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Invoicing Currency, Firm Size, and Hedging

Julien Martin
Isabelle Méjean

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Non-technical Summary

The choice of an invoicing currency for traded goods is the topic of a large literature in international macroeconomics. If prices are rigid in the short-run and nominal exchange rates fluctuate, the choice between the exporter's currency ("Producer Currency Pricing" or PCP) or the money of the importing country ("Local Currency Pricing" or LCP) determines the way national shocks spread across countries. Following Betts & Devereux (1996), a large micro-founded literature seeks to understand the determinants at the root of this choice. Standard determinants entering the firm's decision include structural properties of the foreign market, the sensitivity of the firm's profit to exchange rate risks and the macroeconomic volatility. In this literature however, the possibility for firms to hedge against exchange rate risks using financial instruments is often neglected. Since the availability of hedging instruments and the choice of an invoicing currency are connected in the general management of exchange rate risks at the firm level, we believe this dimension should be taken into account.

This paper uses the results of a survey conducted on a sample of 3,013 exporting firms located in 5 EMU countries (Austria, France, Germany, Italy and Spain) to study the link between invoicing strategies and hedging opportunities. Among many questions on the firm, her structure, her size in terms of employment and turnover, the geographical distribution of her exports, etc., the survey provides information about the currency used by the firm in international transactions. In the data, the use of the euro in transactions with foreign partners is prevalent. More than 90% of firms declare using the euro for exports. However, large firms have a higher propensity to use the local currency of the destination country to price their exports. As a consequence, the use of the euro as an invoicing currency is lower in aggregated nominal exports (between 70 and 80%). This prevalent use of the euro by EMU exporters means that the risk induced by exchange rate fluctuations is largely passed to the importer.

We then investigate another aspect of the way firms manage their exchange rate exposure, namely the possibility to use financial instruments to hedge against exchange rate risk. This dimension is potentially important since financial hedging can be considered as a substitute to pricing in PCP. Under LCP, the firm bears the exchange rate risk in order to stabilize prices in the destination market whatever the behavior of exchange rates. In comparison with a PCP strategy, this protects her from the risk of loosing competitiveness in the destination country

in case of detrimental exchange rate fluctuations. However, this induces an uncertainty on her margin if there exists a delay between the invoicing decision and the time the payment is proceeded. To reduce this source of uncertainty, the firm can use financial instruments to hedge against the exchange rate risk. In that sense, LCP and financial hedging can be considered as complementary in the firm's management of exchange rate risks.

In our data, we show that it is indeed the case that firms using financial hedging are more likely to price in foreign currency, even once other standard determinants of invoicing are controlled for. We further show that this relationship is causal, namely the opportunity to hedge lets firms invoice in foreign currency. This result is interesting from a microeconomic point-of-view. LCP is usually interpreted as a transmission of the exchange rate risk from the consumer to the exporting firm. The result that LCP firms are also more likely to hedge using financial instruments means that the exchange rate risk is in fact borne by financial markets and thus diversified more efficiently than at the individual level. This result partly explains the higher probability for larger firms to price in foreign currency. Hedging using financial instruments incurs a fixed cost that large firms are more likely to afford. This lets large firms adopt LCP strategies without facing more uncertainty on their unit revenues.

Abstract

We use the results of a survey conducted on a sample of 3,013 exporting firms located in 5 EMU countries to explore the link between the invoicing currency of exports, firm size, and hedging. About 90% of firms in the sample invoice exports in their (producer) currency. Large firms are more likely to use another currency. The aggregate use of the euro is thus 15 percentage points lower when firms are weighted by their size than for the average firm. This heterogeneity is robust to controlling for determinants of the invoicing choice stressed by the literature. We however show that large firms and firms pricing in another currency as the euro are also more likely to hedge against exchange rate risk. An IV estimation shows the causal impact of access to hedging on the choice of the invoicing currency. We find (large) firms having access to hedging being more likely to invoice in the importer's currency.

JEL Classification: F31, F41, G32.

Keywords: Invoicing currency, Financial hedging, Firm-level data.

Monnaie de facturation, taille des entreprises, et couverture contre le risque de change

Julien Martin
Isabelle Méjean

Résume non technique

Le choix de la monnaie de facturation des biens échangés fait l'objet d'une littérature importante en macroéconomie internationale. Lorsque les prix sont rigides à court terme et que les taux de change sont flexibles, la décision de facturer en monnaie de l'exportateur ("Producer Currency Pricing" ou PCP) ou en monnaie du pays de destination ("Local Currency Pricing" ou LCP) affecte la manière dont les chocs nationaux se transmettent entre pays. A la suite de Betts & Devereux (1996), une importante littérature micro-fondée a cherché à expliquer les déterminants de ce choix. Parmi les explications traditionnelles de la décision de la firme, on trouve des caractéristiques structurelles du marché importateur, la sensibilité du profit de la firme au risque de change et la volatilité macroéconomique. Cependant, cette littérature ignore généralement la possibilité pour les firmes de se couvrir contre le risque de change par le biais d'instruments financiers. Dans la mesure où l'accés à des instruments de couverture et le choix d'une monnaie de facturation entrent simultanément dans la stratégie de gestion du risque de change de l'entreprise, cette dimension devrait, selon nous, être prise en compte.

Cet article utilise les résultats d'une enquête menée auprès de 3013 entreprises dans 5 pays de l'UME (Autriche, France, Allemagne, Italie et Espagne) pour étudier le lien entre monnaie de facturation des exportations et protection contre le risque de change. Dans la liste des informations collectées, relatives à l'organisation, la taille en termes d'emploi et de chiffre d'affaires, la distribution géographique des exports, etc., figure une question sur la monnaie de facturation utilisée dans les transactions internationales. Dans ces données, une part très importante des entreprises (90%) répondent qu'elles utilisent l'euro comme monnaie de facturation. Les grandes entreprises ont cependant plus tendance à utiliser la monnaie du pays de destination. Par conséquent, l'utilisation agrégée de l'euro dans les exportations en valeur est plus faible (entre 70 and 80%). L'utilisation prépondérante de l'euro par les exportateurs de la zone euro signifie que le risque induit par les fluctuations de change est largement transmis au pays importateur.

Nous étudions ensuite un autre aspect de la gestion du risque de change par les entreprises exportatrices, la possibilité d'utiliser des instruments financiers de couverture contre les mouvements du taux de change. Cette dimension est potentiellement importante puisque la couverture financière est in fine un substitut à la tarification en monnaie domestique. Avec une stratégie de

LCP, la firme supporte le risque de change de façon à stabiliser les prix en monnaie locale quelles que soient les fluctuations de change. Par rapport à une stratégie de PCP, celà la protège des pertes de compétitivité qu'elle subit en cas d'appréciation de son taux de change. Néanmoins, cette stratégie induit de l'incertitude sur sa marge lorsqu'il existe un délai entre la date de facturation et le paiement effectif. Pour réduire cette source d'incertitude, l'entreprise peut utiliser des instruments de couverture financière contre le risque de change. En ce sens, la facturation en LCP et la couverture financière sont des instruments complémentaires de gestion du risque de change.

