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Network-adjusted market share and the currency denomination of trade

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Abstract

The currency denomination of trade has been shown in many recent contributions to have far-reaching effects on different macroeconomic phenomena, such as inflation and the international transmission of nominal shocks. In this work, we apply a novel index of bargaining power, which incorporates the network dimension of trade and brings fresh evidence as to the relevance of network-related features (and implied bargaining power) in the choice of invoicing currency, which has received relatively little attention in the empirical literature, so far. By using a highly disaggregated, almost transaction level, data set of Italian imports and exports, we contribute to the existing empirical literature by documenting a very significant impact of trade network asymmetries, captured by our adjusted index of market share, on the choice of an invoice currency.

KEYWORDS

bargaining power, invoice currency, market shares, network structure

1 | INTRODUCTION

The aim of this study was to provide evidence of a key role played by relative network positions of trade partners in shaping the choice of an invoice currency. We adopt a new index of sector market share (that captures bargaining power) for exporters and importers, in directed and weighted networks, as a proxy for the outside options of the players involved in the negotiation of an invoice currency.

Our aim was to understand whether the relative positions of exporters and importers in the trade network (defined by the trade communication structure) play a role in the choice of an invoice currency.

We add to the literature by providing new evidence showing that the currency determination is a complex process where the bargaining opportunities play a role. In doing so, we move well beyond the simple use of the sector market share as we consider the network structure of trade with the other trading partners.

Previous works, which only control for the global country sector market share (defined as the ratio between the country export/import of a commodity over the global export/import of that commodity), cannot fully account for the asymmetries induced by trade structures that restrict pairwise meetings. By resorting to a new, suitably adjusted index of market share, we will account for the fact that exporters do not always enjoy a free and costless access to every market in every country, as well as for the separation of national markets because of the different local rules.

With highly disaggregated Italian export and import customs data for the year 2010, we document a significant impact on the invoice currency decision for our adjusted index of market share. Importers (exporters) with a stronger position within the network, as implied by the corresponding network-adjusted market share, tend to price their traded goods in the local (producer) currencies. This is true even after controlling for the standard global sector market shares, and the effect is robust to the inclusion of geographical characteristics and many other relevant controls.

2 | LITERATURE

The choice of an invoice currency has been shown by many scholars to play a critical role in the new open economy macroeconomic literature. The exchange rate volatility (Devereux & Engel, 2002) and the impact of exchange rate movements on the economy are influenced by the currency denomination of trade (Chari et al., 2002; Devereux & Engel, 2003; Engel, 1999, 2002, 2003; Obstfeld, 2002). Invoicing in the producer (PCP) or importer (LCP) currency influences the pass-through of exchange rate changes to import prices. Therefore, as argued by Corsetti and Pesenti (2005), since the optimal monetary policy depends on the degree of pass-through,[1] it also depends on the invoicing regime.

From a microeconomic perspective, many theoretical models have been proposed to explain the firm's choice of an invoice currency and its implications at a macroeconomic level.

Bacchetta and van Wincoop (2005) highlight the importance of strategic interactions among firms in the process of the currency denomination decision by finding that exporters with greater industry market share and producing differentiated goods are more likely to price in their currencies. In the Bacchetta and van Wincoop (2005) theoretical model, the choice of invoicing currency rests solely with the exporter, who consider the price elasticity of the importer's demand in choosing the invoice currency.

[1]If all the exporting firms use PCP, then the Corsetti and Pesenti (2005) model simplifies into a dynamic version of Obstfeld and Rogoff (2000) model and the optimal monetary policy replicates the flexible-price equilibrium, while if the price is set in the local (importer) currency, then the national welfare is maximised when exporters' revenues are stabilised in their own currencies and a fixed exchange rate is preferred.

The assumption of a unilateral setting of the invoice currency was criticised in the empirical works by Friberg and Wilander (2008) and Takatoshi et al. (2010). The former surveys a representative panel of Swedish firms to understand the determinants of the currency denomination of trade. One of the main findings is that both price and invoice currency are determined by a process of negotiation between producer and customer. In particular, they found evidence that negotiations include both the price and the currency denomination of trade. The authors found instances when the currency used to quote the price differed from the currency used to invoice the transaction. The survey results show that in approximately 2/3 of these transactions this, perhaps unusual, request originated from the importing firm. Additionally, the study finds that firms in importing countries often request invoicing in a currency other than the Swedish kronor as a result of illiquid kronor currency markets in their home country. Transaction size, the exporting market dimension, product differentiation and firm's dimension all play a significant role in the invoice currency choice, while the competitors' currency denomination decision, the availability of financial instruments and exchange rate transaction costs are deemed unimportant.[2] Takatoshi et al. (2010), surveying Japanese firms, highlight the role of the structure of the firm's supply chain and the destination of the firm's final sales in the invoice currency decision. They find that local currency invoicing is prevalent in exports to developed countries, where the importers face severe competition in the local markets. However, Japanese firms that produce highly differentiated products or have a dominant share in global markets tend to denominate trades in yen (producer currency pricing), even in exports to developed countries. Another finding is related to the use of a vehicle currency: Japanese firms that have shifted production to Asian countries invoice their products to these Asian countries in US dollars as long as the final destination market in the United States.

More recently, Corsetti et al. (2020) examine the universe of large UK exporters (those with more than 100,000 GBP of exports per year). They find that while aggregate currency shares of invoicing remain relatively stable year-over-year, individual firms often use different invoicing currencies to the same destination country of the same product. The fact that individual UK exporters often change their currency invoicing decision suggests that demander-specific features, which are likely revealed during a negotiation, play some part in the currency denomination of individual trade transactions. This builds off of the results in Fabling and Sanderson (2015), which shows that the choice of invoicing currency is often heterogeneous at the firm level in New Zealand exports. Specifically, the study reports that firms with a greater extensive or intensive margin of trade are more likely to invoice exports in local currencies or vehicle currencies, while the producer's currency is more likely to be used when the exporter is foreign-owned or selling a more differentiated good.

Goldberg and Tille (2013) propose an exporter–importer bargaining model of trade, where importers and exporters negotiate over the allocation of exchange rate risk through the choice of both price and the invoice currency, accounting for the counterpart's outside option. The implications of this model are complex as it has no closed solution. In this setting, the share of specific exporters and importers in each other's total profits has a substantial impact on effective bargaining weights, prices and exchange rate exposure. This impact is not limited to specific exporter–importer pairs but also affects the aggregate values of prices and exposure. Devereux et al. (2017) developed a model of monopolistic competition with heterogeneous firms, finding that exchange rate pass-through and producer currency invoicing are non-monotonic, but possess a U-shaped relationship with respect to the export market share, while they are monotonically declining in the importing firms' market share. These theoretical implications are supported by some

[2]Some of their results do not seem to be supported by current empirical evidences (Witte and Ventura, 2016).

empirical findings on a unique Canadian import data set and confirm the role of importer characteristics on the currency invoicing decision.

While Xu et al. (2019) lack access to data regarding the currency denomination of trade, the results of their Columbian import and export exchange rate pass-through confirm that bargaining power impacts the degree of pass-through. By using a matched Columbian importer–exporter, the study examines the bilateral bargaining of exporters versus importers using three different measures of bargaining power as a measurement of reliance on their transaction partner. The results show that the effect of Columbian exporting bargaining power is not consistent; there is, however, higher exchange rate pass-through when importing Columbian firms have greater bargaining power. This implies some role for negotiation and bargaining power held by importing firms.

Alternative explanations of the choice of an invoice currency are proposed by Engel (2006) and Gopinath et al. (2010). The former predicts that the exporting firms are more likely to invoice in their currency if that currency has a lower sensitivity to price shock. If export prices cannot be adjusted in response to shocks, they should be set in the local currency. The latter developed an endogenous currency choice model, where firms that adjust prices less frequently are more likely to invoice in the producer currency.

This work is also related to the findings of Auer and Schoenle (2016). Firms' reactions to changes in competitor prices are equally important as changes in their own cost in explaining the industry-wide equilibrium pass-through rate. Changes in the competitor prices are intuitively captured by changes in the importer market share and should be thus related to the choice of an invoice currency. Other empirical works underline the role of macroeconomic stability on the invoice currency decision, as in Devereux et al. (2004), or the impact of transaction costs in exchange rate market, as in Portes and Rey (1998) or Devereux and Shi (2013). More determinants of the invoice currency were found at the micro-level, such as the 'coalescing effect' (Goldberg & Tille, 2008) or the firm 'information effect' (Friberg & Wilander, 2008; Takatoshi et al., 2010). Faudot and Ponsot (2016) emphasise the symmetrical use of the US dollar as both a dominant vehicle currency and a dominant currency of international debt issuance for lesser developed countries. Liu and Lu (2019) confirm the importance of financing as a determinant of invoicing currency. Specifically, when an importing firm is located in a country with greater financial development, that Columbian exporters are more likely to invoice in the local currency. Invoicing in local currencies is particularly likely when small Columbian exporters are more reliant on foreign financing.

Gopinath and Stein (2021) take many of these empirical results and build a model to help explain how a dominant currency maintains its supremacy over other currencies. Specifically, the authors use five stylised facts about invoicing currency, banking liabilities, corporate borrowing, central bank reserves and violations of uncovered interest parity. Taken together, these five stylised facts show why the US dollar has a dominant position as both an invoicing currency and a lending/borrowing currency. The authors highlight the 'exorbitant privilege' of the US dollar; greater volumes of US dollar-denominated trade increase the demand of importers for safe US dollar deposits. Safe and plentiful US dollar bank accounts can then incentivise greater US dollar trade invoicing.

Our work contributes to the growing literature on the determinants of currency invoicing and the new theoretical models of currency choice in several ways: it brings new, though indirect, support to the view that the currency choice is the result of a bargaining process, where the position in the trade network of both the importer and the exporter plays a role. It presents a new index of network-adjusted market share, which accounts for the network structure of trade, and uses it as a key explanatory variable in the empirical representation of invoice currency choices. It also shows that this index has a larger explanatory power than the standard global sector market shares. Lastly, we do this by using highly disaggregated Italian trade data, almost at transaction level.

