products in the currency of the importing country, and (ii) fully hedges against exchange rate risk. Instead, if the firm is small enough (condition (2) is not met) and condition (1) is not met, the firm (i) invoices its products in its own currency and (ii) does not hedge.*

Proof. See Appendix A.4. □

Consistent with empirical findings summarized in Figure 4, Proposition 3.4 explains why the use of hedging is more prevalent among LCP firms than PCP firms. Under sufficiently high managerial risk aversion, the size threshold for PCP firms to hedge is higher than that of LCP firms (see Appendix A.4). The reason is that a firm chooses PCP because of the convexity of PCP profit in the exchange rate. Therefore, compared to an LCP firm and for the same managerial absolute risk aversion, it takes a larger PCP firm size for the hedging benefit to compensate for the cost (see Section 3.2). This result

can explain why, in the data, we observe a smaller fraction of PCP firms using hedging derivatives relative to LCP firms. This result can also explain the evidence in Figure 4 that the correlation between PCP and hedging increases relatively more than that between LCP and hedging when we weight observations by turnover or exports.

Proposition 3.4 further conveys a key message of this paper: when a firm is able to hedge its exchange rate exposure, it can choose a different invoicing currency than in the case where it cannot hedge. Indeed, if condition (1) is not met, the PCP profit is convex in the exchange rate so that the firm chooses PCP when it cannot hedge (see Section 2.2). However, if the firm is large enough such that condition (2) is met, it chooses to hedge against exchange rate risk. If the firm manager is sufficiently risk averse, the firm then chooses LCP instead of PCP, and hedges fully (see Appendix A.4 and Lemma 3.2). This result emphasizes the importance of studying a firm's invoicing currency choice *jointly* with its choice of whether to hedge against exchange rate risk.

4 Conclusion

The paper offers three novel empirical results. First, large firms in euro-area countries are less likely to use the euro than smaller ones. Second, large firms and firms that price their goods in a foreign currency are more likely to hedge against exchange rate risk. Third, hedging opportunities increase firms' propensity to set their prices in a foreign currency.

We rationalize these findings in a model of invoicing-currency choice augmented with risk aversion and hedging instruments. In our model, we assume managers are risk averse, thereby explaining why firms optimally hedge against exchange rate risk. In the presence of fixed hedging costs, however, hedging is solely profitable for large firms. We show that when a firm is able to hedge its exchange rate exposure, it can choose a different invoicing currency than in the case where it cannot hedge. This result emphasizes the importance of studying a firm's invoicing-currency choice jointly with its choice of whether to hedge against exchange rate risk.

Our results have three main implications. First, the results suggest the development of new technologies that facilitate the hedging of exchange rate risk for individual exporters should lead to an increasing use of foreign currency pricing strategies – be they local currency pricing or dominant currency pricing. These strategies, in turn, should have an end effect on the international transmission of shocks.

Second, the results on financial hedging have important implications for

the costs of exchange rate fluctuations. As large firms tend to hedge against exchange rate fluctuations, they transfer the risk onto financial markets rather than bearing the risk or passing it to their trade partner.

Finally, we show that within countries and sectors, firms have different strategies regarding the invoicing currency of their exports. Such heterogeneity has direct implication for exchange rate pass-through. This heterogeneity is related to firms' access to financial hedging – a dimension that has not yet been explored in the literature on exchange rate pass-through.

A Proofs

A.1 Proposition 3.1

Recall that

$$\pi^{PCP}(S) = p^{PCP} D\left(\frac{p^{PCP}}{S}\right) - C\left[D\left(\frac{p^{PCP}}{S}\right), w(S)\right].$$

The first derivative of $\pi^{PCP}(S)$ with respect to S writes

$$\frac{d\pi^{PCP}(S)}{dS} = \eta D(.)\frac{p^{PCP} - mc}{S} - \frac{\partial C(.)}{\partial w(.)}\frac{\partial w(.)}{\partial S},$$

where $\eta \equiv -\frac{d\ln D(p^*)}{d\ln p^*}$, $mc \equiv \frac{\partial C(.)}{\partial D(.)}$ and we have used $\frac{dp^{PCP}}{dS} = 0$ in a one-period-ahead sticky-price setting. As in Burstein & Gopinath (2014), we allow the marginal cost of production to depend on the quantity produced as well as on the exchange rate: $mc = mc\left(D\left(\frac{p^{PCP}}{S}\right), S\right)$, where the exchange rate modifies the marginal cost of production insofar as some variable costs of production incurred by the exporting firm are local to the importing country. To simplify, we assume $\frac{\partial^2 w(.)}{\partial S^2} = 0$, that is, that $w(S)$ is linear in S. Under this assumption, the second derivative of $\pi^{PCP}(S)$ with respect to S writes:

$$\begin{aligned}\frac{d^2\pi^{PCP}(S)}{dS^2} =& \frac{d\eta}{dS}D(.)\frac{p^{PCP} - mc(.)}{S} \\ &+ \eta\frac{dD(.)}{dp^{PCP}/S}\frac{dp^{PCP}/S}{dS}\frac{p^{PCP} - mc(.)}{S} \\ &- \eta D(.)\frac{p^{PCP} - mc(.)}{S^2} \\ &- \eta D(.)\frac{1}{S}\frac{dmc(.)}{dS}.\end{aligned}$$

