Trade Invoicing Currencies and Exchange Rate Pass-through: The Introduction of the Euro as a Natural Experiment *

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Abstract

A recent literature emphasizes the prominence of dominant currencies in international trade invoicing and the role of invoice currencies in the transmission of exchange rate shocks. In this paper, we examine the introduction of the euro as a once-in-a-century natural experiment that induced a substantial shifting in invoice currencies, allowing us to test existing theories. We use unique data on the invoice currencies of the universe of export and import transactions of Chilean firms trading with the Eurozone over the period 1997-2010. Before the euro, exports to the Eurozone were dominated by the US dollar, and euro legacy currencies were rarely used. The introduction of the euro led a substantial number of firms to switch their invoice currencies to euros, which eventually accounted for 40% of all transactions. We first study the determinants of the adoption of the euro in exports to the Eurozone, finding a key role for strategic complementarities and for the invoice currency of imported inputs. We then show how firms switching from dollars to euros faced a radical transformation of their exchange rate pass-through, in line with recent theories. While the literature has studied trade invoice currencies in settings in which these are very persistent firm-level choices, our findings validate the conjecture that large–scale policy changes can lead to changes in these choices, and simultaneous changes in exchange rate pass-through.

Keywords: Invoicing Currencies, Exchange Rates, Pass-through, Euro, Dominant Currency

JEL classification: F1, F3, F4

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1 Introduction

In the theory of open economy macroeconomics, the currencies used to invoice international trade transactions are key determinants of exchange rate pass–through, shaping the transmission of shocks across borders as well as optimal monetary and exchange rate policy. During the last decade, the literature has gained important insights from firm– or transaction–level data, analyzing firms' invoicing currencies and their effects on pricing [Gopinath et al., 2010, Gopinath and Itskhoki, 2010, Amiti et al., 2014, Gopinath et al., 2020, Amiti et al., 2022]. The most recent theory and evidence [Amiti et al., 2022] emphasizes that invoice currencies and desired exchange rate pass–through (ERPT) are *both* endogenous choices made by firms. At the same time, recent work has established a key role for dominant currencies (especially the US dollar) in international trade invoicing [Gopinath et al., 2020], with novel implications for the international price system. In fact, the evidence shown by Amiti et al. [2022] on the currency choice of Belgian exporters, in a context in which firms opt between using euros or dollars, is "consistent with a framework that allows for *endogenously* emerging dominant currencies."

We contribute to this literature by studying the introduction of the euro as an ideal and unique once–in–a–century natural experiment that created a significant shift in the invoice currencies used for international trade. The euro became a strong candidate for a dominant currency role, competing with the US dollar at least in trade with the Eurozone. This episode allows us to study both the determinants of invoice currency choice and to measure its impact on exchange rate pass–through as firms switch their invoice currencies from US dollars to euros. Such an event had not occurred since the US dollar took over the role of the British pound at some point earlier in the 20th century. In addition, the episode we study has the advantage of having occurred at a precise point in time due to a policy decision, allowing for a clean inference of its effects.

To study the effects of the introduction of the euro on invoicing currency choice and exchange rate pass–through, we analyze rich transaction–level data on exports and imports between a small extra-Eurozone open economy (Chile) and the Eurozone over the period 1997–2010. Our data are especially well suited for our purpose, for the following reasons. First, the data are unique in their reporting of the invoice currency of every transaction for a very long period of time spanning the introduction of the euro, and including both exports and imports. We combine the trade transactions data with data on firm characteristics obtained from a census of manufacturing firms. Observing firm characteristics such as revenue and cost is crucial, as it allows us to test the existing theories of trade invoicing and exchange rate pass–through. It is worth noting that few countries report invoice currencies in customs transactions, and only Amiti et al. [2022] has used such data combining firm characteristics and in-

voicing currencies.[1] In fact, studies with transaction-level data have typically focused on short panels. Another fundamental advantage of our data is that we focus on exports to the Eurozone by an extra–Eurozone economy that had nearly 100% dollar invoicing prior to the introduction of the euro. The clean identification this setting enables would not be feasible if we analyzed intra–Eurozone trade.[2]

Existing theories of currency invoicing and exchange rate pass–through [Amiti et al., 2022] predict that, due to strategic complementarities, adopting the euro is more likely for exporters in industries in which a larger share of competitors price in euros (i.e. in industries with a larger degree of intra–Eurozone competition).[3] Invoicing in euros should also be more likely for larger exporters, for which these strategic complementarities are stronger. In addition, due to a marginal cost channel, switching to euros is more likely for firms with imports also invoiced in euros. Further, the theory proposes that the short-run exchange rate pass–through is in part determined by the invoice currency used.