The remainder of the paper is organised as follows: Section 3 provides the theoretical underpinnings for the network-adjusted market share index, while Section 4 illustrates data, the empirical model and results. Section 5 concludes, with an eye to possible avenues for future research.

3 | BARGAINING POWER IN TRADE NETWORK

Many authors (among all Devereux et al., 2004, 2017; Feenstra et al., 1996; Goldberg & Tille, 2008, 2016; Kamps, 2006) have proved that global or bilateral sector market shares[3] are key elements in the rate of pass-through and invoice currency decision. The invoice currency has been shown to be determined based on some features of importers and exporters or on the relationship between the chosen currency and local costs. Far too little attention has been devoted to the role of asymmetries induced by the trade network that restricts pairwise meeting. As in cooperative game theory, communication restrictions affect choices and economic output. Calvó-Armengol and Jackson (2004) have shown how network connections shape the labour market outcomes and, in turn, are shaped by them; Chaney (2014) has offered a novel theory of trade frictions, where firms export only into markets where they have a contact, searching for new customers by using their existing network of contacts. In this work, we contribute to this stream of literature, considering a bargaining model of trade where importers and exporters bargain over the invoice currency, selecting the bargaining counterpart among the contacts that are available in their communication network.

To do this, we compute a novel index of network-adjusted market share in weighted and directed network, similar to Calvó-Armengol (2001). The communication network is treated as given (exogenously determined), and the communication linkages are defined by the trading structure, which is a weighted and directed network. Therefore, we assume that exporters and importers of a given commodity can only bargain with trading partners that are already serving the market.

Following Calvó-Armengol (2001), we adapt the Rubinstein–Stähl alternating offers game as in Rubinstein (1982) and Stahl (1972). In this game, pairing members creates value, which must be divided between them. One partner (the proponent) randomly selects an individual (the respondent) among her set of connected partners and makes a splitting offer. The respondent can accept or reject. In the case of a rejection, the respondent becomes the new proposer and her respondent is again randomly selected among her connected partners. The assumptions of the model are that only players that are in direct contact with each other can negotiate together, that simultaneous offers to two different neighbours are not possible and that the pairs of neighbours that bargain at every round are randomly[4] chosen within the network constraints. Therefore, the trading network pins down the set of bargaining possibilities. The unique stationary subgame perfect equilibrium is reached when the proposer concedes to the respondent the discounted

[3]Defined as the ratio between the exported or imported goods and the total world export or import for that good and (Devereux, et al., 2017) as the firm's share in the importing market.

[4]Bargainer selection is not considered here as a strategic issue.

expected payoff that can be achieved by the respondent if she rejects the proposal. At equilibrium, players are indifferent between accepting their share as respondents and acting as a delayed proposer. If the payout to split is equal to one and $\left(\alpha_{ij}; 1-\alpha_{ij}\right)$ is the one-cake proposal made by player i to player j, it can be shown that the equilibrium share is equal to:

$$1-\alpha_{ij}=\delta_j \sum_l \frac{w_{jl}}{W_j^{Out}} \alpha_{jl}, \tag{1}$$

where α_{ij} is the payout of player i, $1-\alpha_{ij}$ is the payout assigned to the respondent j by the proposer i, δ_j is the time discount factor ($\delta_j \in (0,1)$), $\frac{w_{jl}}{W_j^{Out}}$ is the relative weight of the link from j to l over the sum of the outward link of j, and α_{jl} is the payout that player j receives for each l.[5] As shown by Calvó-Armengol (2001, 2002), when the population is homogeneous in time preferences with a common discount factor and the payout to split adds to 1 ($\alpha_{ij}+\alpha_{ji}=1$), at equilibrium all players make the standard division proposal independently of their position in the network, equal to $\left(\frac{1}{1+\delta}, \frac{\delta}{1+\delta}\right)$. When the discount factor is equal to 1, the standard Rubinstein–Stähl partition is recovered.

According to the structure of our game, proposer and associates are randomly drawn from a uniform distribution. All players have the same probability to be chosen, as proponent and respondent are treated equally. Given the communication network, it is easy to compute the expected payoff for each member of the network.[6] These individual payoffs define an allocation rule Y_i describing the ex-ante distribution of payoffs equal to the unique (stationary) expected equilibrium. The allocation rule for each member i is defined by the following equations.[7]

$$Y_i\,(outward) = \frac{1}{N_{outward}} \sum_j \frac{w_{ij}}{W_i^{out}} \alpha_{ij} + \frac{1}{N_{inward}} \sum_j \frac{w_{ij}}{W_j^{in}} (1-\alpha_{ji}) \tag{2}$$

$$Y_i\,(inward) = \frac{1}{N_{inward}} \sum_j \frac{w_{ji}}{W_i^{in}} \alpha_{ij} + \frac{1}{N_{outward}} \sum_j \frac{w_{ji}}{W_j^{out}} (1-\alpha_{ji}) \tag{3}$$

where w_{ij} is the link weight from i to j; $W^{in,out}$, the sum of inward or outward weights; and $N_{inward,outward}$, the total number of inwards or outwards players. The ratio $1/N_{inward,outward}$ captures the probability to be chosen as proposer or respondent. This allocation rule is efficient given that $\sum_i Y_i = 1$.

Supposing that the communication network corresponds to the trade network (all the players are in touch with their trading partners in the network) and assuming that, in the trade network,

[5]The payout proposed by i to j is equal to the weighted average of the payoffs that j may obtain acting as a promoter after rejecting the proposal of i. In a trade network, $\frac{w_{jk}}{W_j^{out}}$ is equal to $\frac{x_{jk}}{TotalExport_j}$, where x_{jk} is the trade flow from country k to country j.

[6]As in Calvó-Armengol (2001), ex-ante payoffs given by the expected equilibrium partition of the bargaining game with random selection of the negotiators define the allocation rule.

[7]More generally, assuming i selects j as co-bargainer with probability p, the allocation rule is $Y_i = \left[\sum_j q_i p_{ij} \alpha_{ij} + q_j p_{ji} \left(1-\alpha_{ij}\right)\right]$, where q is the probability to be selected as bargainer.

the outward player is the producer (or the exporter) and the inward player the consumer (or the importer) of a given commodity (whose index will be omitted for brevity), we can derive Equations (4) and (5) for player i as:

$$Y_i\,(exporter) = \frac{1}{N_{\exp}} \sum_j \frac{z_{ij}}{TotalExport_i}\alpha_{ij} + \frac{1}{N_{imp}} \sum_j \frac{z_{ij}}{TotalImport_j}(1-\alpha_{ji}) \tag{4}$$

and for the consumer (or importer) i as

$$Y_i\,(importer) = \frac{1}{N_{imp}} \sum_j \frac{z_{ji}}{TotalImport_i}\alpha_{ij} + \frac{1}{N_{\exp}} \sum_j \frac{z_{ji}}{TotalExport_j}(1-\alpha_{ji}) \tag{5}$$

where N_{exp} and N_{imp} are the total number of exporters and importers of a given commodity included in the trade network, and z_{ij} is the trade flow from player (country) i to player (country) j. The first term on the right of Equations (4) or (5)[8] represents the payoff, which is equal to the expected flows, of exporter or importer i acting as a proposer, while the second term[9] is the expected flows member i obtains as respondent when he collaborates with the proposer.

Plugging the subgame perfect equilibrium shares when players are homogeneous in time preferences (the standard $\frac{1}{1+\delta}, \frac{\delta}{1+\delta}$ cake division) in Equations (4) and (5), we obtain a measure of the ex-ante payoff expected by player i depending on the player's network position. Setting the discount factor δ equal to 1,[10] and assuming to have only one producer (monopolistic firm) and one representative consumer in each country (one importer per country), we can derive the following allocation rules[11] corresponding to the asymmetric Nash bargaining solution:

$$\phi_i\,(exporter) = \frac{1}{2}\left(\frac{1}{N_{\exp}} + \frac{1}{N_{imp}} \sum_j \frac{z_{ij}}{TotalImport_j}\right) \tag{6}$$

$$\phi_i\,(importer) = \frac{1}{2}\left(\frac{1}{N_{imp}} + \frac{1}{N_{\exp}} \sum_j \frac{z_{ji}}{TotalExport_j}\right) \tag{7}$$

where N_{exp} and N_{imp} are the number of countries exporting and importing the particular good, and $\phi_i\,(exporter)$ or $\phi_i\,(importer)$ is the network-adjusted bargaining power as exporter or importer of country i for that good. These indices capture the asymmetries induced by the geometry of trade network and are related to the number and weights of links of each player. Importantly, these indices, in the special case of homogeneous preferences with discount factors equal to 1, are equivalent to the probabilities that player i is selected as exporter or importer (both as proposer and as

[8] $\frac{1}{N_{exp}} \sum_j \frac{z_{ij}}{TotalExport_i}\alpha_{ij}$ and $\frac{1}{N_{imp}} \sum_j \frac{z_{ji}}{TotalImport_i}\alpha_{ij}$.

[9] $\frac{1}{N_{imp}} \sum_j \frac{z_{ij}}{TotalImport_j}(1-\alpha_{ji})$ and $\frac{1}{N_{exp}} \sum_j \frac{z_{ji}}{TotalExport_j}(1-\alpha_{ji})$.

[10] We focus on the special case where players are indifferent to postpone the agreement (δ is the cost to delay); in this case, the bargaining outcome is independent of the identity of the first proposer.

[11] $\sum_j \frac{z_{ji}}{TotalImport_i}\frac{1}{1+\delta}$ and $\sum_j \frac{z_{ij}}{TotalExport_i}\frac{1}{1+\delta}$ are equal to $\frac{1}{1+\delta}$, given that δ does not vary for each j.

respondent) of a commodity, given the communication network.[12] We can therefore interpret this distinctive index of bargaining power (computed when all players are indifferent to delay the agreement) as a network-adjusted market share. As an attentive reading of expressions (6) and (7) reveals, these indexes balance the overall number of agents (importers and exporters) in the network, with the number of actual connections of a firm/sector and with the relevance of these connections, in terms of percentage of exports/imports covered. All else equal, the network-adjusted market shares will decrease in the number of exporters/importers and will increase in the number and strength of actual trade links.