with

$$\begin{aligned}\frac{dmc}{dS} =& \frac{\partial mc(.)}{\partial D(.)}\frac{dD(.)}{dS} + \frac{\partial mc(.)}{\partial S} \\ =& \frac{mc(.)}{S}\left(\eta mc_q + mc_S\right),\end{aligned}$$

where $mc_q \equiv \frac{\partial \ln mc(.)}{\partial \ln D(.)}$ is the elasticity of the marginal cost with respect to output and $mc_S \equiv \frac{\partial \ln mc(.)}{\partial \ln S}$ is the partial elasticity of the marginal cost with

respect to the exchange rate. We finally obtain:

$$\frac{d^2\pi^{PCP}}{dS^2} = \eta D(.)\frac{p^{PCP} - mc(.)}{S^2}\left(-\frac{d\ln\eta}{d\ln\frac{p^{PCP}}{S}} + \eta - 1 - \frac{mc(.)}{p^{PCP} - mc(.)}\left(\eta mc_q + mc_S\right)\right),$$

and the concavity (convexity) of π^{PCP} with respect to the exchange rate S depends on the term within the parenthesis as given in (1). QED.

A.2 Proposition 3.3

We derive the conditions under which the firm chooses to hedge, considering the two possible invoicing strategies sequentially.

LCP case. From the firm's program, we can show the firm chooses HLCP over LCP whenever

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] - \mathbb{E}\left[u\left(\pi^{LCP}(S)\right)\right] > 0.$$

From lemma 3.2, we know that, conditional on hedging, the firm hedges fully. Therefore, conditional on hedging, profits are certain ex ante:

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] = u\left(\pi^{HLCP}(\mathbb{E}[S])\right).$$

The first-order conditions of expected utility maximization with respect to prices and the hedging quantity are

$$\mathbb{E}\left[\frac{du(.)}{d\pi(.)}\left(S\left(p^{*,j}\frac{dD(.)}{dp^{*,j}} + D(.)\right) - mc\frac{dD(.)}{dp^{*,j}}\right)\right] = 0 \tag{A.1}$$

$$\mathbb{E}\left[\frac{du(.)}{d\pi(.)}\left(-S + f\right)\right] = 0, \tag{A.2}$$

where $j \in \{LCP, HLCP\}$. Rearranging and substituting (A.2) into (A.1) implies:

$$f\left(p^{*,j}\frac{dD(.)}{dp^{*,j}} + D(.)\right) = mc\frac{dD(.)}{dp^{*,j}}. \tag{A.3}$$

Condition (A.3) is independent of both the shape of the utility function and the stochastic properties of the exchange rate. This independence is a version of the "separation theorem" result that exchange rate uncertainty does not

influence prices or traded quantities. We then write:

$$u\left(\pi^{HLCP}(\mathbb{E}[S])\right) = u\left(\pi^{LCP}\left(\mathbb{E}[S]\right) - F\right).$$

We approximate $u\left(\pi^{LCP}\left(\mathbb{E}(S)\right) - F\right) \simeq u\left(\pi^{LCP}\left(\mathbb{E}(S)\right)\right) - \frac{du(\pi^{LCP})}{d\pi^{LCP}}F$. Inequality (2) obtains.

PCP case. As before, a PCP firm chooses HPCP whenever

$$\mathbb{E}\left[u\left(\pi^{HPCP}(S)\right)\right] - \mathbb{E}\left[u\left(\pi^{PCP}(S)\right)\right] > 0.$$

Again, using lemma 3.2, we know that, conditional on hedging, the firm hedges fully. However, in contrast to the LCP case, expected utility from HPCP profits is not certain ex-ante:

$$\mathbb{E}\left[u\left(\pi^{HPCP}(S)\right)\right] = u\left(\pi^{HPCP}(\mathbb{E}[S])\right) - \Delta(S),$$

where $\Delta(S)$ is higher the more risk averse the firm's manager, and the sign of $\Delta(S)$ depends on condition (1). $\Delta(S) = 0$ if PCP profits are linear in the exchange rate.[23] If PCP profit is concave in the exchange rate (condition (1) is satisfied), $\Delta(S) > 0$. Instead, if PCP profit is convex in the exchange rate (condition (1) is not satisfied), the sign of $\Delta(S)$ depends on the value of the manager's absolute risk aversion relative to PCP profit convexity. Indeed, we then have $\Delta(S) > 0$ if and only if

$$-\frac{u''(.)}{u'(.)} > \frac{\pi''(.)}{(\pi(.))^2}. \tag{A.4}$$

Note the separation theorem does not hold under PCP or HPCP. Indeed, risk aversion affects the optimal price because unlike in the LCP case, exchange rate surprises now affect demand. One then cannot get a condition equivalent to (A.3). However, if prices could be set *after* the exchange rate were known, PCP and HPCP would yield the same profits: All variables are then known and the exporter can set p^{PCP} and p^{HPCP} optimally. Therefore, we have

$$u\left(\pi^{HPCP}(\mathbb{E}[S])\right) = u\left(\pi^{PCP}\left(\mathbb{E}[S]\right) - F\right),$$

so that similar to condition (2) in the case of LCP, the firm hedges fully

[23] The demonstration would then be similar to that above when firms choose between LCP and HLCP.