Dans nos données, il apparaît que les entreprises qui utilisent la couverture financière sont effectivement plus susceptibles de facturer en monnaie étrangère, et celà même lorsqu'on tient compte des autres déterminants traditionnels de la monnaie de facturation. En outre, cette relation est causale, c'est la possibilité pour les firmes de se couvrir qui les amène à facturer en monnaie étrangère. Ce résultat est intéressant du point-de-vue microéconomique. La stratégie de LCP est souvent interprétée comme une transmission du risque de change de l'acheteur vers l'exportateur. Dans la mesure où les firmes en LCP sont aussi plus enclines à se couvrir, le risque est in fine supporté par les marchés financiers donc diversifié d'une manière plus efficace qu'au niveau individuel. Le résultat obtenu explique en partie la plus grande propension des grandes entreprises à facturer en monnaie étrangère. La couverture via les marchés financiers engendre un coût fixe que les grandes firmes sont mieux à même de payer. Ceci permet aux grandes entreprises d'adopter des stratégies de LCP sans supporter l'incertitude associée sur leurs revenues unitaires.

Résumé court

Cet article étudie les liens entre monnaie de facturation des exportations, taille des entreprises et couverture contre le risque de change. L'analyse empirique porte sur des données issues d'une enquête auprès de 3013 entreprises dans 5 pays de l'UME. Dans cet échantillon représentatif du secteur manufacturier des pays de la zone euro, 90% des entreprises répondent facturer leurs exportations en euro. Les grandes entreprises ont plus tendance à utiliser une autre monnaie de facturation. Par conséquent, l'utilisation agrégée de l'euro dans les exportations de ces pays est 15 points de pourcentage plus faible qu'au niveau individuel. Cette hétérogénéité dans l'utilisation de l'euro reste valide lorsqu'on prend en compte d'autres déterminants de la monnaie de facturation mis en avant dans la littérature. En outre, les grandes entreprises et les entreprises facturant dans une autre monnaie de facturation que l'euro ont plus tendance à se couvrir contre le risque de change. Une estimation à partir de variables instrumentales permet d'étudier l'impact causal de l'accès à des services de couvertures sur le choix de la monnaie de facturation. Les (grandes) entreprises ayant un meilleur accès à des services de couverture sont plus enclines à facturer leurs exportations dans la monnaie du pays de destination.

Classification JEL :F31, F41, G32.

Mots clés : Monnaie de facturation, Couverture financière, Données individuelles.

Invoicing Currency, Firm Size, and Hedging[1]

Julien Martin*
Isabelle Méjean†

1. Introduction

The choice of an invoicing currency for traded goods is the topic of a large literature in international macroeconomics, starting from Betts & Devereux (1996). Whether the price of exported goods is set in the currency of the exporter ("Producer Currency Pricing" or PCP) or in the currency of the importing country ("Local Currency Pricing" or LCP) matters if prices are rigid in the short-run and nominal exchange rates fluctuate. Assuming LCP instead of PCP has been shown to affect the predictions of international macro models on the transmission of international shocks (Corsetti & Pesenti 2009), the optimal monetary policy (Devereux & Engel 2003) or the choice of an exchange rate regime (Corsetti & Pesenti 2005). From a microeconomic perspective, the choice between PCP and LCP determines who, among the consumer and the exporting firm, bears the exchange rate risk.

While early papers took the choice of an invoicing currency as an exogenous variable, the literature has then moved to endogeneize the decision.[2] These papers emphasize several determinants for the choice of an invoicing currency, including structural aspects of the industry, the curvature of the demand function, the structure of costs and the macroeconomic volatility. Most of the literature however neglects one potentially important aspect of the question, namely the possibility for firms to hedge against exchange rate risk using financial instruments. In this paper, we use survey data on more than three thousands exporting firms located in five EMU countries to study the relationship between local currency invoicing and financial hedging against exchange rate risk.

Until recently, the theoretical macro literature on invoicing choices was motivated by limited empirical evidence due to a lack of suitable data. The justification of these papers

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*IRES Université Catholique de Louvain (j.martin@uclouvain.be).
†Ecole Polytechnique, CREST and CEPR (isabelle.mejean@polytechnique.edu).
[2]See, among others, Friberg (1998), Bacchetta & van Wincoop (2005), Devereux, Engel & Storgaard (2004) and Gopinath, Itskhoki & Rigobon (2010).

was based on the estimates of the exchange rate pass-through.[3] Pass-through estimates based on aggregated data can be used to infer the proportion of exporters that use PCP or LCP in their transactions with foreign consumers. The caveat of this approach is that it potentially hides contrasting patterns across heterogeneous exporters and does not help discriminate among various theories of invoicing choices.

The increasing availability of micro data makes it possible to provide direct evidence on the currency used in international transactions. Goldberg & Tille (2006) analyze the shares of exports and imports that are denominated in the own currency or U.S. dollars for a cross-section of 24 countries. They show the wide spread use of the U.S. dollar as a vehicle currency and for denominating trade in goods where firms have little price setting power. Goldberg & Tille (2009) use even more disaggregated transaction data on Canadian imports. They show that LCP is more frequent for larger transactions. Their interpretation of the result is that consumers buying a larger volume of goods have more bargaining power in the determination of the invoicing currency. This is consistent with Friberg & Wilander (2008) who use a survey on a representative sample of Swedish exporters and show that the invoicing currency is predominantly set through a negotiation between the exporter and the consumer. Finally, Gopinath et al. (2010) use BLS data to study the frequency of price adjustment in U.S. imports and the relationship to the currency of invoicing. They show a link between the choice of an invoicing currency and the optimal degree of pass-through chosen by the firm conditional on price adjustment.

In this paper, we use the results of a survey conducted on a sample of 3,013 exporting firms located in 5 EMU countries (Austria, France, Germany, Italy and Spain). Among many questions on the firm, her structure, her size in terms of employment and turnover, the geographical distribution of her exports, etc., the survey provides information about the currency used by the firm in international transactions. In the data, the use of the euro in transactions with foreign partners is prevalent. More than 90% of firms declare using the euro for exports. This proportion is large in comparison with previous studies of the currency denomination of EMU exports that find that about 70% of the value of EMU exports are invoiced in euro.[4] The proportion however decreases once firms in the sample are weighted by their size. This means that large firms have a higher propensity to use the local currency of the destination country to price their exports. This result, together with the well-documented prevalence of large firms in international trade (Bernard, Jensen, Redding & Schott 2011), explains why aggregate results on the role of the euro as an invoicing currency for EMU exports display a lower proportion of euro priced exports than what we obtain using simple averages across firms.

We discuss the robustness of this finding to controlling for the geographical composition

[3]See Goldberg & Knetter (1997) for a review of the empirical literature on the exchange rate pass-through. Engel (2006) provides equivalence results between the choice of an invoicing currency and the optimal degree of exchange rate pass-through.