Our findings provide support to the most recent theories of currency invoicing and exchange rate pass–through. In the first part of our analysis, we document the expansion of the euro as an invoice currency and study the firm- and product-level determinants of its adoption. We document that the euro was very successful in gaining traction as an invoice currency at the expense of the dollar. Prior to 2002, the euro legacy currencies were rarely used for invoicing Chilean exports to the Eurozone (accounting for less than 0.1% of transactions and value traded) and nearly all exports were invoiced in dollars. After the introduction of the euro in physical format, a fraction of firms immediately switched to euros, and by 2010, 29.2% of transactions (accounting for 39.3% of export value) were invoiced in euros, with 37.9% of exporters invoicing at least some trade in euros.

This increasing use of the euro was driven almost entirely by the intensive margin (i.e. by continuing firms switching their invoices from dollars to euros) rather than by exporter entry or exit. In addition, we find that the increase in invoicing in local (i.e. destination) currency was specific to the Eurozone and was not part of a worldwide trend. We do find an increase in invoicing in euros to other European destinations, including countries that become Eurozone members toward the end of our sample (between 2007 and 2010) and countries that peg their currencies to the euro. In this regard, we see evidence of firm–level spillovers, such that firms that export in euros toward the initial 12 Eurozone members are

[1] Note for instance that members of the Eurozone report trade invoice currencies only starting in recent years, and only regarding extra-Eurozone trade.

[2] The existing data [Boz et al., 2022, Kamps, 2006, Emerson et al., 1992, Hartmann, 1998] indicates that trade between Eurozone members switched from euro legacy currencies and vehicle currencies to euros. Thus, identifying the effect of invoice currencies on exchange rate pass–through is easier in our context in which trade is invoiced entirely in dollars before the introduction of the euro. In addition, firm– or transaction–level data on invoice currencies for Eurozone members during this period has not been made available in the literature.

[3] The reason is that intra–Eurozone trade shifted from being invoiced in a combination of euro legacy currencies and vehicle currencies to being invoiced almost entirely in euros [Boz et al., 2022, Kamps, 2006, Emerson et al., 1992, Hartmann, 1998]. Thus, Chilean exporters would find that competitors' prices in any Eurozone destination would be much more stable in euros than what they were before in any euro legacy currency.

also more likely to start invoicing in euros when they export to other European countries.

We find that adopting the euro was substantially more likely among products facing more competition from within the Eurozone and among larger firms, which is evidence of the strategic complementarities mechanism featured in the theory of invoice currency choice.[4] In fact, consistent with Amiti et al. [2022]'s theory, we show that the effect of intra–Eurozone competition on the probability of adopting the euro was larger for larger firms. We also find that exporters with a higher ratio of imports invoiced in euros over cost, and those with a lower ratio of imports in dollars over cost, were more likely to invoice exports in euros. This is in line with Amiti et al. [2022]'s marginal cost channel. In addition, firms with a higher share of exports sold in Eurozone destinations are also more likely to invoice in euros, which suggests a fixed cost per currency used.[5] Finally, exporters that are affiliates of Eurozone multinationals also adopted the euro at a higher rate, suggesting that multinationals might make invoicing decisions globally and prefer headquarter currencies. Focusing on the dynamics, we see that the effect of the cost channel and firms' multinational affiliate status are more relevant in the initial years, while the effect of firm size, capturing the markup channel, becomes more relevant over time.

In the second part of the paper, we show that currency switching had drastic effects on exchange rate pass–through. Our natural experiment allows us to circumvent the key difficulty found in the literature to establish this relationship, which is that firm characteristics can determine both currency choice and desired exchange rate pass–through. In contexts with little currency switching (which is the type of data available in the literature so far), the state–of–the–art approach consists of estimating an exchange rate pass–through regression in which the regressors are both the invoice currency and the firm–level determinants of desired pass–through [Amiti et al., 2022]. This structural approach is model–dependent, in the sense that the firm–level determinants of desired pass–through are dictated by a theoretical model. Our approach, instead, relies on a natural experiment with substantial variation over time in invoice currencies. Instead of controlling for the firm–level determinants dictated by a model, we are able to control for firm × product × destination fixed effects, which capture *any* firm–level determinants that shape pass–through.