under PCP if the following condition is satisfied:

$$u\left(\pi^{PCP}\left(\mathbb{E}\left[S\right]\right)\right) - \mathbb{E}\left[u\left(\pi^{PCP}(S)\right)\right] > \frac{du(\pi^{PCP}(S))}{d\pi^{PCP}(S)}F + \Delta(S). \qquad \text{(A.5)}$$

Depending on the sign of $\Delta(S)$, condition (A.5) is more or less stringent than (2). If condition (1) is met, (A.5) is more stringent than (2). Instead, if condition (1) is not met, (A.5) is more stringent than (2) only if (A.4) is also satisfied. Otherwise, it is less stringent. QED.

A.3 Extension to a more general hedging cost

On top of the fixed cost assumed in Section 3.2, we could assume hedging costs entail a variable component. Although, in reality, the variable costs of hedging are likely decreasing in the amount hedged, we discuss in this appendix the robustness of our results to variable costs that are increasing in the amount hedged, which is the only situation that may eventually overturn some of the results in the text. We now explain why the qualitative results in proposition 3.3 are not modified when we add a hedging cost component that increases in the quantity hedged h. Assume

$$HC\left[h\right] = c(h) + F,$$

where $c(h)$ is the variable cost component. With a variable cost component that is increasing in h (i.e., when $c'(h) > 0$), the optimal strategy no longer necessarily involves full hedging. Instead, the firm chooses h to maximize expected utility $\max_{p^i,h} \mathbb{E}\left[u\left(\pi^i(S)\right)\right]$. The first-order condition with respect to h is $\mathbb{E}\left[\frac{du\left(\pi^i(S)\right)}{d\pi^i(S)}\left(-S + f - c'(h)\right)\right] = 0$. This condition, together with $f = \mathbb{E}(S)$, implies $\text{Cov}\left[\frac{du\left(\pi^i(S)\right)}{d\pi^i(S)}, -S\right] = \mathbb{E}\left[\frac{du\left(\pi^i(S)\right)}{d\pi^i(S)}\right]c'(h)$, so that the exporter does not necessarily fully hedge when hedging costs entail a variable component. We are not able to determine the optimal quantity hedged without further assumptions on the relative curvature of the utility function and the hedging cost.

To highlight the fact that our qualitative results continue to hold, note $\frac{d^2u\left(\pi^i(S)\right)}{d(\pi^i(S))^2} < 0$ so that the term $\mathbb{E}\left[\frac{du(\pi^i(S))}{d\pi^i(S)}\right]$ is lower for larger (more profitable) firms. As long as the variable cost of hedging $c(h)$ is not too convex in the quantity hedged h, we have that $\text{Cov}\left[\frac{du\left(\pi^i(S)\right)}{d\pi^i(S)}, -S\right]$ is lower for larger firms. In words, our main result that larger firms are more likely to hedge therefore continues to hold except for extreme cases in which the variable cost is very

convex in the quantity hedged. In the realistic case in which the variable cost is decreasing in h (i.e., $c(h)$ is concave in h), larger firms with larger hedging demand are even more likely to hedge than smaller firms, reinforcing our model's prediction.

The more risk averse the exporting firm's manager, the more likely the benefits from hedging are to outweigh the costs for larger firms. When hedging costs entail a variable cost component, this latter should not be too convex for hedging to be optimal.

A.4 Proposition 3.4

First, if condition (1) is not met, Proposition 3.1 tells us the firm chooses PCP over LCP. Second, if condition (2) is met, Proposition 3.3 tells us the firm chooses HLCP over LCP.

We assume condition (A.4) is met, so that the utility of HPCP profit is concave in S and $\Delta(S) > 0$. We show that if condition (2) is met, the firm chooses HLCP over HPCP. From Lemma 3.2, we have

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] = u\left(\pi^{HLCP}(\mathbb{E}\left[S\right])\right) = u\left(\pi^{LCP}(\mathbb{E}\left[S\right]) - F\right).$$

Then, using the monetary neutrality assumption, we have $\pi^{PCP}(\mathbb{E}[S]) = \pi^{LCP}(\mathbb{E}[S])$, so that

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] = u\left(\pi^{PCP}(\mathbb{E}\left[S\right]) - F\right) = u\left(\pi^{HPCP}(\mathbb{E}\left[S\right])\right).$$

$\Delta(S) > 0$ implies the manager's utility of HPCP profit is concave in exchange rate fluctuations. We obtain

$$\mathbb{E}\left[u\left(\pi^{HLCP}(S)\right)\right] > \mathbb{E}\left[u\left(\pi^{HPCP}(S)\right)\right].$$

If condition (2) is met, the firm is large enough to choose to hedge. It then optimally chooses LCP and hedges fully against exchange rate risk. Instead, if condition (2) is not met, the firm is too small to choose to hedge, and it chooses PCP. QED.