[4]See Kamps (2006) or the ECB (2011) annual report on the internationalization of the euro.

of exports, the industry the firm belongs to and the nationality of her competitors. In the theoretical and empirical literatures, these dimensions have been shown important to explain the choice of an invoicing currency. Firms mainly exporting in developing countries are expected to price in PCP while exports to the US or other large industrialized countries are more likely to be priced in LCP. Likewise, certain sectors, as the oil industry and a lot of agricultural markets, are well-known to over-use the dollar in international markets, whatever the nationality of the exporter. Finally, firms should be more likely to choose a LCP strategy when their competitor is located in a foreign country and is not affected by fluctuations in the bilateral exchange rate between the exporter's and the destination countries. Would large firms have a higher tendency to export in more remote countries, to be concentrated in some specific sectors or to compete with firms located in countries using a different currency, one could explain the link between a firm's size and her propensity to adopt LCP strategies by such indirect determinants of currency choices. However, we show that the higher propensity of large firms to price in local currency is robust to controlling for such determinants.

We then investigate another aspect of the way firms manage their exchange rate exposure, namely the possibility to use financial instruments to hedge against exchange rate risk.[5] This dimension is potentially important since financial hedging can be considered as a substitute to pricing in PCP. Under LCP, the firm bears the exchange rate risk in order to stabilize prices in the destination market whatever the behavior of exchange rates. In comparison with a PCP strategy, this protects her from the risk of loosing competitiveness in the destination country in case of detrimental exchange rate fluctuations. However, this induces an uncertainty on her margin if there exists a delay between the invoicing decision and the time the payment is proceeded. To reduce this source of uncertainty, the firm can use financial instruments to hedge against the exchange rate risk. In that sense, LCP and financial hedging can be considered as complementary in the firm's management of exchange rate risks.

In our data, firms are questioned about their use of instruments such as derivatives or trade insurances, that can eventually include a protection against exchange rate risk. We use this information to investigate the potential complementarity between hedging and LCP. Our probit estimations show that it is indeed the case that firms using financial hedging are more likely to price in foreign currency, even once other standard determinants of invoicing are controlled for. Since this relationship may be biased by reverse causality, namely firms choosing to hedge because they are forced to price in LCP, we instrument the use of financial hedging by various exogenous variables and find that the relationship between LCP and hedging is even stronger once endogeneity is controlled for. This result is interesting from a microeconomic point-of-view. LCP is usually interpreted as a transmission of the exchange rate risk from the consumer to the exporting firm. The

[5]Dohring (2008) also considers the hedging and invoicing strategies jointly. However, his data do not let him test for a statistical relationship between hedging and invoicing decisions.

result that LCP firms are also more likely to hedge using financial instruments means that the exchange rate risk is in fact borne by financial markets and thus diversified more efficiently than at the individual level.

While studying the joint behavior of hedging and LCP invoicing in the data, we show that both are correlated with the size of the firm: Large firms are more likely to invoice exports in local currency *and* to hedge against exchange rate risk. The first relationship is consistent with Goldberg & Tille (2009) who explain the link in terms of bargaining power in the choice of an invoicing currency. The size-hedging link is consistent with Dohring (2008), who explains it by hedging involving a fixed cost that large firms are more likely to be willing to pay. In our data, when we control for the instrumented hedging variable, the impact of the firm's size on the probability to adopt a LCP strategy decreases. This result offers an alternative explanation for the size-LCP invoicing relationship found in the literature. Namely, it suggests that large firms have better access to financial hedging, which lets them adopt LCP strategies without bearing the exchange rate risk.

Last, the paper is connected to the recent literature on firm heterogeneity and pass-through. Berman, Martin & Mayer (2011) show that large French exporters increase more their markups after an appreciation of their currency. They find such heterogeneity within sector, for exports to a given destination. They propose several explanations consistent with this fact. All are related to the curvature of the demand function which turns out to be heterogenous because small and large firms have different market powers or react differently to (additive) distribution costs. Our paper suggests a complementary explanation for heterogeneity in pass-through, namely the heterogeneity in invoicing currency. If their prices are set in local currency, large firms have no incentive to adjust *consumer* prices to ER fluctuations. Since their prices in local currency are fixed, their markups adjust one to one to ER changes. In contrast, small firms, pricing in producer currency, have less incentives to adjust perfectly their markups.[6]

The rest of the paper is organized as follows. Section 2 presents our data and the way we selected our sample. In section 3, we present a number of stylized facts on invoicing and hedging choices. Section 4 then uses a probit framework to study the determinants of local currency invoicing. Besides standard determinants, we test for the impact of hedging on LCP invoicing in an IV regression. Finally, Section 5 discusses the aggregate implications of our findings.

[6]This result suggests that large firms have more volatile markups and thus face more uncertainty. However, we show that large firms are able to hedge against ER risk. Instead, such strategy (LCP + hedging) limits two types of risk. First, it dampens the risk to lose competitiveness in the foreign market due ER changes. Second, the hedging dampens the risk linked to markups fluctuations.

2. Data

The dataset used in our empirical analysis is based on a survey collected within the European Firms in a Global Economy (EFIGE) project. The database consists of a representative sample of about 15,000 firms of more than 10 employees from 7 countries (Austria, France, Germany, Hungary, Italy, Spain, and UK). This survey provides detailed information on the structure of the firms, their workforce, market and pricing, their internationalization, as well as information on investment and innovation. Most of questions concern the firm's activity during the year 2008.

The questionnaire includes more than 150 items. The firm characteristics used in this paper are the followings. For each firm, we know the 4-digit industry classification, the ownership structure, the turnover, the share of foreign markets in total sales, the number of destination markets, and the distribution of exports across 8 areas (EU15, rest of EU, non EU European countries, China and India, other Asian countries, USA and Canada, rest of America, and rest of the world). One question is devoted to the currency denomination of exports. To refine our analysis, we further use items concerning the financial and non financial hedging of firms against exchange rate fluctuations, their pricing strategy, and the structure of the market in which they operate. Details on these variables are provided in Tables 1 and 2.

There are 14,911 firms in the initial database. However, we do not use the entire sample of firms for our analysis. First, firms that declare that they do not export, or report a value of exports of 0 euro, or a number of destinations of 0 are dropped. We further delete 103 firms with inconsistent responses (share of exports greater than 100 for instance). Firms that do not reply to the question on invoicing currency are also dropped. Finally, we focus on euro countries and drop observations for UK and Hungary. With this trimming we keep 6,278 observations.