We proceed gradually, and first document a substantial change in the overall pass–through coefficients between the 1997–2001 and 2002–2010 periods. The short–run pass–through coefficient for the peso–dollar exchange rate to prices expressed in Chilean pesos is very close to one (1.068) in the pre-2002 period and substantially lower (0.543) in the post-2002 period.[6] The coefficient for the peso–euro

[4] We also find that invoicing in euros was more likely for exporters of differentiated goods, which is consistent with the well–documented fact that in the present as well as historically commodities are typically invoiced in dollars.

[5] Amiti et al. [2022] show that a simple extension of their baseline model, adding a fixed cost per currency used, can generate this result. They find that Belgian exporters with a higher share of Eurozone sales are more likely to invoice in euros their trade with other destinations. This type of fixed cost for currency management is also featured in Crowley et al. [2020].

[6] Note that while we refer to "prices", we are actually measuring unit values (value over quantity), given that we use

exchange rate, in contrast, is essentially zero pre-2002 (-0.014) and rises to 0.489 after the introduction of the euro. This is exactly what the theory predicts [Gopinath et al., 2010, Amiti et al., 2022]. When trade is invoiced almost entirely in dollars, the pass–through of the peso–dollar exchange rate is nearly complete and the pass–through of the peso–euro exchange rate is zero. After the euro is introduced, when trade is invoiced partly in dollars and partly in euros, prices respond to both exchange rates. Further, we show that just as the adoption of the euro occurs gradually over time, this change in exchange rate pass–through is also gradual, being stronger in the latest years of the sample. As an important check to our findings, we find no change in exchange–rate pass–through in exports to destinations outside Europe. This is consistent with the lack of change in invoice currencies in exports to the rest of the world.

Our strongest evidence compares exchange rate pass–through based on invoice currencies and the pre and post periods. For transactions invoiced in dollars the pass–through of the peso–dollar exchange rate is close to one (both before and after 2002), while the pass–through of the peso–euro exchange rate is near zero in both periods. The exact opposite is true for transactions invoiced in euros. The peso–dollar exchange rate pass–through is close to zero, while the pass–through of the peso–euro exchange rate is close to one. To conclude, we perform several exercises that rule out that these large changes in pass–through coefficients are due only to changes in desired pass–through, and are in fact driven by invoice currencies.[7]

Summing up, based on a natural experiment our results validate the view that invoice currencies shape exchange rate pass–through [Amiti et al., 2022].

Contribution to the Literature Our work adds, first, to the literature on the determinants of trade invoicing currency choice. Work in this area has provided many important insights in either cross-sectional contexts (based on cross-country, cross-industry, or cross-firm variation) or studying short panels in which currency choice is very persistent. The patterns and determinants of trade invoice currencies have been studied by Goldberg and Tille [2008], Goldberg and Tille [2016], Chung [2016], Lyonnet et al. [2022], Goldberg [2005], Devereux et al. [2017], Crowley et al. [2020] and Boz et al. [2022]. Our findings are consistent with this literature. The key difference of our paper is focusing on the introduction of the euro as a unique natural experiment, thus providing the first firm-level evidence on the emergence of a new global currency. Empirical evidence in this regard is very limited, because the only events in recent history one could study are the emergence of the euro or the emergence of the US dollar (which was presumably much more gradual over time). As far as we know, there is no evidence

customs data.

[7] We also verify the robustness of our results to a broad set of alternative specifications. In addition, we show that exchange rate pass–through changes only in exports to Eurozone destinations, and not in exports to non–European countries.

on the mechanisms that made the euro gain popularity as an invoice currency because aside from our paper there has been no availability of industry– or firm–level data in trade invoice currencies for that period. From a theoretical perspective, Mukhin [2022] develops a framework to analyze endogenous dominant currencies, which is shown to match the aggregate patterns of invoice currency use seen after the introduction of the euro. Our evidence could potentially be used to calibrate or validate this type of framework at a more microeconomic level.