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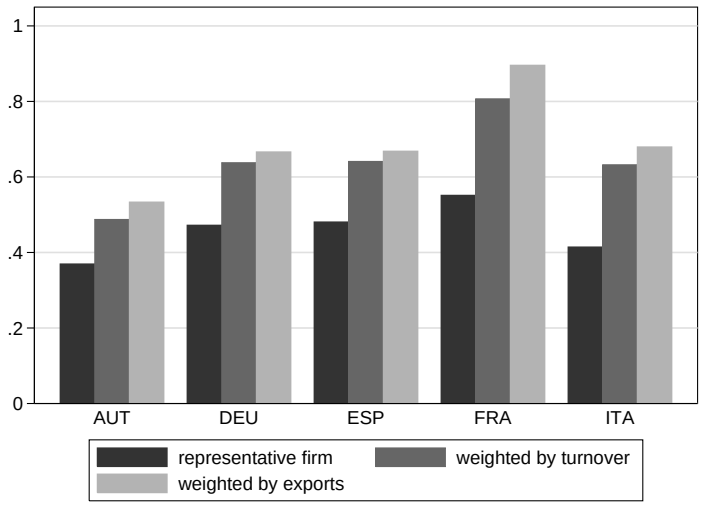
Figure 1 – Share of exporters facing exchange rate risks



Notes: This graph displays the share of firms from each country that claim they are exposed to exchange rate risks when selling their product abroad. The black bars correspond to the answer of the representative firm, obtained by weighting individual answers using the absolute sample weights. The light grey bars weight individual firms by their size, as measured by their sales. The medium grey bars weight firms by the value of their exports.

Table 1 – Description of variables

Question	Answer	Variable
How do you deal with the exchange rate risk? Which of the following statements is similar to what your firm does?	1- I use a foreign exchange risk protection 2- I do not normally hedge against exchange rate risk 3- The question is not applicable, as I only sell to countries with the same currency of my domestic market	**Dummy exporter faces ER risk:** 1 if answer = 1 or 2 **Dummy hedging**: 1 if answer = 1

Continued on next page

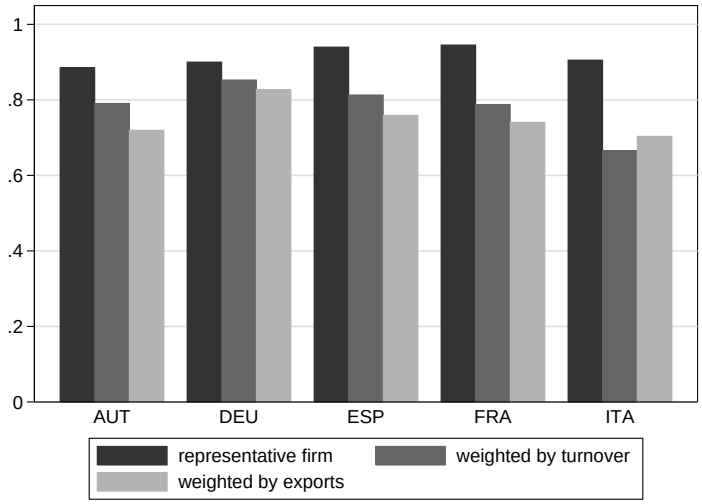
Question	Answer	Variable
In which currency do you set your prices in foreign countries?	1- Euro 2 - Domestic (for UK and Hungarian firms) 3- Other	**Dummy PCP**: 1 if answer = 1
In which of the following ranges falls the annual turnover in 2008 of your firm?	1- less than 1 million euro 2- 1-2 million euro 3- 2-10 million euro 4- 10-15 million euro 5- 15-50 million euro 6- 50-250 million euro 7- + 250 million euro	**One dummy for each interval** **Dummy Sales +50M:** 1 if answer = 6 or 7
Please indicate the total number of employees of your firm in your home country? Include all the employers, temporary staff, but exclude free lancers and occasional workers.	1- 10-19 employees 2- 20-49 employees 3- 50-249 employees 4- 250 employees and more	**1 dummy for each interval**
Which percentage of your 2008 annual turnover did the export activities represent?	Percentage: 1 to 100	**Export share**
Indicate to how many countries in total the firm exported its products in 2008?	Quantity: 1 to 200	**# dest.**
If we assume that the total export activities equal to 100 which percentage goes to destinations in the EU(15)? Same question for: Other EU cties, Other European not EU, China-India, Other Asian cties, USA-Canada, Central-South America, Other cties	Percentage: 0 to 100	**Share destination**