Firms are asked how they deal with exchange rate (ER) risk. A possible answer is that the question is not applicable, as the firm only sells to countries with the same currency as her domestic market. We classify these firms as facing no ER risk. Figure 1 shows the share of firms exposed to exchange risk movements. Statistics are weighted by the probability to be in the sample (first bar) and by the probability to be in the sample multiplied by firm size. The weighting procedure is described in the next paragraph. We see that large firms are more exposed to ER risk. This is a consequence of their openness to non-euro destination countries. Since we are interested in the behavior of firms facing ER risk, we restrict our analysis to firms replying they face such risk. The final dataset contains 3,013 observations, for 5 countries: Austria (99 obs.), France (770 obs.), Germany (630 obs.), Italy (844 obs.), and Spain (670 obs.).

– Figure 1 about here –

The survey also displays the relative and absolute sample weights of firms. These weights

indicate the probability of firms to be sampled. The absolute weights are computed as the ratio of the number of firms in a strata over the number of firms from this category in the survey. The relative weights are absolute weights multiplied by the weight of the strata in the economy. Strata are defined by country, class size (10-49, 49-249, more than 249 employees), and NACE 1-digit sector. In our description of firm behavior, we present three types of facts. First, the facts for the representative firm, obtained using absolute sample weights. Second, we present the facts obtained using the sample weights multiplied by the firm's turnover. This takes the relative size of firms into account.[7] Third, we present the facts using the sample weights multiplied by the firm's turnover and her exports to turnover share, to account for the relative size of firms in exports. Comparing the results for the representative firm with size weighted results allows us to compare the behavior of small and large firms. In the econometric analysis, all regressions are weighted by the inverse of the probability to be in the sample.

3. Facts

3.1. Currency choice

Firms were asked in which currency they set their price in foreign markets. EMU firms had the choice between the Euro and a foreign currency. If "euro" was chosen, we classified the firms as doing PCP, if "other" was chosen, firms were classified as doing "LCP". Figure 2 displays results for each country in our sample. Three interesting facts emerge from this Figure. First, results are very similar across countries. Second, the vast majority of firms set their export prices in euro: from 88% in Austria to 95% in France (first bar, representative firm). Third, large firms - both in terms of total turnover and in terms of total exports - use relatively less the euro as an invoicing currency.

– Figure 2 about here

At first sight, the result that EMU firms disproportionatly use the euro as an invoicing currency goes against previous findings in the literature. Kamps (2006) thus finds that, in 2004, only 60% of EMU exports are invoiced in euro. In the ECB (2011) report on the internationalization of the euro, the proportion is equal to 68% for EMU exports to non euro area countries. These are aggregate figures. As such, they should be compared to our size-weighted statistics which are more in line with ECB figures. We see that accounting for firm size, about 75% of exports are invoiced in euro (70% for Italy, 82% for Germany). It is worth noting that our weighting procedures is based on firms size and total exports, while ECB figures are for exports to non euro-area countries. Since large firms probably export relatively more to non euro-countries, the weight on those

[7]Note that we do not have access to turnover at the firm level. Instead, we use Amadeus and compute by country, 4-digit nace sectors, and intervals of firm turnovers, the average size of firms in these bins. We then match our database with figures on turnover according to those three dimensions.

firms should be *relatively* larger and the share of euro exports may decrease even more for results to be comparable with the ECB's. This first fact shows how aggregate figures hide the important micro heterogeneity that prevails among exporters in the use of the euro for exports.

3.2. Geography, industry, and competition

The large propensity of firms to invoice in euro found in Figure 2 may be due to important geographical composition effects. For instance, it might be that only large firms export to the US and use US dollars, which may explain why large firms are more likely to invoice in LCP. To take this possibility into account, we focus on 4 areas: European Union, North America, Asia, and the rest of the world. We plot the share of PCP for firms whose export share to one of these areas is greater than the firm at the 75^{th} percentile. Comparing the 4 panels of Figure 3, we see that firms exporting relatively more to the EU use PCP in a greater proportion (0.96) than those exporting more to North America (0.85), Asia (0.86), or the Rest of the World (0.84). However, among firms exporting relatively more to a given area, one finds again that large firms are less likely to price in euro.

– Figure 3 about here –

Figure 4 explores another type of composition effect, namely industry composition. It may be that large firms belong to concentrated industries that feature a certain type of currency invoicing (the petroleum industry extensively uses US dollars for instance). We do not observe a strong heterogeneity across sectors. Textile and leather are sectors relying the less on the euro as an invoicing currency. Nonetheless, 88% of exports in these sectors are invoiced in euro. Moreover, within sectors, we find again that large firms are more likely to do LCP. The gap between small and large exporters can be large. For instance, in the plastic sector, 96% of firms invoice exports in euro, and the proportion drops to 60% once the size of firms is taken into account.

– Figure 4 about here –

In Figure 5, we investigate another potential explanation for our results. It might be that firms adopt the currency of their main competitor. If large firms have competitors outside the euro area, they may well decide to follow their competitors and adopt their currency - to limit adverse competitive effects of exchange rate fluctuations. In the survey, firms have to give the nationality of their main competitors. We consider as domestic competitors the ones located in the same country or in another EU15 country. For the average firms, no significant result emerge. The use of PCP seems independent from the origin of the competitor. Once again we find that large firms, facing either domestic or foreign competition are more likely to do LCP. This gap is especially strong when the main competitor is located outside the EU15.

– Figure 5 about here –

3.3. Hedging

In the survey, firms are asked whether they hedge against exchange rate risk,[8] whether they use financial derivatives (for instance for foreign exchange rate risk protection), whether they have an export insurance or financed part of their trade through trade credit. Figure 6 gives the proportion of firms using one of these instruments and the relative propension of large firms to use them. Hedging seems widespread in EMU countries: between 25 and 50% of firms reply that they do hedge against exchange rate risk. Trade insurance is also used by a substantial share of firms, from 25% in Italy to 40% in Austria. The use of derivatives and trade credits is much less developed: below five percent, with Spain and Italy being exceptions with 20% of firms using such instruments. Those instruments - in particular hedging and trade insurance - are used in a larger proportion by the largest exporters.

– Figure 6 about here –

Figure 7 links the invoicing currency to the use of the different instruments described above. We see that within countries, exporters using hedging or financial derivatives are more likely to price in a foreign currency. This is consistent with the view that hedging and LCP are complementary.

– Figure 7 about here –

4. Determinants of currency choice

4.1. PCP and firms 'size

Heterogeneity in invoicing currency choice is a key feature of the stylized facts presented in Section 3. In particular, large firms tend to adopt LCP more often than smaller ones. This section uses probit estimations to study those facts in more details. We also propose an explanation based on the hedging opportunity of large firms.