To better understand why our network-adjusted index differs from the more standard index of market share, apart from the presence of the reciprocal of the number of exporting or importing countries, we may, for example, rewrite (6) as:

$$\phi_i\,(exporter) = \frac{1}{2}\left(\frac{1}{N_{\exp}} + \sum_j \frac{z_{ij}}{TotalImports} * \frac{1}{\frac{N_{imp} * TotalImports_j}{TotalImports}}\right) \tag{6a}$$

where the first term after the summation is the contribution of an exporting transaction to the standard market share, which does not depend on the trading partner, whereas the weight provided by the multiplicative term does depend on the trading partner, and in particular on its relative importance with respect to the overall market. Only when that weight is equal to one does an additional export transaction alter standard market shares in the same way as network-adjusted market shares. Whether an additional export transaction is carried out in a country already part of the trading network or not does not matter for the standard index of market share, but it generally does for the network-adjusted index of market share, unless some kind of symmetry between trade partners is assumed.

We illustrate in the following Figure 1 two examples of trade networks where the number N of exporters equals the number N of importers or, in other words, where all the players are both exporters and importers. In this special case (a fully connected network), the two previous equations simplify into Equations (8) and (9):

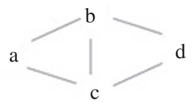
$$\phi_i\,(exporter) = \frac{1}{2N}\left(1 + \sum_j \frac{z_{ij}}{TotalImport_j}\right) \tag{8}$$

$$\phi_i\,(importer) = \frac{1}{2N}\left(1 + \sum_j \frac{z_{ji}}{TotalExport_j}\right) \tag{9}$$

In the example in panel A of Figure 1, high variable trading cost prevents firms in countries a and d from trading. Total exporter market shares (Exporter MS) are equal for all firms in the various countries and do not capture the asymmetry of the trade network. Differently, our index

[12] $pr(i) = \frac{1}{2}\left[\frac{1}{N_i} + \sum_j \frac{1}{N_j}\left(pr_{ji}\right)\right]$ where N_i is the number of proponents; N_j, the number of respondents; and pr_{ji}, the probability that j select i as a respondent.

(a) *Trade network with high variable trading cost*

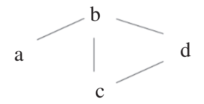


Trading matrix

		Country j				
		a	b	c	d	*Total Export$_i$*
Country i	a	0	30	30	0	60
	b	20	0	20	20	60
	c	20	20	0	20	60
	d	0	30	30	0	60
Total Import$_j$		40	80	80	40	240

Country	ϕ_i (*Exp*)	Exporter MS	ϕ_i (*Imp*)	Importer MS
a	0.219	0.250	0.208	0.167
b	0.281	0.250	0.292	0.333
c	0.281	0.250	0.292	0.333
d	0.219	0.250	0.208	0.167

(b) *Trade network with high variable trading cost and high fixed cost to trade between a and c*



Trading matrix

		Country j				
		a	b	c	d	*Total Export$_i$*
Country i	a	0	100	0	0	100
	b	50	0	25	25	100
	c	0	50	0	75	125
	d	0	50	50	0	100
Total Import$_j$		50	200	75	100	400

Country	ϕ_i (*Exp*)	Exporter MS	ϕ_i (*Imp*)	Importer MS
a	0.188	0.235	0.188	0.118
b	0.323	0.235	0.363	0.471
c	0.250	0.294	0.219	0.176
d	0.240	0.235	0.231	0.235

FIGURE 1 Exporter and importer network adjusted market shares for two hypothetical network structures

of adjusted market shares captures the asymmetry of the communication structure, where firms in countries *b* and *c* have a larger bargaining power, given that they are in contact with more trading partners. The same argument applies to the players in the trade network of Figure 1, panel B. Export market shares are not able to properly measure the impact of trade network asymmetry, which is captured by our index. Similar arguments apply to the importer market shares. Notice that the difference between market shares and adjusted market shares is not uniquely determined by the number of trade partners, but by the overall network structure, as in the case exporters *c* and *d* in Figure 1, panel B.

When the asymmetry of the trade network increases, as is the case where in a relatively balanced market new producers enter the market or importers exit the market (consumer concentration), the value of market share and network-adjusted market share can deeply diverge. This is shown in Figure 2, where market shares and network-adjusted market shares are computed for two different goods exported by firms in the United States. We clearly observe a negative correlation for the two different indices, after China began to open its economy, entering GATT in 1986. Notice that global exporter market shares for the two sectors do not fully account for the increasing bargaining power of firms in competing countries. Another comprehensive example about the incomplete information given by global market shares is when an exporter absorbs market shares of firms operating in other exporting countries (producer concentration). In this case, global market shares of the remaining competitors are not affected, as they keep exactly the same share as the one they have before the concentration, while the value of our indices change.

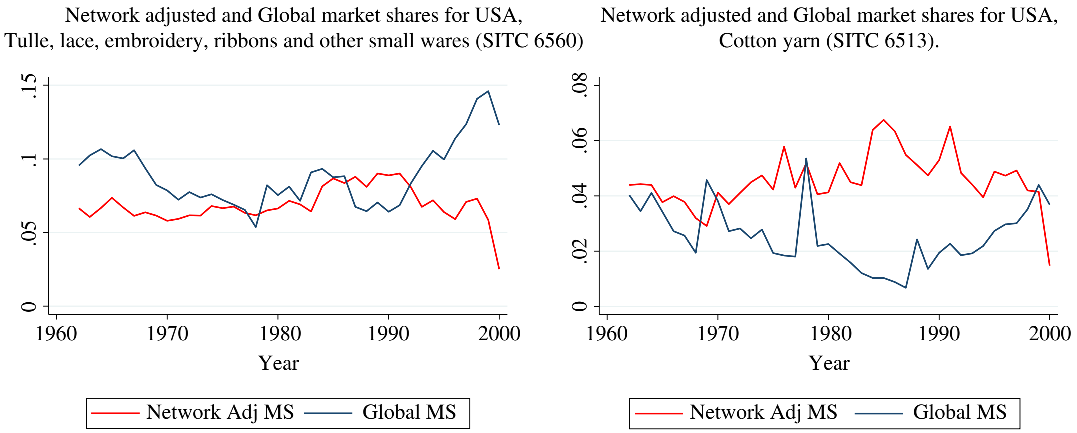


FIGURE 2 Exporter market shares and network adjusted exporter market shares for two products exported by US firms, from 1960 to 2000[Colour figure can be viewed at wileyonlinelibrary.com]

Notably, our index increases more than the global market share for the exporter concentrating production, given that the asymmetry of the trade network increases.

For example, let us consider four exporting (*a*, *b*, *c* and *d*) firms of a given commodity, possibly located in four different countries (though this is inessential) There exist three importers (*A*, *B* and *C*), of different sizes. *A* imports 50, and *B* and *C* import 25 each. The initial trade configuration has *a* and *b* exporting 25 each to *A*, while *c* and *d* export 25 to, respectively, *B* and *C*. The standard market shares of the four exporters is the same, 25%, as each of them accounts for a quarter of total exports (or imports) of this commodity. However, given the difference in relative (bilateral) market shares among the fours exporters, the initial network-adjusted market shares will differ, and be equal to 5/24 for *a* and *b*, and 7/24 for *c* and *d*. The larger market shares in the individual markets featured by *c* and *d* turn into a higher adjusted market share.

To have a better grasp of the dynamics of the adjusted market share indexes, let us now compare two hypothetical developments in the trade configuration, both in the direction of producer concentration. The first case is that of *a* absorbing *b*, and the second is *a* absorbing *c*. The main difference between the two is that in the second situation, exporter *a* diversifies its outlets, as it will serve both importers *A* and *B*. The new network-adjusted market shares of exporter *a* after the two alternative acquisitions are, respectively, 1/3 and 5/12, showing that increasing the number of outlets yields a higher bargaining power, although in the two cases the global market share is the same (it rises to 50%). The adjusted market shares of the remaining exporters (*c* and *d* in the first case, *b* and *d* in the second) also increase, given the decrease in the number of exporters, though to a smaller extent, and even if their (standard) market shares remain the same.

That the asymmetries in trade networks might play an important role in shaping currency choices was shown by the Survey work of Friberg and Wilander (2008), illustrated in Section 2.

It should be stressed for clarity that, for all our purposes in the sequel, the relevant indexes will be computed for finely disaggregated production sectors, which therefore constitute the reference units of our analysis (both theoretical and empirical). The implicit assumption is that all (importing and exporting) firms, within those precisely defined sectors, enjoy similar bargaining power and behave symmetrically. This is why, to compute our indices, we use the number of exporting and importing countries of a particular commodity.

In what follows, we will verify in a reduced form that the bargainers' adjusted network position, defined by our index, has the predicted impact on choice of the invoice currency. A theoretic explanation of the bargaining mechanism is provided in Appendix A.

4 | DATA, EMPIRICAL MODEL AND RESULTS

4.1 | Data and preliminary evidence

We compute the network-adjusted market share specified in Equations (6) and (7) using the UN-Comtrade data for the year 2010 at the 5-digit SITC Rev. 4 industry level, for all available countries and sectors. The index is added to a data set representing the universe of Italian imports and exports—external to EU—recorded by the Agenzia delle Dogane e dei Monopoli in Italy in 2010, almost at transaction level, augmented with a set of control variables.[13] Each observation contains information on the country of origin or destination, value, weight, invoicing currency, reference exchange rate and date.[14]

Transactions having the same trading partners, industry code (at the 10-digit-harmonised service level), currency, time period and reference exchange rate are aggregated by the data provider into one observation. Each observation includes an average of 8 transactions for Italian imports and 7.7 for Italian exports, while the median is equal to 2 for both data sets.

In merging the network-adjusted market share index computed from the UN-Comtrade data with this data set, we lose some observations due to the lack of some reported trades in the UN-Comtrade data and, to a minor extent, to the fact of moving from HS10 to the 5-digit SITC Rev. 4 classification. Nevertheless, we have been able to keep more than 71% of the observations for the export data—76% in terms of value—while for the import data, we are able to keep more than 81% of the observations—60% in terms of value.