Continued on next page

Question	Answer	Variable
Has your firm benefited/purchased a trade/export insurance coverage?	1- Yes 2- No	**Dummy Trade Insurance**: 1 if answer = 1
During the last year did your firm use any kind of derivatives products (e.g. forward operations, futures, swaps) for external financing needs or treasury management or foreign exchange risk protection?	1- Yes 2- No	**Dummy Derivatives**: 1 if answer = 1
Has a significant share of your exports been financed by export credit?	1- Yes 2- No	**Dummy Trade Credit**: 1 if answer = 1
Factors preventing growth - Lack of management and/or organizational resources	1- Yes 2- No	**Dummy management**: 1 if answer = 1
How do you mainly set your prices in your domestic market?	1- margin o/ total costs 2- margin o/ variable costs 3- fixed by the market 4- regulated 5- Other	**Dummy Market:** 1 if answer = 3

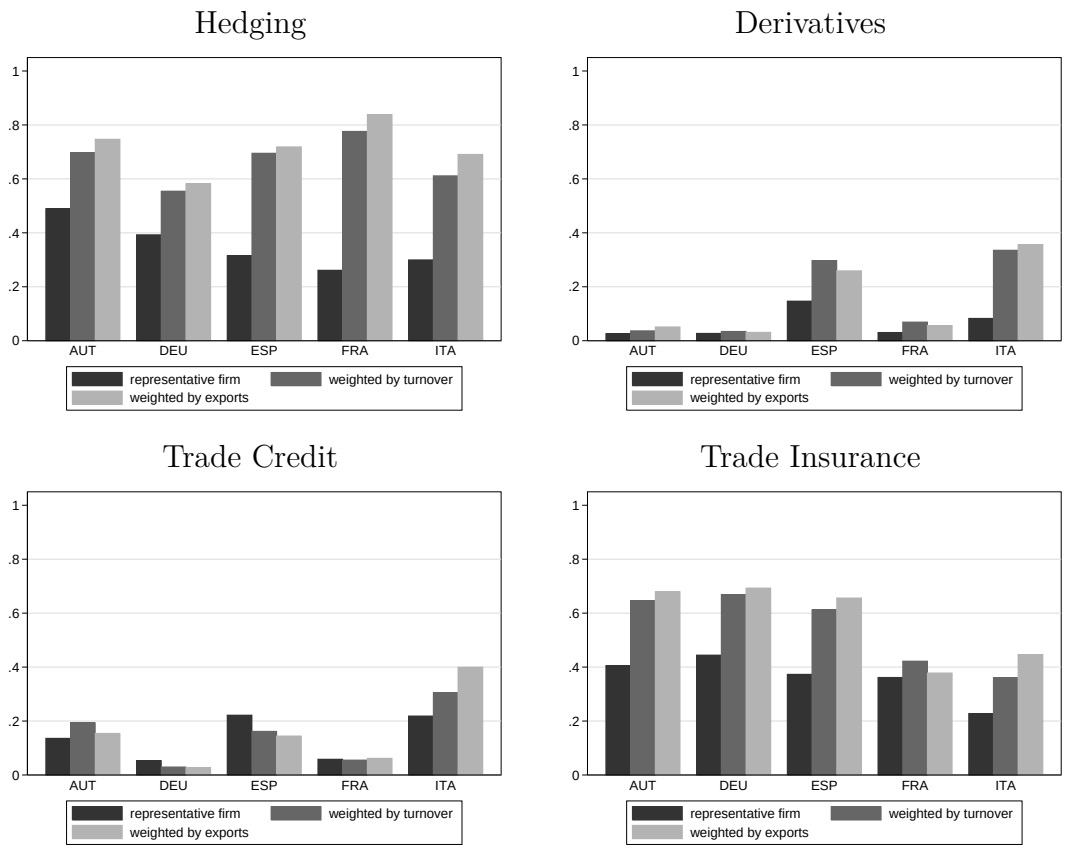
Notes: This table reproduces the questions exploited in our empirical analysis, the possible answers proposed in the survey, and the corresponding variables as used in the regressions.