Table 3 shows the negative impact of the size of firms on their decision to price in euro. The table displays the results of probit regressions explaining the likelihood that the firm price in PCP by the turnover of the firm and other control variables. Namely, all regressions include controls for the country in which the firm is located and its main sector of activity. Since the impact of the turnover is likely to be non linear, we estimate its impact non parametrically, considering intervals of turnover. The first column of Table 3 shows that larger firms are less likely to price in Euro. The coefficients on turnover intervals are decreasing and become negative and highly significant for firms with a turnover above 50 million euros. To see how robust this determinant is, we present in column 2 the probability to do PCP given the size of the firm, measured through the

[8]Firms do not precise whether they use financial or operational hedging. We interpret a positive answer as evidence of financial hedging.

number of employees. This second estimate confirms the previous results. Large firms, both in terms of employment and in terms of turnover, are more likely to price in another currency than the Euro, in comparison with smaller firms. The third column introduces the share of exports in total turnover as an additional control variable. The coefficient is negative ad significant which shows that conditional on turnover, firms exporting more are less likely to use the euro as an invoicing currency. In the last column, we introduce a new dummy equal to one for firms with a turnover greater than 50 million euros. This alleviates the presentation and does not change the results, neither quantitatively nor qualitatively.

– Table 3 about here –

In Table 4, we introduce different potential determinants of invoicing decisions found in the previous literature. In the first column, we introduce variables measuring the distribution of firm exports across different geographic areas. This takes into account the possibility that heterogeneity in invoicing choices in fact explains by the geographical distribution of firms' exports. Estimation results suggest that LCP is more often chosen by firms exporting a significant quantity of goods in Asia and in America. In the second column, we add a dummy equal to one if the firm is part of multinational group. Multinational activities offer the firm with the opportunity to manage her exchange rate exposure through operational hedging. One should thus expect those firms to find it less costly to price in local currency. This is indeed the case in our data since the coefficient on this variable is negative and significant. It is worth noting however that, in non reported results, we show that once we introduce the different turnover intervals, the coefficient on this variable is no more significant. In column 3, we add the number of destinations served by the firm based on the intuition that firms selling in a larger number of destinations are less exposed to one specific exchange rate risk and should thus use this diversification opportunity to price in LCP. This variable has no significant impact of the invoicing currency, however. Finally, in the last column, we use a dummy equal to one if the firm reports that her price is mainly determined by the market. The coefficient is negative and significant suggesting that prices determined on world markets are more likely to be set in another currency as the euro, probably the dollar. This is consistent with anecdotal evidence, for the oil industry for instance.

– Table 4 about here –

In Table 5, we investigate the correlation between hedging and currency choice. In each of those regressions, we use as controls exporter country dummies, sector dummies, and the distribution of firm exports to 7 geographic areas. In columns 1-4 of Table 5, different variables related to hedging are introduced. We see that firms self-reporting as hedging against exchange rate risk are less likely to use the euro as an invoicing currency (column 1). In the second column, we use a dummy equal to one if the exporter reports using derivatives. Firms using such instruments are also more likely to use foreign currency to

invoice their exports. In columns 3-4, we show that neither the dummy for firms using trade credit nor the subscription of trade insurances have an impact on the choice of the invoicing currency. Finally, in the last column, we introduce the four previous instruments together. The impact of hedging is still negative and highly significant, the coefficient on derivatives is negative and significant at 5%. The effect of the two other instruments are not significantly different from zero.

– Table 5 about here –

Then, we try to go beyond the correlation between invoicing currency and hedging, and investigate the causal impact of hedging on the currency choice of exporters. In doing so, we develop an instrumental variable strategy. We propose two specifications using respectively two and four instruments. The first two instruments are a dummy equal to one if the firms has subscribed to a trade insurance, and a dummy equal to one if the firm self reports she is lacking organizational resources. We use trade insurance based on evidence for France that firms subscribing to trade insurances are proposed hedging instruments against ER risk.[9] As shown in Table 5 trade insurance does not impact currency choice. The second instrument is a variable equal to one if the firm reports that one of the main factors preventing her growth is the lack of management and/or organizational resources. We assume that firms with management concerns have less ability to hedge against ER risk but this is not correlated with their invoicing choice. The other two instruments are the number of destinations served by the firms (linked to the decision of hedging as shown by Allayannis, Ihrig & Weston (2001)) and a dummy equal to one if part of firms' trade is financed through trade credit.

In the first column of Table 6, we show that none of those instruments has a significant and direct impact on the choice of the invoicing currency. In columns 2-3, we present the first and second stages of an instrumented probit, in which we explain the use of the euro by the size of the firm, different sector and country characteristics and the use of hedging. Here, the hedging variable is instrumented by the use of a trade insurance and a measure of the lack of organizational resources of the firm. In the first stage (column 3), we find that large firms, firms using trade insurance and firms that do not lack of organizational resources are more likely to hedge against exchange rate risk. In the second stage (column 2), we find a negative and significant impact of the instrumented hedging variable on the decision to use the euro as an invoicing currency. The coefficient is less precisely measured, but larger, than without instrumentation (column 1). Columns 4-5 reproduce the same exercise but adding two instruments (trade credit and the number of destinations) to the specification. Once again we find a negative and significant causal impact of hedging on the decision to use the euro, once endogeneity is taken into account.

– Table 6 about here –

[9] See www.coface.fr.

These results suggest that, controlling for size, firms with better access to hedging instruments are less likely to price in euro. Since 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 her invoicing behavior. It is indeed the case that, once hedging is taken into account, the coefficient on the firm's size decreases, in absolute value (compare Table 4 and Table 5). Thus, the size-invoicing relationship in part explains by large firms having better access to financial hedging. This opportunity to hedge against exchange rate risk lets them invoice in local currency without facing a risk on their unit margin. This explains why their propensity to invoice in local currency is larger. However, the size-invoicing relationship does not completely disappears once hedging is taken into account. Other economic mechanisms, for instance related to the relative strengths of the producer and the consumer in the bargaining determining the invoicing currency, may be at play in the data and explain this relationship.

5. Conclusion

The paper offers three new results. First, large firms in EMU countries are less likely to use the euro than smaller ones. Second, large firms and firms doing LCP are more likely to hedge against ER risk. Third, hedging opportunity increases the propensity of firms to do LCP.

These new facts open the way for future empirical and theoretical research avenues. First, more empirical evidence are needed to confirm the link between invoicing currency, firm heterogeneity and hedging. Our preliminary results however suggest that theoretical models should consider firms' access to hedging when modeling the choice of invoicing currencies. Recent results on the heterogeneity in pass-through across firms within an industry might also be read in light of the evidence we provide that firms have heterogenous behaviors when it comes to deciding on the invoicing currency. Last, the results on hedging have important implications for the costs of ER fluctuations. Actually, since large firms tend to hedge against ER fluctuations, it seems that ER risk is not born solely by one of the two parties involved in export transactions, as usually assumed by the literature. Instead, the risk seems diversifiable through financial markets.