The large difference between the total value of trade matched in the import data set comes from the lack of recorded data in the UN-Comtrade about large transactions of oil, originating mostly from a few countries in Asia and Africa. These missing oil transactions account for roughly 67% of the difference. For the same reason, the average total value of trade transaction in the full sample of Italian import is higher than in our reduced sample. This is rather irrelevant given that our study is about the determination of the currency denomination of trade and oil is predominantly invoiced in U.S. dollars (USDs) and not particularly susceptible to firm-level concerns. Checking for the consistency of our data, we do not find other relevant differences between the original transaction data set and our reduced sample, as reported in Tables 1 and 2.

The distribution of our network-adjusted market share (computed in Equations 6 and 7) is very close to a lognormal distribution, as shown in Figure 3, where the distribution of network-adjusted market shares for Italian exporting sectors is plotted against that of the corresponding importing sectors in the left panel, and the distribution of the network-adjusted market shares for Italian importing sectors is plotted against that of the corresponding exporting sectors in the right panel. A cursory inspection of those distributions suggests that Italian firms tend to trade with foreign firms in countries and industries with less bargaining power,

[13]This data set was already used by Witte and Ventura (2016) and is described in more detail there.

[14]Date includes only the year and a two-month reference period.

TABLE 1 Descriptive statistics for the Italian exports data set, differences between full sample and reduced sample data

	Full sample data			Reduced sample		
Variable	**Mean**	**SD**	**Median**	**Mean**	**SD**	**Median**
Producer currency pricing	0.727	0.446	1	0.718	0.450	1
Local currency pricing	0.077	0.266	0	0.088	0.284	0
Vehicle currency pricing	0.196	0.397	0	0.194	0.395	0
Total value of trade transaction	135,660	2,118,925	9187	135,989	2,293,913	9709
Exporter's sector network-adjusted market share				0.039	0.028	0.076
Importer's sector network-adjusted market share				0.011	0.012	0.032
Exporter's market share of world exports of good	0.077	0.072	0.058	0.077	0.071	0.057
Exporter's market share of world imports of good	0.039	0.024	0.034	0.039	0.025	0.033
Importer's market share of world exports of good	0.017	0.048	0.001	0.02	0.052	0.002
Importer's market share of world imports of good	0.02	0.043	0.005	0.023	0.045	0.006
US market share of world exports of good	0.076	0.057	0.07	0.077	0.057	0.071
US market share of world imports of good	0.133	0.072	0.123	0.129	0.071	0.116
EMU's market share of world exports of good	0.231	0.061	0.236	0.228	0.062	0.23
EMU's market share of world imports of good	0.258	0.107	0.258	0.257	0.107	0.253
% of competition's import value of good using PCP	0.781	0.144	0.815	0.782	0.144	0.814
% of competition's import value of good using LCP	0.112	0.096	0.081	0.107	0.092	0.081
Modified Herfindahl Index of exports of good	0.106	0.056	0.09	0.105	0.055	0.092
Modified Herfindahl Index of imports of good	0.055	0.033	0.046	0.054	0.033	0.046
Value of trade is in lowest quartile	0.251	0.433	0	0.245	0.43	0
Value of trade is in highest quartile	0.249	0.432	0	0.249	0.433	0
Rauch classification—homogeneous	0.021	0.143	0	0.021	0.143	0
Rauch classification—differentiated	0.831	0.375	1	0.814	0.389	1
Importer weekly exch. rate volatility relative to EUR (last 3 years)	0.009	0.003	0.009	0.009	0.003	0.009
Importer weekly exch. rate volatility relative to USD (last 3 years)	0.016	0.005	0.017	0.016	0.005	0.018

Note: Merging the computed network-adjusted market share with the full sample data provided by the Agenzia delle Dogane e dei Monopoli in Italy in 2010, we lose some observations (28.6%) due mainly to missing reported trade and, to a minor extent, to going from HS10 to 5-digit SITC Rev. 4.

TABLE 2 Descriptive statistics for the Italian imports data set, differences between full sample and reduced sample data

Variable	Full sample data			Reduced sample		
	Mean	SD	Median	Mean	SD	Median
Producer currency pricing	0.199	0.399	0	0.210	0.408	0
Local currency pricing	0.367	0.482	0	0.368	0.482	0
Vehicle currency pricing	0.434	0.496	0	0.421	0.494	0
Total value of trade transaction	283,049	6,734,675	6075	187,419	2,984,809	5986
Exporter's sector network-adjusted market share				0.035	0.049	0.012
Importer's sector network-adjusted market share				0.021	0.016	0.016
Exporter's market share of world exports of good	0.057	0.093	0.017	0.059	0.093	0.018
Exporter's market share of world imports of good	0.038	0.059	0.013	0.038	0.059	0.014
Importer's market share of world exports of good	0.062	0.058	0.049	0.063	0.059	0.048
Importer's market share of world imports of good	0.04	0.03	0.034	0.04	0.029	0.033
US market share of world exports of good	0.077	0.064	0.068	0.078	0.062	0.07
US market share of world imports of good	0.143	0.077	0.134	0.137	0.074	0.125
EMU's market share of world exports of good	0.227	0.062	0.232	0.225	0.062	0.229
EMU's market share of world imports of good	0.231	0.101	0.21	0.231	0.1	0.217
% of competition's import value of good using PCP	0.121	0.142	0.069	0.123	0.143	0.072
% of competition's import value of good using LCP	0.455	0.184	0.429	0.455	0.185	0.429
Modified Herfindahl Index of exports of good	0.111	0.062	0.094	0.11	0.061	0.094
Modified Herfindahl Index of imports of good	0.062	0.042	0.052	0.061	0.041	0.051
Value of trade is in lowest quartile	0.253	0.435	0	0.254	0.435	0
Value of trade is in highest quartile	0.251	0.434	0	0.249	0.433	0
Rauch classification— homogeneous	0.025	0.156	0	0.023	0.15	0
Rauch classification—differentiated	0.838	0.368	1	0.83	0.376	1
Exporter weekly exch. rate volatility relative to EUR (last 3 years)	0.009	0.002	0.009	0.009	0.002	0.009
Exporter weekly exch. rate volatility relative to USD (last 3 years)	0.015	0.005	0.016	0.015	0.005	0.016

Note: Merging the computed network-adjusted market share with the full sample data provided by the Agenzia delle Dogane e dei Monopoli in Italy in 2010, we lose some observations (18.9%) due mainly to missing reported trade and, to a minor extent, to going from HS10 to 5-digit SITC Rev. 4.

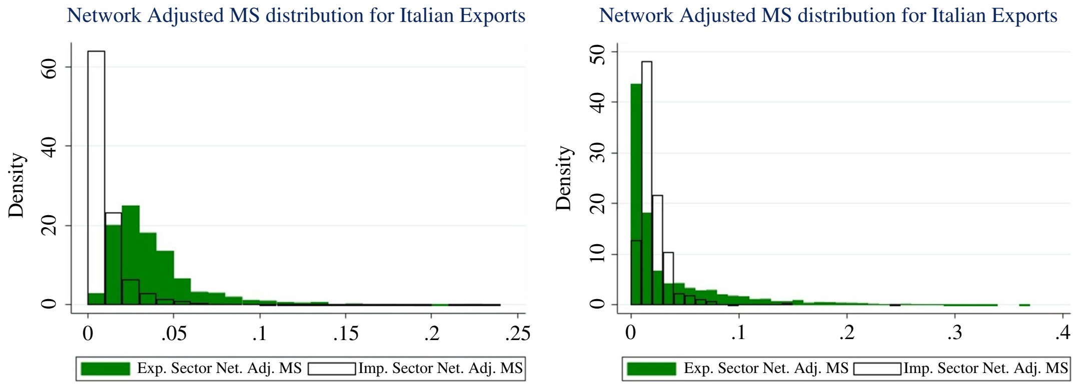


FIGURE 3 Network adjusted market share distribution for Italian exports and imports[Colour figure can be viewed at wileyonlinelibrary.com]

and the average value of our index is higher for both Italian export and import with respect to the trade counterparts.

In our empirical analysis, we will use the ratio of exporter and importer network-adjusted market share indices to define what kind of players predominate in the network. Intuitively, a ratio greater than 1 characterises exporter-driven networks, while an average ratio smaller than 1 characterises importer-driven networks, and we conjecture that in a bargaining process, the most likely adopted invoice currency is that of the country whose firms/sectors enjoy the highest network-adjusted market share index ratio. Therefore, if the index is greater than 1 we expect to observe more transactions invoiced in the exporter (producer) currency, while if the index is smaller than 1, we would expect more transactions invoiced in the importer (local) currency. By taking the log of ratios (which makes the mean a consistent statistic for the first moment of the index, given its approximate lognormal distribution), all of our previous considerations should hold, with a cut-off value of 0 instead of 1.

What our data reveal—as shown in Table 3—broadly confirms our expectations. The mean of the log of our index ratio for the Italian export data set is equal to 1.41; Italian exports disclose an exporter-driven network structure, and indeed, most of the transactions (73%) are settled using the producer currency, as expected.

On the contrary, Italian imports exhibit an importer-driven network structure (the average of the log of the ratio is equal to −0.62) with most of the transactions denominated in the local—importer—currency (37%) rather than in the producer currency (20%).

These findings are illustrated graphically in Figure 4. The higher the value of the ratio, the more likely for the invoice currency to be settled in the producer currency (PCP), while the lower that ratio, the more likely we are to observe transactions denominated in the importer or vehicle currency (LCP + VCP). Notice that the percentage of transactions settled in the producer currency exactly equals the percentage of transactions settled in local or vehicle currency when the log value of our ratio is equal to 0. This visual evidence strengthens our intuition that the network bargaining power of exporter and importer plays a relevant role in the determination of the invoice currency.

A simple OLS regression (results in Appendix B, Table A1) confirms our visual findings. The exporter's sector network-adjusted market share is positively related to producer currency pricing and negatively correlated with local and vehicle currency pricing, in terms of both number of transactions and value. Conversely, a higher Importer's sector network-adjusted market share is

TABLE 3 Percentage of transactions value in producer (PCP) or local (LCP) currency and average of the log of ratio between the exporter's and importer's network-adjusted market shares

	$\ln\left(\frac{\phi_i(exporter)}{\phi_i(importer)}\right)$		% of transaction in the data set with producer or local currency		
	Mean	**Std dev**	**% PCP**	**% LCP**	**(% PCP)/(% LCP)**
Italian export	1.41	0.86	73%	8%	9.13
Italian import	−0.62	1.20	20%	37%	0.54

Note: Italian exports disclose an exporter-driven network structure with most of the transaction settled in the producer currency while Italian imports exhibit an importer-driven network structure with a larger share of trade invoiced in the local currency rather than in the producer currency.ϕ_i (*exporter*) and ϕ_i (*importer*) are specified in Equations (6) and (7).