Figure 2 – Share of firms pricing in euros



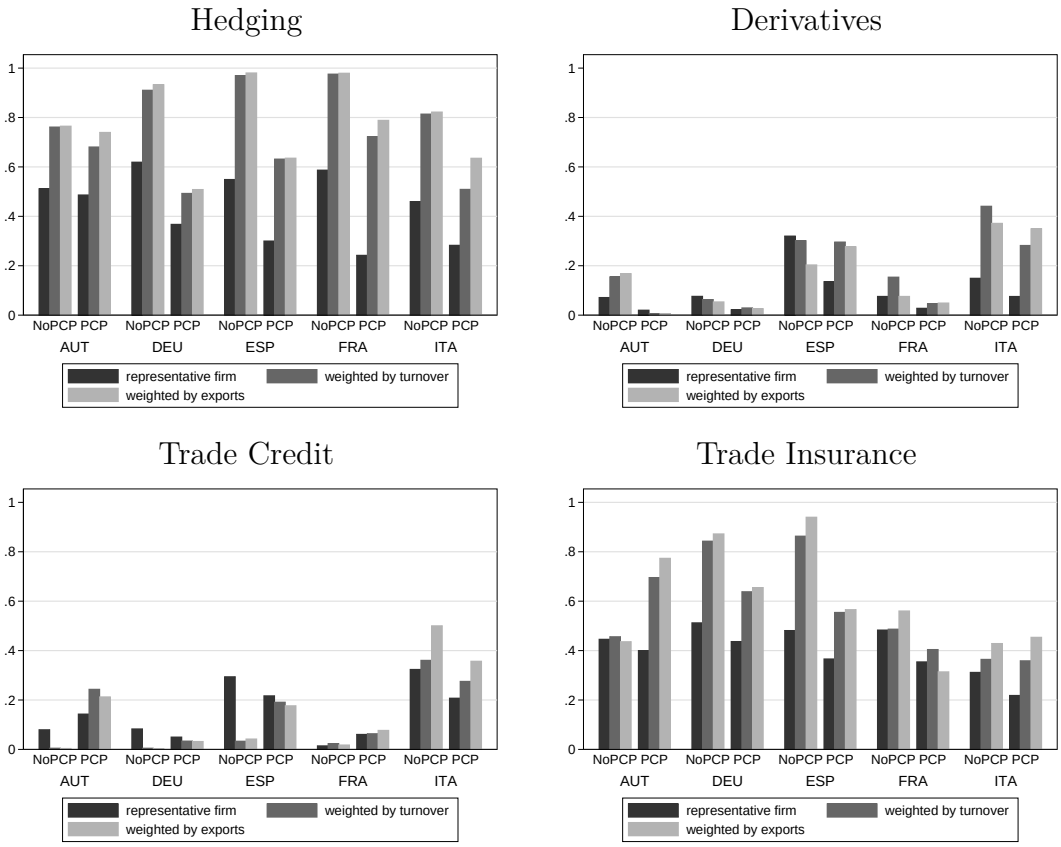
Notes: This graph displays the share of firms from each country that declare setting their price in euros. The black bars correspond to the answer of the representative firm, obtained by weighting individual answers using the absolute sample weights. The light grey bars weight individual firms by their size, as measured by their sales. The medium grey bars weight firms by the value of their exports.

Figure 3 – Use of hedging, derivatives, or trade finance



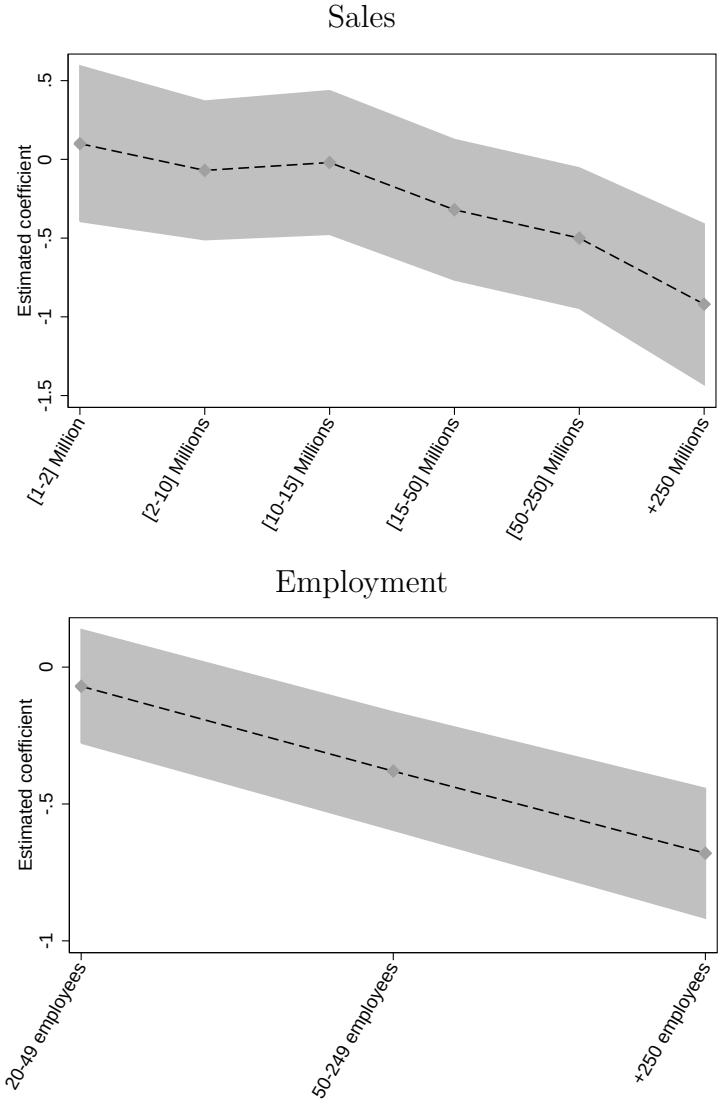
Notes: These graphs display the share of firms from each country that declare using financial hedging for dealing with their exchange rate exposure ("Hedging"), using financial derivatives ("Derivatives"), financing their export activity using a trade credit ("Trade Credit"), and being covered by a trade insurance ("Trade Insurance"). The black bars correspond to the answer of the representative firm, obtained by weighting individual answers using the absolute sample weights. The light grey bars weight individual firms by their size, as measured by their sales. The medium grey bars weight firms by the value of their exports.