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Figure 1 – Share of exporters facing ER risk

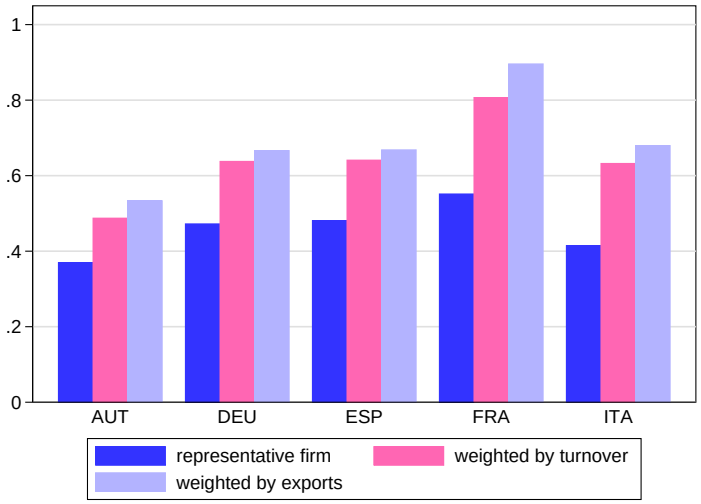


Figure 2 – Producer Currency Pricing

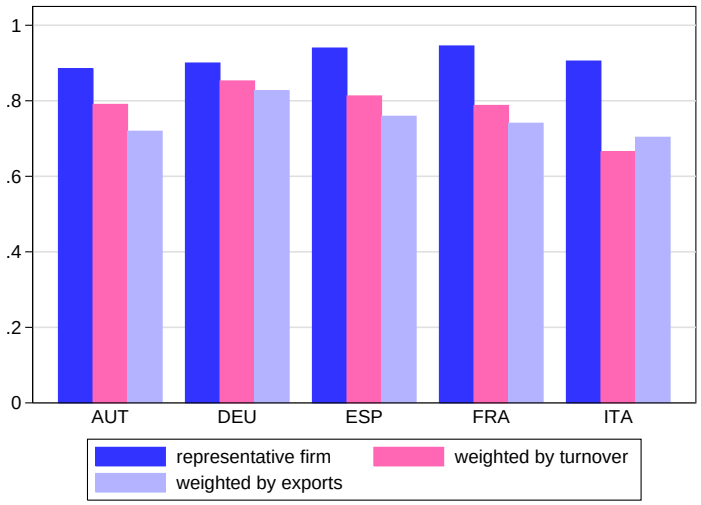
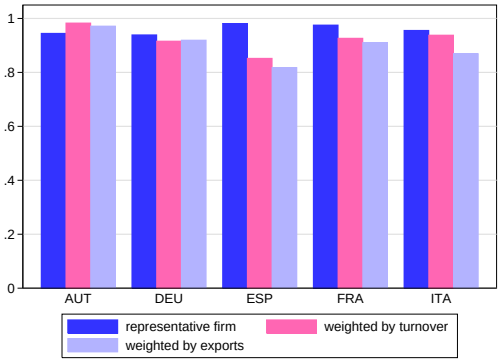
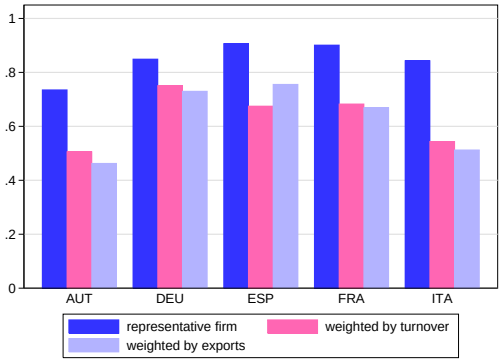


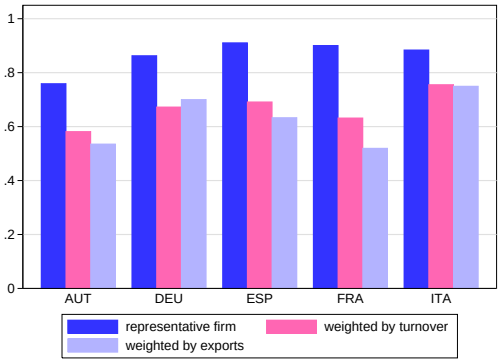
Figure 3 – PCP and Geography of Firms' Exports



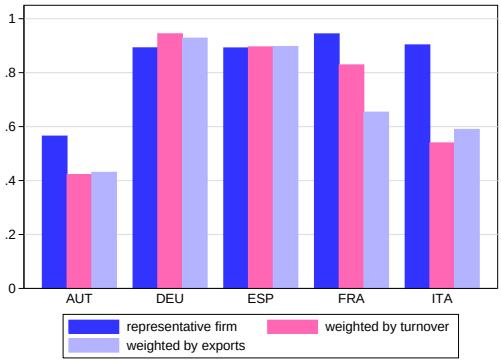
Export to EU $> 90\%$



Export to North America $> 10\%$



Export to Asia $> 10\%$



Export to Rest of the World $> 15\%$

Thresholds are defined as the 75^{th} percentile of the share of exports toward an area.