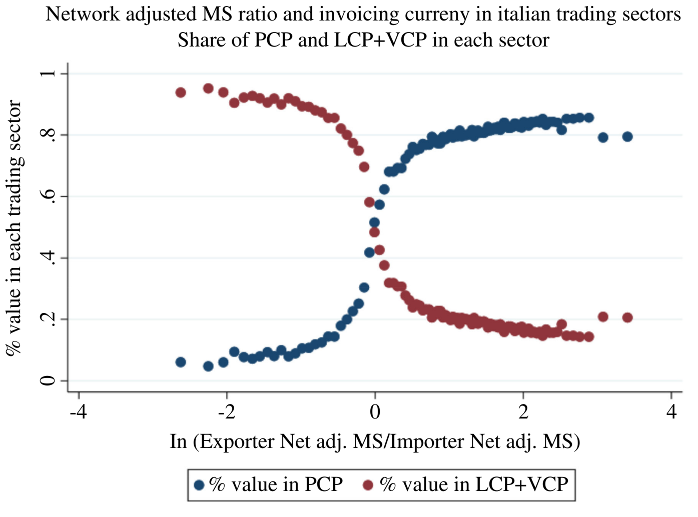


FIGURE 4 Percentages of sector transactions in Producer (PCP) and Local or Vehicle (LCP + VCP) currency conditioned to the log of the ratio of the network adjusted market shares[Colour figure can be viewed at wileyonlinelibrary.com]

negatively related to producer currency pricing while exhibiting a positive relationship with the share of local and vehicle currency. The variance of the invoice currency's share explained by our index ranges from about 14% to about 24%[15] and is higher than it is the case for the standard global sector market share.[16] Moreover, the effect of our index is robust to the inclusion of global sector market shares, as reported in panel *c* of Table A1. The network effect is only slightly affected by the inclusion of global market shares, confirming the non-redundancy of the information included in our novel index. Using data only for differentiated goods, as shown in Appendix B, Table A2, improves the fit of our model. Therefore, the network dimension of our index seems to better determine the currency invoicing decision than simple global market shares. This is further confirmed by the results reported in Appendix B, Table A3, when exporter–importer pairs and sector (at the 5-digit SITC level) fixed effects are considered. Controlling for this very rich set of fixed effects, we

[15]With a log specification of the bargaining index, *R*-squared approaches 40% for almost all the invoicing currency shares.

[16]*R*-squared statistics for the global sector market shares range from about 12% to 19%.

are able to control for most of the cofounding factors influencing the invoicing decision, which do not depend on our network-adjusted market shares, as implied by our theoretical framework, and which are reported in Appendix A1, Equation (A6). An increase of 1 p.p. in the exporter's network-adjusted market share increases the share of transaction invoiced in the producer currency (PCP) by 0.35%, while the same increase in the importer's network-adjusted market share decreases the PCP share by −0.2%. The same result does not hold when we consider global market shares. After controlling for exporter–importer pairs and sector fixed effects, a positive coefficient is reported for the importer's global market shares. The higher the market share of the importer, the higher is the share of transaction invoiced in the producer currency, which is at odd with intuition and theory. This seems robust evidence, at least for all the transactions involving Italian imports and exports, that the asymmetry of the trade network plays a relevant role in the invoicing currency decision.

4.2 | Empirical model and results

Following Witte and Ventura (2016), we estimate our model using a multinomial probit model instead of a multinomial logit to exclude the assumption of the independence of irrelevant alternatives.

The currency denomination decision is expressed by three options: producer (PCP), local (LCP) or vehicle (VCP) currency pricing. Weighting the regression by value, we give more weight to observations associated with larger transactions, thereby providing a more accurate picture of the aggregate behaviour of the Italian imports and exports through the following model specification:

$$Pr\left(InvCurr_{i,j,z} | Y = PCP, LCP, VCP\right) = \Phi\left(\beta_0 + \beta_1 ExpSectorBP_{i,k} + \beta_2 ImpSectorBP_{j,k} + \beta_3 X_{i,j,k} + \beta_4 I_{i,j,k}\right) \quad (10)$$

where $InvCurr_{i,j,z}$ is the invoicing currency of the Italian imports from the trading partner i, or the Italian exports to the trading partner j, for the good traded in the transaction z. $ExpSectorBP_{i,k}$ is our exporter sector network-adjusted market share index computed in Equation (6) for sector k of the good exported in transaction z by country i, while $ImpSectorBP_{j,k}$ is the importer's network-adjusted market share index computed in Equation (7) for sector k *in* country j. $X_{i,j,k}$ is a vector of control variables including standard controls (modified Herfindahl Index of exports–imports of good, one binary variable taking value 1 if the value of trade is in the lowest or highest quartile, one binary variable indicating whether a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years, exporter/importer weekly exchange rate volatility relative to the USD over last 3 years) and geographical controls (the log of distance between the two trading partners, binary variables accounting for the presence of a bilateral investment treaty or for a bilateral tax treaty), which are supposed to affect the relative utility to invoice in own currency.[17] $I_{i,j,k}$ is a vector of binary variables controlling for the most often observed trading partners (the first 8 importers and exporters[18]) and sector fixed effects (at the one-digit SITC industries[19]). The inclusion of fixed effect, which allows us to control for some rele-

[17]Because the frequency of the played strategy increases with the associated utility, we need to control for factors influencing the PCP, LCP and VCP utilities.

[18]The other importer–exporter dummies are excluded for multicollinearity and to prevent unfeasible results.

[19]For feasible estimates, we limit the industry fixed effect at the one-digit level.

vant unexplained heterogeneity, makes us less worried about possible endogeneity concerns, in particular those related to the omitted variable bias. Moreover, as mentioned in the previous section, even including dummies for exporter–importer pairs and sectors (at the 5-digit SITC level) does not alter our main findings, in the context of an OLS analysis. Clearly, it would be much better if we might control for firms' heterogeneity, as suggested in Fabling and Sanderson (2015), but this is not made possible by our data set.

If the currency determination is affected by the traders' outside options, we should observe a significant contribution of our network-adjusted market share index in Equation (10). If paying in own currency is the preferred choice, the coefficient of the exporter network-adjusted market share index should exhibit a positive sign for the producer currency pricing (PCP), as sectors in countries with a large adjusted market share are more likely to invoice in their own currency. Likewise, the importer's adjusted market share should increase the likelihood of local currency pricing (LCP)—importers with a high index are more likely to invoice in their currency. The ratio between the two measures should exhibit an opposite contribution for PCP and LCP, assuming there is a threshold above (below) which a sector in a country is more (less) likely to invoice in its own (in the partner's) currency. Lastly, to avoid multiple equilibria due to equivalent dominant strategies, we exclude transactions where exporters or importers have a currency peg to Euro or US dollar. Results are shown in Table 4, where VCP is selected as the base outcome.

The coefficients of our indices all exhibit the expected sign and significance. Transactions in sectors with greater adjusted market shares are more likely to be invoiced in own currency rather than in a vehicle currency, while the network-adjusted market share of the trading partner has an opposite effect (models 2 and 5 of Table 4). This is strongly confirmed in models 3 and 6, where we compute the log of the ratio between the exporter's and importer's adjusted market shares. When the ratio takes a positive value, we are more likely to observe transactions in the producer currency, while negative values increase the likelihood that transactions are priced in the consumer (local) currency. Remarkably, this effect is robust to the inclusion of standard sector market shares.[20]

By looking at Table 4, we realise that the ratio of adjusted market share indices explains the currency invoice decision better, also in terms of statistical significance, than the standard global market share. This finding, coupled with the results in Tables A1 and A2 in Appendix B, is a clear indication that our index contains some specific and relevant informative and explanatory content, over and above what is proxied by global market shares.[21]

For robustness checks, we report in Table 5 another set of estimates of the previous parameters, controlling for a larger set of control variables,[22] which are detailed in the notes to the table. Moreover, in models 4 and 5 of Table 5, we compute our index excluding market shares of sectors

[20]Exporter, exporter-squared and importer sector market shares, as shown in model one and four. Results do not significantly change excluding the squared effect.

[21]We also ran additional regressions, whose results we did not include for brevity, where only the second component of the network-adjusted market share index was included. Those regressions showed that the second component, which incorporates a network dimension, accounts for most of the explanatory power of the index, which is preserved even once global market shares are accounted for.

[22]EMU's market share of world exports and imports of good, % of Italian exports (import) with destination (from other) EMU for that industry, % of EMU exports/imports (all but Italy) to/from world for that industry, % of Italian exports/imports that go to/come from the United States in that industry.

TABLE 4 Multinomial probit of invoicing currency

Model	(1) PCP	(1) LCP	(2) PCP	(2) LCP	(3)	(3) LCP	(4) PCP	(4) LCP	(5) PCP	(5) LCP	(6) PCP	(6) LCP
Exporter sector Net. Adj. MS			9.29***	−2.83***					9.16***	−3.09***		
			(0.67)	(0.75)					(0.69)	(0.82)		
Importer sector Net. Adj. MS			−6.95**	5.30***					−6.94**	4.98***		
			(2.56)	(1.29)					(2.54)	(1.33)		
ln(Exp. Sect. N. Adj. MS/ Imp. Sect.N. Adj. MS)					0.24***	−0.23***					0.24***	−0.22***
					(0.017)	(0.021)					(0.017)	(0.022)
Exporter's market share of world exports of good	6.89***	−1.66*			2.80***	2.36*	6.80***	−1.10			2.79***	2.43**
	(0.63)	(0.74)			(0.72)	(0.92)	(0.67)	(0.75)			(0.73)	(0.94)
Exporter's market share of world exports of good, squared	−9.88***	5.04**			−2.94+	−1.75	−9.55***	4.63**			−2.71+	−1.46
	(1.63)	(1.62)			(1.60)	(1.85)	(1.71)	(1.62)			(1.65)	(1.86)
Importer's market share of world exports of good	−2.13*	7.06***			0.54	4.70***	−2.51**	7.28***			0.091	4.72***
	(0.83)	(0.70)			(0.83)	(0.70)	(0.87)	(0.74)			(0.87)	(0.74)
Standard control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Geographical control							Y	Y	Y	Y	Y	Y
Exporter, importer and sector F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1,221,586	1,221,586	1,221,586	1,221,586	1,221,586	1,221,586	1,214,381	1,214,381	1,214,381	1,214,381	1,214,381	1,214,381

Note: Base outcome is VCP. Countries with higher adjusted market shares tend to invoice in own currencies. Standard controls include the following: modified Herfindahl Index of exports/imports of good, one binary variable if the value of trade is in the lowest or highest quartile, one binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years and exporter/importer weekly exchange rate volatility relative to the USD over last 3 years. Geographical controls include the following: the log of distance between the two countries, one binary variable equal to 1 if there is a tax treaty and another one if there is a bilateral investment treaty.