Figure 4 – Correlation between hedging and currency choices



Notes: These graphs display the share of firms from each country which declare using financial hedging for dealing with their exchange rate exposure ("Hedging"), using financial derivatives ("Derivatives"), financing their export activity using a trade credit ("Trade Credit") and being covered by a trade insurance ("Trade Insurance"). The statistics are depicted separately for firms pricing in euros ("PCP" bars) and for firms pricing in the importer's currency ("LCP" bars). The black bars correspond to the answer of the representative firm, obtained by weighting individual answers using the absolute sample weights. The light grey bars weight individual firms by their size, as measured by their sales. The medium grey bars weight firms by the value of their exports.

Figure 5 – PCP probability as a function of the firm's size



Notes: Estimated coefficients of the probit model explaining the probability that the firm prices in euros, as a function of her size. The firm's size is measured by her turnover, in million euros (top panel) or her employment (bottom panel). In both cases, the reference group corresponds to the smallest firms. All regressions also control for a full set of fixed effects for the firm's country of origin and sector of activity. The grey area is the 95% confidence interval.

Table 2 – Determinants of currency choices: Baseline results

	Dep.Var: Probability(PCP)			
	(1)	(2)	(3)	(4)
Sales above 50 millions	-0.48***	-0.54***	-0.55***	-0.52***
	(-5.346)	(-5.784)	(-5.783)	(-5.527)
Share of exports	-0.71***	-0.56***	-0.58***	-0.56***
	(-5.427)	(-4.031)	(-3.723)	(-4.040)
Sh. Oth. EU		0.00	0.00	0.00
		(0.685)	(0.668)	(0.675)
Sh. Other Eur.		-0.00	-0.00	-0.00
		(-0.918)	(-0.904)	(-1.063)
Sh. Chn-Ind		-0.01***	-0.01***	-0.01***
		(-3.114)	(-3.115)	(-3.079)
Sh. Other Asia		-0.01**	-0.01**	-0.01**
		(-2.398)	(-2.405)	(-2.531)
Sh. North Am.		-0.01***	-0.01***	-0.01***
		(-6.134)	(-6.079)	(-6.299)
Sh. South Am.		-0.01***	-0.02***	-0.01***
		(-6.048)	(-6.075)	(-5.982)
Sh. Row		-0.00	-0.00	-0.00*
		(-1.503)	(-1.520)	(-1.721)
# destinations			0.01	
			(0.329)	
No pricing power				-0.21**
				(-2.563)
Origin country FE	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes
# Observations	3,011	3,011	3,011	3,011

Notes: This table presents the estimated coefficients of a probit model. The explained variable is the probability that the firm set prices in euros (PCP strategy). The explanatory variables are a dummy equal to 1 if the firm's turnover is above 50 million euros ("Sales above 50 millions"), the share of exports in total sales ("Share of exports"), the share of exports sold in the EU15 ("Sh. Oth. EU"), in the rest of Europe ("Sh. Other Eur"), in China or India ("Sh. Chn-Ind"), in the rest of Asia ("Sh. Other Asia"), in North America ("Sh. North Am."), in South America ("Sh. South Am."), and in the rest of the world ("Sh. Row"), the log of the number of destinations ("# destinations"), and a dummy equal to 1 if the firm declares herself not having any pricing power ("No pricing power"). Regressions control for sector and country-of-origin fixed effects. T-statistics computed from robust standard errors are reported in parenthesis. ***, ** and *, respectively, indicate significance at the 1, 5, and 10% levels.

Table 3 – Determinants of currency choices: The role of financial hedging

	Dep.Var: Probability(PCP)				
	(1)	(2)	(3)	(4)	(5)
Sales > 50 millions	-0.41***	-0.47***	-0.50***	-0.52***	-0.38***
	(-4.334)	(-4.956)	(-5.274)	(-5.545)	(-3.963)
Share of exports	-0.46***	-0.53***	-0.54***	-0.53***	-0.43***
	(-3.259)	(-3.783)	(-3.883)	(-3.785)	(-2.976)
No pricing power	-0.21***	-0.21***	-0.21***	-0.21***	-0.22***
	(-2.582)	(-2.622)	(-2.615)	(-2.593)	(-2.664)
Hedging	-0.38***				-0.34***
	(-4.796)				(-4.072)
Derivatives		-0.42***			-0.32**
		(-3.304)			(-2.368)
Trade Insurance			-0.11		-0.04
			(-1.347)		(-0.458)
Trade Credit				-0.14	-0.06
				(-1.327)	(-0.545)
Origin country FE	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes
Shares areas	yes	yes	yes	yes	yes
Obs.	3,011	3,011	3,011	3,011	3,011

Notes: This table presents the estimated coefficients of a probit model. The explained variable is the probability that the firm set prices in euros (PCP strategy). The explanatory variables are a dummy equal to 1 if the firm's turnover is above 50 million euros (Sales > 50 millions), the share of exports in total sales (Share of exports), a dummy equal to 1 if the firm claims it has no pricing power, and dummies for the use of hedging instruments (Hedging), financial derivatives (Derivatives), trade insurance (Trade Insurance), or trade credit (Trade Credit). All regressions also control for country-of-origin and sector dummies, and the share of different areas in the firm's export sales. T-statistics computed from robust standard errors are reported in parenthesis. ***, **, and *, respectively, indicate significance at the 1, 5, and 10% levels.