Figure 4 – Producer Currency Pricing, by Sector

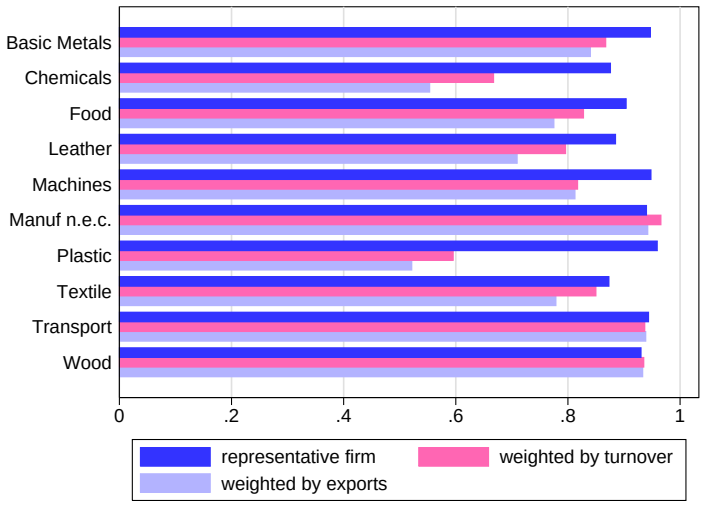


Figure 5 – Producer Currency Pricing

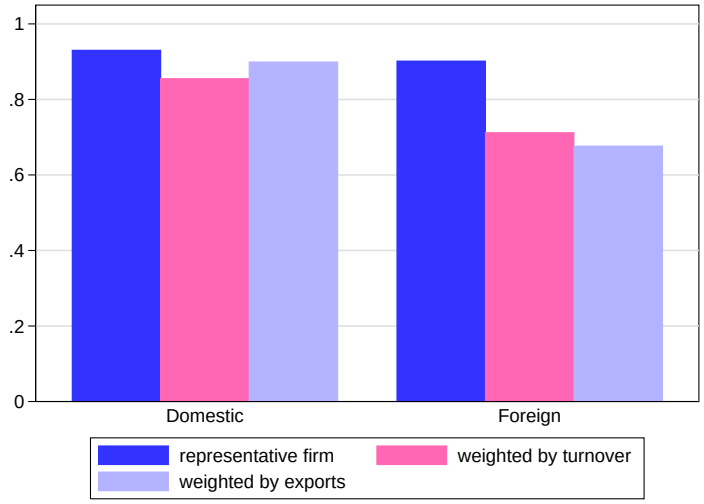


Figure 6 – Use of Hedging, Derivatives, or Trade Finance

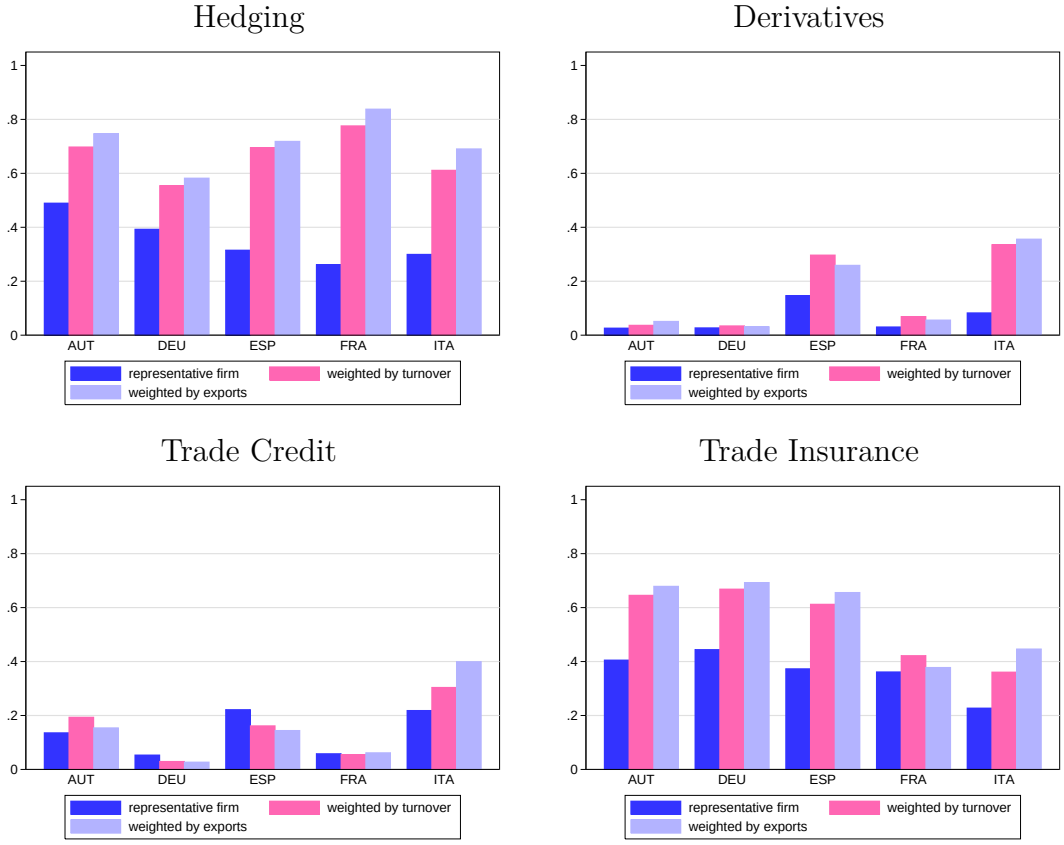


Figure 7 – Hedging and PCP

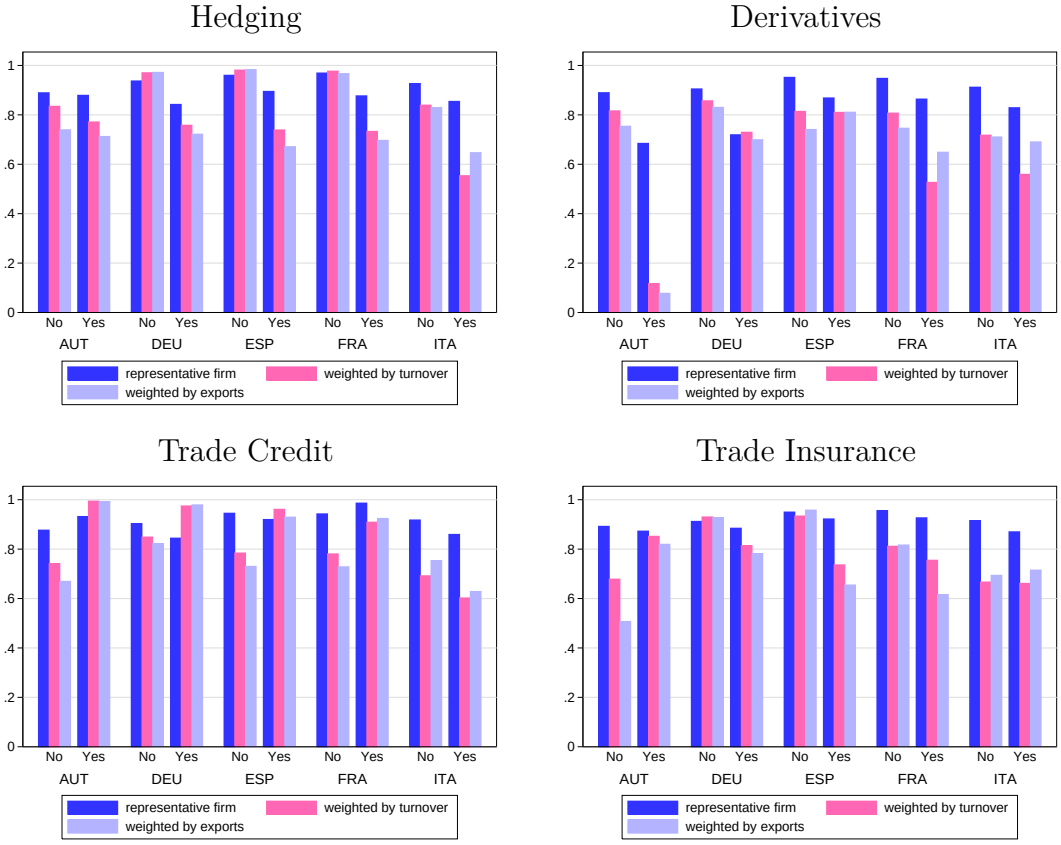


Table 1 – Description of variables

Questions	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
In which currency do you set your prices in foreign countries?	1- Euro 2 - Domestic[10] 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.**
Does your firm belong to a group?	1- Yes, National 2- Yes, Foreign 3- No	**Dummy multinational**: 1 if answer = 1 or 2

Table 2 – Description of variables

Questions	Answer	Variable
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**
Has your firm benefitted/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