Robust standard errors in parentheses $+p < .10$, $*p < .05$, $**p < .01$ and $***p < .001$.

TABLE 5 Multinomial probit of invoicing currency, excluding direct market shares in the partner country

	(1)	(1)	(2)	(2)	(3)	(3)	(4)[a]	(4)[a]	(5)[a]	(5)[a]
Model	**PCP**	**LCP**	**PCP**	**LCP**	**PCP**	**LCP**	**PCP**	**LCP**	**PCP**	**LCP**
Exporter sector network Adj. MS[a]			9.144***	−2.478**			9.266***	−2.402**		
			(0.704)	(0.760)			(0.724)	(0.774)		
Importer sector network Adj. MS[a]			−5.451*	7.901***			−5.317*	8.492***		
			(2.478)	(1.469)			(2.550)	(1.536)		
ln(Exp. Sect Net. Adj. MS /Imp. Sect. Net. Adj. MS)[a]					0.279***	−0.193***			0.272***	−0.201***
					(0.0270)	(0.0362)			(0.0276)	(0.0364)
Exporter's market share of world exports of good	7.518***	0.234			3.465***	2.603**			3.522***	2.669**
	(0.713)	(0.731)			(0.830)	(0.996)			(0.833)	(0.999)
Exporter's market share of world exports of good, squared	−10.68***	2.067			−5.055**	−1.178			−5.122**	−1.243
	(1.750)	(1.533)			(1.764)	(1.804)			(1.765)	(1.805)
Importer's market share of world exports of good	−1.492+	8.419***			0.793	6.555***			0.721	6.485***
	(0.808)	(0.756)			(0.831)	(0.786)			(0.833)	(0.788)
Standard control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Geographical control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Currency control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Exporter, Importer and Sector F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376	1,214,376

Note: Base outcome is VCP. Standard controls include the following: modified Herfindahl Index of exports/imports of good, one binary variable if the value of trade is in the lowest or highest quartile, one binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years and exporter/importer weekly exchange rate volatility relative to the USD over last 3 years. Geographical controls include the following: the log of distance between the two countries, one binary variable equal to 1 if there is a tax treaty and another one if there is a bilateral investment treaty. Currency controls include the following: EMU's market share of world exports and imports of good, % of Italian exports (import) with destination (from other) EMU for that industry, % of EMU exports/imports (all but Italy) to/from world for that industry and % of Italian exports/imports that go to/come from the United States in that industry.

Robust standard errors in parentheses $+p < .10$, $^{*}p < .05$, $^{**}p < .01$ and $^{***}p < .001$.

[a]Network-adjusted market shares in Table 5, and Models 4 and 5, are computed excluding direct market shares in the partner country.

in the partner country, to prevent possible endogeneity due to shocks that could contemporaneously affect both the bilateral value of trade and the invoicing currency. Results remain significant and consistent with our previous estimates.

In Appendix B, we reported other robustness test. To verify that our findings are not due to particular trading patterns emerged in 2010, we estimated the parameters of Equation (10) on a new data set including only Italian imports[23] from 2003 to 2008. As in model 3 of Table 5, we report the impact on PCP and LCP of the logarithm of the ratio between our exporter adjusted market share and importer adjusted market share indices, to assess the impact of bargaining power on the invoice currency choice in different years. Results reported in Tables A4 and A5 broadly confirm our previous findings. PCP is positively affected by higher values of the ratio, while the impact on LCP is negative. Moreover, the coefficients that are estimated separately for the different years are quite stable, especially for the PCP dependent variable. For the LCP-dependent variables, we observe coefficient values that are slightly decreasing in time. Exploring this trend, we realise that Italian industries with higher bargaining power increased their invoicing in USD during the Euro crisis. This seems a behaviour that is fully compatible with the equilibrium solution of a mixture strategy with 3 currencies, where the utilities to invoice in the vehicle currency is higher than the utility to invoice in the own currency.

5 | CONCLUSIONS

In this analysis, we introduced a new index to measure the relative bargaining power of importer and exporter in real trade networks, which accounts for restrictions and asymmetries of the communication structures. When all members of the network are indifferent to delay the agreement with other parties, our index equals a network-adjusted market share that supports the idea of a bargaining process in the determination of the currency denomination of trade. Our results suggest a robust and large effect of the trading position on the currency denomination of trade, over and above the effect of global sector market shares. The asymmetry of the communication structure (defined by the trade network), influencing the bargaining possibility of each player, modifies the mixture strategy played by each competitor for the determination of the invoice currency. Transactions are more likely to be priced in the producer currency if the asymmetry of the trade network reduces the trading possibilities of the importers. Conversely, exporters are less likely to invoice in their own currency if the asymmetry of the network increases the trading possibilities of importers.

We contribute to the literature on the currency denomination of trade by suggesting that trade network structures are quite relevant, in the frame of a bargaining process. Those features should be included in future theoretical models and used as controls in future empirical research.

As policy implications, we suggest that policymakers increase their efforts not only in boosting trade among their given set of trade partners but to pay attention to the diversification of export and import markets to avoid weakening their bargaining power in their trade relationships. Concentration of exporting or importing firms in few countries should be attentively monitored and possibly avoided, for the same purpose. As is the case for the determination of an invoice currency, negotiating with partners having a higher bargaining power tends to be less favourable to the weak party, with obvious and important implications in terms of exchange rate pass-through and monetary shock dependence. Furthermore, while we have looked solely at the role of the network-adjusted bargaining power to determine currency denomination of trade, it is possible

[23]Unfortunately, we obtained data on exports only for 2010.

that other features of trade transactions (price, quantity and timing) or characteristics of trade agreement (governing law and jurisdiction in international contracts, protection of designations of origin or trademark and intellectual property) may equally be sensitive to the role of network structure, with important consequences on national welfare. We would then suggest that our results, if suitably extended, may not only enhance our understanding of the currency denomination of trade but could also shed light on a variety of other bargaining-related issues. Ultimately, our findings have relevant implications even for consumer welfare, whenever the collusion and competition policies rely upon market shares for assessing firms' bargaining power.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX A

Mixture strategy as an equilibrium solution for invoice currency decisions

In a simple framework, as described in Viaene and De Vries (1992) where home currencies are the preferred monetary regimes for both parties in the transaction, and where the traders hedge to cover their currency risks, the exporter and the importer have opposite preferences relative to the invoice currency decision. Usually, invoicing in a foreign currency is partially suboptimal; firms and consumers try to invoice in their own currencies, and the partner can accept or reject this decision, and even terminate the negotiation. In this classical bargaining process, if the partner stops the negotiation, the two players may propose another offer to another firm or consumer in the same trading country or to a different player located in a different country.[24] Likewise, the player that rejected the initial offer can invite bids from other firms or consumers. The relative value of these outside options will be captured by our network-adjusted market share index, which is a function of the ex-ante payoff that the players can achieve conditional on their positions in the network,[25] and it is equivalent to the probability to be chosen or to choose in a new negotiation, when players have a unit discount factor. Within this framework, firms and

[24]Given the lack of complete producer–consumer network microdata, we are forced to use national sector data; we therefore simplify this setting assuming to have only one monopolistic firm and one representative consumer for each traded good. Alternatively, we can ease this restriction by considering that oligopolistic firms and consumers in the same sector coordinate their choices.

[25]Theoretically, in a bargaining process, when two players have the possibility of opting out, Rubinstein's equilibrium (Rubinstein, 1982) could be broken (Ponsati & Sákovics, 1996) deviating from the outside option principle (Binmore et al., 1989). Consequently, the bargaining outcome depends on the size of the outside options, as shown by Cunyat (1998), Li et al. (2004) or Manzini and Mariotti (2004), and the relative bargaining power increases in the own outside option and decreases in the partner's outside option.

consumers contact different counterparts and bargain with them in order to obtain their best solution, in terms of invoice currency.

For illustrative purposes, we simplify our model considering only two invoice currencies, in order to obtain the simplest unique feasible solution. Transactions between each importer–exporter pair can be priced in the producer (exporter) or local (importer) currency. The exporter–importer pair bargains over the invoice currency, and both counterparts can opt out, leaving the negotiation.[26]

The standard equilibrium solution to this kind of bargaining problem is proposed by Kalai and Smorodinsky (1975) (KS, in the sequel), that substituted the condition of independence of irrelevant alternatives of the Nash (1950) bargaining equilibrium with a resource monotonicity assumption,[27] keeping all other axioms.[28] Following KS, the solution to the bargaining problem is computed as the maximal utility point equalising the relative gain of players, namely:

$$\frac{U_i - d_i}{U_i^{max} - d_i} = \frac{U_j - d_j}{U_j^{max} - d_j} \tag{A1}$$

where, for player i, U_i is the utility level, d_i the utility of opting out and U_i^{max} the maximum utility level that the player can achieve. The same applies for player j. Given that the transaction can be settled in producer or local currency, the two players maximise their utility ($U_{i,j}$) with a mixture strategy, solving the system described by Equation (A2).

$$\begin{gathered} max \frac{U_i - d_i}{U_i^{PCP} - d_i} = \frac{U_j - d_j}{U_j^{LCP} - d_j} \\ U_i = x_{ij} U_i^{PCP} + y_{ij} U_i^{LCP} \\ U_j = x_{ij} U_j^{PCP} + y_{ij} U_j^{LCP} \\ \text{s. t. } x + y = 1 \text{ and } x, y \geq 0 \end{gathered} \tag{A2}$$

U_i^{PCP} and U_j^{LCP} are respectively the utilities of player i and j when the transaction is producer currency priced (PCP) or local currency priced (LCP).[29] x_{ij} and y_{ij} are the percentages of time that options PCP or LCP are chosen by the bargaining pair ij, and they are equivalents to the percentage of transactions carried out by PCP or LCP. The maximum utility level, U^{max}, that player i *or* j can achieve is obtained when the own currency, PCP or LCP, is chosen.