Table 4 – Determinants of currency choices: Bivariate probit regressions

	(1) PCP -	(2) PCP 2^{st} stp	(3) Hedg. 1^{st} stp	(4) PCP 2^{st} stp	(5) Hedg. 1^{st} stp
Sales > 50 millions	-0.42***	-0.23	0.59***	-0.18	0.56***
	(-4.308)	(-1.421)	(7.420)	(-1.184)	(6.979)
Sh. Exports	-0.49***	-0.28	0.70***	-0.24	0.54***
	(-3.040)	(-1.447)	(6.668)	(-1.269)	(4.533)
No Pricing Power	-0.21***	-0.20**	0.03	-0.19**	0.03
	(-2.588)	(-2.441)	(0.459)	(-2.420)	(0.574)
Hedging	-0.37***	-0.95**		-1.10***	
	(-4.544)	(-2.089)		(-2.715)	
Trade Insurance	-0.04		0.50***		0.44***
	(-0.482)		(8.263)		(6.940)
Trade Credit	-0.08				0.29***
	(-0.768)				(3.708)
Weak Management	0.22		-0.16*		-0.18**
	(1.607)		(-1.884)		(-2.108)
# destinations	0.03				0.07**
	(0.810)				(2.256)
Origin country FE	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes
Shares areas	yes	yes	yes	yes	yes
Obs.	3,011	3,011	3,011	3,011	3,011

Notes: This table presents the results of two bivariate probit regressions. The explained variable in the second regression is a dummy equal to 1 if the firm invoices exports in euros. The "instrumented variable" in the first stage is a dummy equal to 1 if the firm hedges against ER risk. Other explanatory variables include a dummy equal to 1 if the firm's turnover is above 50 million euros ("Sales > 50 millions"), the share of exports in her total sales ("Sh. Exports"), a dummy equal to 1 if the firm claims it has no pricing power ("No Pricing Power"), a dummy for the firm's country of origin, a dummy for its sector of activity, and a set of export shares measuring the geographic composition of her exports. The instruments are dummies for the use of a trade insurance ("Trade Insurance"), or a trade credit ("Trade Credit"), a dummy equal to 1 if the firm reports lacking organizational or management resources ("Weak Management"), and the log of the number of destinations served ("# destinations"). T-statistics computed from robust standard errors are reported in parenthesis. ***, **, and *, respectively, indicate significance at the 1, 5, and 10% levels.

Table 5 – Determinants of currency choices: Restricted sample

	(1) PCP -	(2) Hedg. 1^{st} stp	(3) PCP 2^{st} stp	(4) Hedg. 1^{st} stp	(5) PCP 2^{st} stp
Sales > 50 millions	-0.56***	0.69***	-0.05	0.69***	-0.09
	(-4.386)	(6.020)	(-0.144)	(5.889)	(-0.292)
Sh. Exports	-0.88***	0.79***	-0.29	0.72***	-0.34
	(-4.259)	(5.501)	(-0.716)	(4.527)	(-0.912)
No Pricing Power	-0.20*	0.01	-0.19**	0.01	-0.19*
	(-1.940)	(0.066)	(-1.966)	(0.103)	(-1.938)
Hedging			-1.43*		-1.33*
			(-1.767)		(-1.774)
Trade Insurance	-0.07	0.42***		0.39***	
	(-0.703)	(3.456)		(3.700)	
Trade Credit	-0.19			0.34***	
	(-1.372)			(3.069)	
Weak Management	0.17	-0.17		-0.17	
	(1.014)	(-1.357)		(-1.422)	
# destinations	0.10			0.01	
	(1.509)			(0.212)	
Origin country FE	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes
Obs.	1,470	1,470	1,470	1,470	1,470

Notes: This table presents the results of two bivariate probit regressions on a sample restricted to firms that have at least one of their top 3 partners located outside a euro country and accounts for at least 15% of total exports. The explained variable in the second regression is a dummy equal to 1 if the firm invoice exports in euro. The "instrumented variable" in the first stage is a dummy equal to 1 if the firm hedges against ER risk. Other explanatory variables include a dummy equal to 1 if the firm's turnover is above 50 million euros ("Sales > 50 millions"), the share of exports in her total sales ("Sh. Exports"), a dummy equal to 1 if the firm claims it has no pricing power ("No Pricing Power"), a dummy for the firm's country of origin, a dummy for her sector of activity and a set of export shares measuring the geographic composition of her exports. The instruments are dummies for the use of a trade insurance ("Trade Insurance"), or a trade credit ("Trade Credit"), a dummy equal to 1 if the firm reports lacking organizational or management resources ("Weak Management") and the log of the number of destinations served ("# destinations"). T-statistics computed from robust standard errors are reported in parenthesis. ***, **, and *, respectively, indicate significance at the 1, 5, and 10% levels.