Table 3 – Invoicing currency choice

	Probit regression. Euro Main currency == 1			
	(1)	(2)	(3)	(4)
Sales 1-2 M	0.13		0.10	
	(0.567)		(0.397)	
Sales 2-10 M	-0.07		-0.07	
	(-0.342)		(-0.312)	
Sales 10-15 M	-0.06		-0.02	
	(-0.257)		(-0.086)	
Sales 15-50 M	-0.37*		-0.32	
	(-1.658)		(-1.407)	
Sales 50-250 M	-0.58***		-0.50**	
	(-2.608)		(-2.200)	
Sales +250 M	-0.97***		-0.92***	
	(-3.807)		(-3.538)	
20 - 49 employees		-0.07		
		(-0.662)		
50 - 249 employees		-0.38***		
		(-3.452)		
+250 employees		-0.68***		
		(-5.630)		
Share of exports			-0.67***	-0.71***
			(-5.074)	(-5.427)
Sales + 50 M.				-0.48***
				(-5.346)
EXP. Cty. DUM	YES	YES	YES	YES
Sector DUM	YES	YES	YES	YES
Obs.	3,011	3,011	3,011	3,011

This table presents the results of a probit regression. The explained variable is a dummy equal to one if the firm invoice exports in euro. The explanatory variables are turnover intervals, employment size intervals, the share of export in total turnover, and a dummy equal to one if the turnover is larger than 50 million euros. Sector and country of origin dummies are introduced in all the regressions. T-statistics computed from robust standard errors are reported under parenthesis. *, **, and *** indicate significance at 10, 5, and 1 percent levels.

Table 4 – Invoicing currency choice

	Probit regression. Euro Main currency == 1			
	(1)	(2)	(3)	(4)
Sales + 50 M.	-0.54***	-0.51***	-0.55***	-0.52***
	(-5.784)	(-5.315)	(-5.783)	(-5.527)
Share of exports	-0.56***	-0.52***	-0.58***	-0.56***
	(-4.031)	(-3.776)	(-3.723)	(-4.040)
Sh. Oth. EU	0.00	0.00	0.00	0.00
	(0.685)	(0.643)	(0.668)	(0.675)
Sh. Row Eur.	-0.00	-0.00	-0.00	-0.00
	(-0.918)	(-0.975)	(-0.904)	(-1.063)
Sh. Chn-Ind	-0.01***	-0.01***	-0.01***	-0.01***
	(-3.114)	(-3.108)	(-3.115)	(-3.079)
Sh. Row Asia	-0.01**	-0.01**	-0.01**	-0.01**
	(-2.398)	(-2.447)	(-2.405)	(-2.531)
Sh. North. Am.	-0.01***	-0.01***	-0.01***	-0.01***
	(-6.134)	(-6.138)	(-6.079)	(-6.299)
Sh. South Am.	-0.01***	-0.02***	-0.02***	-0.01***
	(-6.048)	(-6.095)	(-6.075)	(-5.982)
Sh. Row	-0.00	-0.00	-0.00	-0.00*
	(-1.503)	(-1.584)	(-1.520)	(-1.721)
Multinational		-0.23**		
		(-2.032)		
# dest.			0.01	
			(0.329)	
Market				-0.21**
				(-2.563)
EXP. Cty. DUM	YES	YES	YES	YES
Sector DUM	YES	YES	YES	YES
Obs.	3,011	3,011	3,011	3,011

This table presents the results of a probit regression. The explained variable is a dummy equal to one if the firm invoice exports in euro. The explanatory variables are a dummy equal to one if the turnover is larger than 50 million euros, a dummy equal to one if the firm is part of a multinational group, the log of the number of destinations, a dummy equal to one if the prices of the firm are set on world markets, and the share of exports directed to EU15, rest of EU, rest of Europe, North America, South America, China, India, Rest of Asia, and the rest of the world. Sector and country of origin dummies are introduced in all the regressions. T-statistics computed from robust standard errors are reported under parenthesis. *, **, and *** indicate significance at 10, 5, and 1 percent levels.

Table 5 – Currency choice and Hedging

	Euro Main currency == 1				
	(1)	(2)	(3)	(4)	(5)
Sales > 50 M.	-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)
Market	-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 Insur.			-0.11		-0.04
			(-1.347)		(-0.458)
Trade Credit				-0.14	-0.06
				(-1.327)	(-0.545)
EXP. Cty. DUM	YES	YES	YES	YES	YES
Sector DUM	YES	YES	YES	YES	YES
IMP. area distrib.	YES	YES	YES	YES	YES
Obs.	3,011	3,011	3,011	3,011	3,011

This table presents the results of a probit regression. The explained variable is a dummy equal to one if the firm invoice exports in euro. The explanatory variables are a dummy equal to one if the turnover is larger than 50 million euros, the share of exports, dummies for the use of hedging instrument, financial derivatives, trade insurance, or trade credit, the share of exports directed to EU15, rest of EU, rest of Europe, Noth America, South America, China, India, Rest of Asia, and the rest of the world, and sector and country of origin dummies. T-statistics computed from robust standard errors are reported under parenthesis. *, **, and *** indicate significance at 10, 5, and 1 percent levels.

Table 6 – Currency choice and hedging (IV)

	(1) PCP -	(2) PCP 2^{st} stp	(3) Hedg. 1^{st} stp	(4) PCP 2^{st} stp	(5) Hedg. 1^{st} stp
Sales + 50 M.	-0.42***	-0.32**	0.23***	-0.31**	0.22***
	(-4.308)	(-1.966)	(7.978)	(-2.039)	(7.603)
Sh. Exports	-0.49***	-0.36*	0.23***	-0.36*	0.18***
	(-3.040)	(-1.860)	(6.740)	(-1.889)	(4.670)
Market	-0.21***	-0.21**	0.01	-0.21**	0.01
	(-2.588)	(-2.541)	(0.559)	(-2.539)	(0.659)
Hedging	-0.37***	-0.74*		-0.74*	
	(-4.544)	(-1.678)		(-1.794)	
Trade Insur	-0.04		0.18***		0.16***
	(-0.482)		(8.514)		(7.549)
Trade Credit	-0.08				0.10***
	(-0.768)				(3.369)
Mgmt	0.22		-0.05*		-0.05**
	(1.607)		(-1.849)		(-2.022)
# dest.	0.03				0.02*
	(0.810)				(1.723)
EXP. Cty. DUM	YES	YES	YES	YES	YES
Sector DUM	YES	YES	YES	YES	YES
IMP. area distrib.	YES	YES	YES	YES	YES
Obs.	3,011	3,011	3,011	3,011	3,011

This table presents the results of a probit regression. The explained variable is a dummy equal to one if the firm invoice exports in euro or a dummy equal to one if the firm hedges against ER risk. The explanatory variables are a dummy equal to one if the turnover is larger than 50 million euros, the share of exports, the log of the number of destinations, dummies for the use financial derivatives, trade insurance, or trade credit, a dummy equal to one if the reports lacking organizational or management resources, the share of exports directed to EU15, rest of EU, rest of Europe, Noth America, South America, China, India, Rest of Asia, and the rest of the world, and sector and country of origin dummies. T-statistics computed from robust standard errors are reported under parenthesis. *, **, and *** indicate significance at 10, 5, and 1 percent levels.