Solving the maximisation problem of Equations (A2)[30] in x_{ij}, we compute the average share of time that the bargainers i and j choose to invoice in the producer currency (PCP); namely:

[26]After opting out, exporter and importer look for another counterpart conditional on their communication network.

[27]As stated by Kalai and Smorodinsky (1975) 'If, for every utility level that player 1 may demand, the maximum feasible utility level that player 2 can simultaneously reach is increased, then the utility level assigned to player 2 according to the solution should also be increased'.

[28]Pareto optimality of the returned agreement, symmetry and invariance to affine transformation. A further obvious condition is that the utility from disagreeing must not be greater than the utility of agreeing, for both players.

[29]The local currency may also be defined as the consumer or importer's currency.

[30]To solve the maximisation problem, we need to substitute $U_i = x_{ij} U_i^{PCP} + y_{ij} U_i^{LCP}$ and $U_j = x_{ij} U_j^{PCP} + y_{ij} U_j^{LCP}$ in the first equation, with $y = 1 - x$.

$$x_{ij} = \frac{\left(U_i^{PCP} - U_i^{LCP}\right)\left(U_j^{LCP} - d_j\right)}{\left[2\left(U_i^{PCP}U_j^{LCP}\right) - U_i^{LCP}U_j^{LCP} - U_i^{PCP}U_j^{PCP}\right] - d_i\left(U_j^{LCP} - U_j^{PCP}\right) - d_j\left(U_i^{PCP} - U_i^{LCP}\right)} \tag{A3}$$

Defining party i as the exporter and j as the importer, we note that the percentage of time (or of transactions) option PCP is chosen is clearly decreasing in the value of the importer's outside option (d_j), and increasing in the value of the exporter's outside option d_i. Notice that $U_i^{PCP} - U_i^{LCP}$ is always greater than zero, as long as the half-variance of the exchange rate of the producer over local currency is greater than the covariance between the marginal cost of producing and the exchange rate—as shown by Devereux et al. (2004)—or, in other words, as long as the exporter prefers to invoice in the own currency. We further assume that $U_j^{LCP} - U_j^{PCP}$ is greater than zero, given that even the importer prefers to invoice in her own currency.[31]

As our bargaining power index (with the unit time discount factor) is equivalent to the probability to be chosen as a partner in the negotiation, conditional on the position in the directed and weighted network ξ, the outside option d_i is equal to:

$$d_i = pr\left(b = i|\xi\right) * E\left(U_i|b = i\right)$$

where $pr\left(b = i|\xi\right)$ is the probability that the counterpart i is chosen as a bargainer, given the trade network structure ξ is equal to our network-adjusted market share. $E\left(U_i|b = i\right)$ is the expected utility achieved by i, when i is chosen as a bargainer, while the utility to do not bargain is obviously equal to 0.

Defining

$$E\left(U_i|b = i\right) = E\left[x_{ij}U_i^{PCP} + \left(1 - x_{ij}\right)U_i^{LCP}\right] \text{ and } E\left(U_j|b = j\right) = E\left[x_{ij}U_j^{PCP} + \left(1 - x_{ij}\right)U_j^{LCP}\right]$$

we derive the following expectations:

$$\begin{aligned} E\left(U_i|b=i\right) &= \frac{1}{J}\sum_{j=1}^{J}\left[x_{ij}\left(U_i^{PCP} - U_i^{LCP}\right) + U_i^{LCP}\right] \\ E\left(U_j|b=j\right) &= \frac{1}{J}\sum_{i\neq j}^{J}\left[x_{ij}\left(U_j^{PCP} - U_j^{LCP}\right) + U_j^{LCP}\right] \end{aligned} \tag{A4}$$

Given that the bargainers know their own utilities when producer or local currencies are chosen, it is straightforward to note that the expected payouts depend only on the expectations about the number of time that the PCP option will be chose in the next steps of the game. Defining $\frac{1}{J}\sum_j^J\left(x_{ij}\right) = E_i\left[x_{ij}\right] = \overline{x_i}$, we can rewrite the outside options as:

$$\begin{aligned} d_i &= pr_i\left[\overline{x_i}\left(U_i^{PCP} - U_i^{LCP}\right) + U_i^{LCP}\right] \\ d_j &= pr_j\left[\overline{x_j}\left(U_j^{PCP} - U_j^{LCP}\right) + U_j^{LCP}\right] \end{aligned} \tag{A5}$$

[31]To define the preferred currencies of the two counterparts is not the aim of this paper, as there is already an exhaustive literature dealing with it. Our goal is to disclose the role of the communication network on the invoicing currency, underlying the effect of the asymmetry of the network.

The outside option, d_i, is a function of pr_i (the probability to be chosen as a bargainer in the network, that is equivalent to our network-adjusted market share), $\overline{x_i}$ (the i's expectation that her own currency is chosen), and of the payout utilities, U_i^{PCP} and U_i^{LCP}.

Plugging Equation (A5) into Equation (A3), we can rewrite the percentage of time that the PCP option is chosen as a function of our index pr_i, the counterparts' utilities $U_{i,j}^{PCP,LCP}$ and the counterparts' expectations $(\overline{x_i}, \overline{x_j})$. Defining $\theta_{ij} = \left[2(U_i^{PCP}U_j^{LCP} - U_i^{LCP}U_j^{LCP} - U_i^{PCP}U_j^{PCP})\right]$

$$x_{ij} = \frac{(U_i^PCP - U_i^LCP)(U_j^LCP - pr_j[(\overline{x}_j)(U_j^PCP - U_j^LCP) + U_J^LCP])}{\theta_{ij} - pr_i[(\overline{x}_i)(U_i^PCP - U_i^LCP) + U_i^LCP](U_j^LCP - U_j^PCP) - pr_j[(\overline{x}_j)(U_j^PCP - U_j^LCP) + U_J^LCP](U_i^PCP - U_i^LCP)} \tag{A6}$$

As an example, we consider the special case of symmetric payouts, with $U_i^{PCP} = U_j^{LCP} = 2U_i^{LCP} = 2U_j^{PCP} = 2U$. In this special case, Equation (A6) simplifies to:

$$x_{ij} = \frac{2 - pr_j\left(2 - \overline{x_j}\right)}{4 - pr_i\left(\overline{x_i} + 1\right) - pr_j\left(2 - \overline{x_j}\right)} \tag{A7}$$

Under the hypothesis of exogeneity of expectations ($\overline{x_j}$ and $\overline{x_i}$), for example for large I and J, it is straightforward to show that an increase in the partner's adjusted market share (pr_j) decreases producer (i) currency invoicing, while an increase in the own adjusted market share (pr_i) increases producer currency invoicing.

APPENDIX B

TABLE A1 OLS regression of the share of producer (PCP), local (LCP) and vehicle (VCP) currency pricing on the sector network-adjusted market share and global sector market share, sectoral data

	Full sample, % of observations in each industry			Full sample, % value in each industry		
	% PCP	**% LCP**	**% VCP**	**% PCP**	**% LCP**	**% VCP**
(a) Sector Bargaining Power Index and Invoicing Currency						
Exporter's sector Net. Adj. Market Sh.	1.774***	−1.077***	−0.697***	2.287***	−1.474***	−0.813***
	(0.110)	(0.0550)	(0.0713)	(0.141)	(0.0988)	(0.0853)
Importer's sector Net. Adj. Market Sh.	−8.391***	4.522***	3.869***	−9.835***	4.950***	4.886***
	(0.502)	(0.333)	(0.226)	(0.667)	(0.458)	(0.336)
Constant	0.647***	0.134***	0.219***	0.657***	0.192***	0.151***
	(0.00749)	(0.00452)	(0.00425)	(0.00967)	(0.00658)	(0.00531)
R-Squared	0.235	0.226	0.158	0.219	0.146	0.14
N	112,993	112,993	112,993	112,993	112,993	112,993
(b) Global Sector Market Share and Invoicing Currency						
Exporter's global sector market share	0.827***	−0.493***	−0.334***	1.149***	−0.637***	−0.512***
	(0.0656)	(0.0299)	(0.0402)	(0.0937)	(0.0609)	(0.0470)
Importer's global sector market share	−2.904***	1.528***	1.377***	−3.462***	1.836***	1.625***
	(0.0975)	(0.0708)	(0.0496)	(0.151)	(0.111)	(0.0806)
Constant	0.606***	0.155***	0.238***	0.607***	0.208***	0.185***
	(0.00447)	(0.00230)	(0.00307)	(0.00613)	(0.00423)	(0.00362)
R-Squared	0.190	0.177	0.132	0.191	0.127	0.120
N	112,993	112,993	112,993	112,993	112,993	112,993

TABLE A1 (Continued)

	Full sample, % of observations in each industry			Full sample, % value in each industry		
	% PCP	% LCP	% VCP	% PCP	% LCP	% VCP
(c) Sector Network-Adjusted Market Share, Global Sector Market Share and Invoicing Currency						
Exporter's sector Net. Adj. Market Sh.	1.156***	−0.721***	−0.435***	1.192***	−1.038***	−0.154
	(0.127)	(0.0640)	(0.0853)	(0.183)	(0.123)	(0.109)
Importer's sector Net. Adj. Market Sh.	−6.221***	3.450***	2.772***	−7.023***	3.340***	3.682***
	(0.515)	(0.353)	(0.236)	(0.668)	(0.498)	(0.360)
Exporter's global sector market share	0.374***	−0.217***	−0.157***	0.673***	−0.263***	−0.410***
	(0.0699)	(0.0310)	(0.0460)	(0.111)	(0.0687)	(0.0579)
Importer's global sector market share	−1.301***	0.637***	0.664***	−1.654***	0.967***	0.686***
	(0.111)	(0.0813)	(0.0508)	(0.161)	(0.128)	(0.0811)
Constant	0.643***	0.136***	0.221***	0.650***	0.195***	0.155***
	(0.00735)	(0.00444)	(0.00425)	(0.00947)	(0.00649)	(0.00532)
R-Squared	0.255	0.242	0.174	0.244	0.162	0.158
N	112,993	112,993	112,993	112,993	112,993	112,993

Note: These tables report OLS regressions of the percentage of transactions priced in producer (PCP), local (LCP) and vehicle (VCP) currency on network-adjusted and global sector market shares, for sectoral data. Standard errors are clustered at the 5-digit SITC Rev. 4 industry level.

Standard errors in parentheses +$p < .10$, *$p < .05$, **$p < .01$ and ***$p < .001$.

TABLE A2 OLS regression of the share of producer (PCP), local (LCP) and vehicle (VCP) currency pricing on the sector network-adjusted market share and global sector market share, for differentiated goods, sectoral data

	Full sample, % of observation in each industry			Full sample, % value in each industry		
	% PCP	**% LCP**	**% VCP**	**% PCP**	**% LCP**	**% VCP**
(a) Sector Network-Adjusted Market Share and Invoicing Currency						
Exporter's sector Net. Adj. Market Sh.	2.084***	−1.199***	−0.885***	2.626***	−1.594***	−1.032***
	(0.129)	(0.0571)	(0.0862)	(0.151)	(0.0945)	(0.0959)
Importer's sector Net. Adj. Market Sh.	−8.110***	4.452***	3.657***	−9.733***	4.717***	5.017***
	(0.630)	(0.434)	(0.273)	(0.854)	(0.572)	(0.432)
Constant	0.636***	0.141***	0.223***	0.659***	0.195***	0.146***
	(0.00918)	(0.00571)	(0.00505)	(0.0119)	(0.00778)	(0.00651)
R-Squared	0.254	0.253	0.175	0.241	0.169	0.168
N	83,286	83,286	83,286	83,286	83,286	83,286
(b) Global Sector Market Share and Invoicing Currency						
Exporter's global sector market share	0.948***	−0.559***	−0.389***	1.240***	−0.692***	−0.548***
	(0.0843)	(0.0388)	(0.0496)	(0.116)	(0.0723)	(0.0567)
Importer's global sector market share	−2.670***	1.385***	1.285***	−3.260***	1.528***	1.732***
	(0.109)	(0.0829)	(0.0587)	(0.183)	(0.123)	(0.103)
Constant	0.593***	0.166***	0.241***	0.606***	0.217***	0.177***
	(0.00570)	(0.00288)	(0.00382)	(0.00774)	(0.00509)	(0.00444)
R-Squared	0.200	0.192	0.145	0.201	0.132	0.149
N	83,286	83,286	83,286	83,286	83,286	83,286

TABLE A2 (Continued)

	Full sample, % of observation in each industry			Full sample, % value in each industry		
	% PCP	**% LCP**	**% VCP**	**% PCP**	**% LCP**	**% VCP**
(c) Sector Network-Adjusted Market Share, Global Sector Market Share and Invoicing Currency						
Exporter's sector Net. Adj. Market Sh.	1.277***	−0.693***	−0.584***	1.404***	−1.046***	−0.358**
	(0.164)	(0.0749)	(0.107)	(0.232)	(0.139)	(0.128)
Importer's sector Net. Adj. Market Sh.	−6.378***	3.706***	2.671***	−7.417***	3.764***	3.653***
	(0.656)	(0.473)	(0.285)	(0.870)	(0.649)	(0.455)
Exporter's global sector market share	0.457***	−0.289***	−0.168**	0.694***	−0.311***	−0.382***
	(0.0914)	(0.0409)	(0.0572)	(0.141)	(0.0860)	(0.0699)
Importer's global sector market share	−0.987***	0.408***	0.579***	−1.304***	0.531***	0.773***
	(0.132)	(0.101)	(0.0591)	(0.201)	(0.154)	(0.103)
Constant	0.631***	0.144***	0.226***	0.651***	0.198***	0.151***
	(0.00920)	(0.00574)	(0.00510)	(0.0119)	(0.00786)	(0.00661)
R-Squared	0.270	0.267	0.190	0.261	0.178	0.188
N	83,286	83,286	83,286	83,286	83,286	83,286

Note: Those tables report OLS regressions of the percentage of transactions priced in producer (PCP), local (LCP) and vehicle (VCP) currency on network-adjusted and global sector market shares, sectoral data, for differentiated goods. Standard errors are clustered at the 5-digit SITC Rev. 4 industry level.

Standard errors in parentheses $+p < .10$, $*p < .05$, $**p < .01$ and $***p < .001$.

TABLE A3 OLS regression of the share of producer (PCP) currency pricing on the sector network-adjusted market share and global sector market share, controlling for importer–exporter pairs and sector (5-digit SITC) fixed effects

	Full sample, % value in each industry					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	% PCP	**% PCP**	**% PCP**	**% PCP**	**% PCP**	**% PCP**
Exporter's sector Net. Adj. Market Sh.	2.287***		0.293***		0.352***	
	(0.141)		(0.0202)		(0.0331)	
Importer's sector Net. Adj. Market Sh.	−9.835***		−0.808***		−0.196***	
	(0.667)		(0.0452)		(0.0559)	
Exporter's global sector market share		1.149***		0.174***		0.222***
		(0.0937)		(0.00974)		(0.0136)
Importer's global sector market share		−3.462***		−0.330***		0.0685**
		(0.151)		(0.0215)		(0.0209)
Importer–exporter fixed effects	N	N	Y	Y	Y	Y
Sector (5 digit) fixed effects	N	N	N	N	Y	Y
R-Squared	112,993	113,662	112,993	113,662	112,993	113,662
N	0.219	0.191	0.789	0.789	0.913	0.913

Note: This table reports OLS regressions of the percentage of transactions priced in producer (PCP) currency on network-adjusted and global sector market shares, controlling and not controlling for importer–exporter pairs and sector fixed effects. Model 5 identifies the effect reported in Equation 18 (for the exporter network-adjusted market share) and Equation 19 (for the importer network-adjusted market share). Coefficients have the expected signs, and they are statistically significant at 99.9%. Importer's global sector market share does not capture the bargaining power of importers, as reported by the wrong sign in the coefficient in model.

Robust standard errors in parentheses $+p < .10$, $^{*}p < .05$, $^{**}p < .01$ and $^{***}p < .001$.

TABLE A4 Multinomial probit of invoicing currency for Italian import, from 2003 to 2008 and 2010, for producer currency pricing (PCP)

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2010**
	PCP	**PCP**	**PCP**	**PCP**	**PCP**	**PCP**	**PCP**
ln(Exp. Sect Net. Adj. MS /Imp. Sect. Net. Adj. MS)	0.429***	0.435***	0.394***	0.319***	0.512***	0.516***	0.420***
	(0.00522)	(0.00575)	(0.00541)	(0.00407)	(0.00611)	(0.00542)	(0.00471)
Exporter's market share of world exports of good	3.087***	0.864***	0.756***	0.732***	−0.435*	−2.128***	−2.400***
	(0.172)	(0.161)	(0.153)	(0.138)	(0.219)	(0.212)	(0.182)
Exporter's market share of world exports of good, squared	−12.43***	−8.105***	−7.426***	−7.941***	−9.730***	−7.364***	−6.830***
	(0.453)	(0.390)	(0.374)	(0.363)	(0.639)	(0.595)	(0.499)
Importer's market share of world exports of good	1.086***	1.162***	1.180***	1.464***	2.152***	1.968***	1.127***
	(0.105)	(0.123)	(0.113)	(0.0932)	(0.107)	(0.118)	(0.103)
Standard control	Y	Y	Y	Y	Y	Y	Y
N	4,644,22	853,192	912,105	1,453,508	400,101	353,926	466,961

Note: Base outcome is VCP. Standard controls include the following: modified Herfindahl Index of exports/imports of good (except for year 2006, for feasibility purpose), one binary variable if the value of trade is in the first, second or third quartile, one binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years and 9 binary variables to control for the main SITC sectors. Robust standard errors in parentheses +$p < .10$, *$p < .05$, **$p < .01$ and ***$p < .001$.

TABLE A5 Multinomial probit of invoicing currency for Italian import, from 2003 to 2008 and 2010, for local currency pricing (LCP)

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2010**
	LCP	**LCP**	**LCP**	**LCP**	**LCP**	**LCP**	**LCP**
ln(Exp. Sect Net. Adj. MS /Imp. Sect. Net. Adj. MS)	−0.150***	−0.0668***	−0.0968***	−0.0715***	−0.0462***	−0.0312***	−0.0445***
	(0.00392)	(0.00393)	(0.00368)	(0.00274)	(0.00384)	(0.00420)	(0.00368)
Exporter's market share of world exports of good	−0.00264	0.677***	1.233***	0.193**	−3.622***	−4.040***	−4.298***
	(0.0847)	(0.0806)	(0.0770)	(0.0619)	(0.0891)	(0.0942)	(0.0802)
Exporter's market share of world exports of good, squared	−0.363**	−0.688***	−0.946***	−0.0918	3.457***	3.878***	4.152***
	(0.134)	(0.119)	(0.113)	(0.0914)	(0.144)	(0.151)	(0.126)
Importer's market share of world exports of good	0.533***	2.799***	2.477***	2.460***	−0.318***	−0.243*	−1.099***
	(0.0770)	(0.0845)	(0.0779)	(0.0632)	(0.0892)	(0.104)	(0.0925)
Standard control	Y	Y	Y	Y	Y	Y	Y
N	4,644,22	853,192	912,105	1,453,508	400,101	353,926	466,961

Note: Base outcome is VCP. Standard controls include the following: modified Herfindahl Index of exports/imports of good (except for year 2006, for feasibility purpose), one binary variable if the value of trade is in the first, second or third quartile, one binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years and 9 binary variables to control for the main SITC sectors. Robust standard errors in parentheses $+p < .10$, $^{*}p < .05$, $^{**}p < .01$ and $^{***}p < .001$.