In addition, our work contributes to the literature on exchange rate pass-through. Recent firm– or transaction–level analyses include [Gopinath and Itskhoki, 2010, Berman et al., 2012, Amiti et al., 2014, Chen and Juvenal, 2016, Cravino, 2017, Heise, 2019, Bonadio et al., 2020].[8] Within this literature, our paper is especially linked to work that examines the relationship between invoice currencies and exchange rate pass–through [Gopinath and Rigobon, 2008, Gopinath et al., 2010, Chen et al., 2022, Boz et al., 2022, Gopinath et al., 2020].[9] Our findings speak most closely to Amiti et al. [2022], who study theoretically and empirically the determinants of currency choice in Belgian exports and imports, and how invoice currencies determine exchange rate pass–through. The Belgian case is interesting because firms face a choice between two competing global currencies – euros and dollars. Given the persistence in invoice currencies and the short panel used, the effect of invoice currencies on exchange rate pass–through is based on a comparison across firms estimating structural model–derived regressions. In that paper, the causal effect of invoice currencies on pass–through is obtained by controlling for firm–level flexible pass–through determinants. In this regard, our main contribution to the exchange rate pass–through literature is leveraging what we believe is the ideal natural experiment to establish the relationship between invoice currencies and exchange rate pass–through. Our findings turn out to be in full support of recent theories, and we view our empirical approach as complementary to Amiti et al. [2022]'s and to the rest of the existing empirical evidence.

Methodologically, our approach based on a natural experiment stemming from a one-off policy event resembles Auer et al. [2021], who study the unexpected appreciation of the Swiss franc against the euro in 2015. Our episode and goal, however, are very different. We study a policy establishing a new cur-

[8] Cravino [2017] uses Chilean exports with invoice currencies to study how nominal exchange rates impact output and productivity. Consistent with Gopinath et al. [2010] and with our findings, he documents that export prices are rigid in the currencies in which they are invoiced, even though his work is primarily focused on the adjustment of quantities.

[9] Burstein and Gopinath [2014] and Gopinath and Itskhoki [2022] provide detailed surveys of the literature. Studying US export and import prices, Gopinath and Rigobon [2008] document that almost all US trade is invoiced in dollars, that international prices are highly rigid, and that exchange rate pass–through into US import prices is relatively low. Gopinath et al. [2010] find a large difference in exchange rate pass–through into US import prices comparing transactions in dollars vs. other currencies. Chen et al. [2022] study UK imports and document a pervasive use of vehicle currencies and pass–through that depends on the invoice currency used, which helps understand inflation patterns following sterling devaluations. Using a comprehensive global data of invoice currency use and country–pair level exchange rate pass–through regression, Boz et al. [2022] find that that pass–through into import prices of the dollar (or euro) exchange rate is larger for countries with a higher share of trade invoiced in dollars (or euros) respectively.

rency (which, key to our identification strategy, induced substantial invoice currency switching), while Auer et al. [2021] study the effects of an appreciation on border and retail prices. Other work taking advantage of large devaluations includes Corsetti et al. [2022], who study exchange rate pass-through around the Brexit referendum and Cravino and Levchenko [2017], who establish the distributional consequences of Mexico's 1994 devaluation.[10]

The rest of the paper is organized as follows. We provide a brief theoretical discussion to guide our empirical work in Section 2. In Section 3 we describe the data sources. Next, we examine the patterns and determinants of the adoption of the euro in Section 4. Finally, in Section 5 we establish how large–scale switching to invoicing in euros fundamentally changed exchange rate pass–through.

2 Theoretical discussion

We first provide a brief theoretical discussion to guide our empirical work. Our discussion is based on the model by Amiti et al. [2022], which unifies the literature on invoice currencies and exchange rate pass–through.

Consider Chilean firms exporting to Eurozone destinations. In principle, these firms can choose between producer currency pricing (invoicing in Chilean pesos), local currency pricing (invoicing in euros after it was introduced or euro legacy currencies before), or dominant currency pricing (invoicing in US dollars). In practice, the Chilean peso is not used, so we focus the discussion on the latter two options.[11]

Given our empirical setting, our discussion is focused on short–run exchange rate pass–through. Consider an environment with sticky prices, such that in each period only a fraction of prices can be adjusted after the state of the world (which includes exchange rate movements) is revealed. For the set of prices that are adjusted, exchange rate pass–through will be equal to desired exchange rate pass–through. For prices that cannot be adjusted, exchange rate pass–through is completely determined by the invoice currency. Exports invoiced in dollars have complete pass–through of the peso–dollar exchange rate to the price expressed in Chilean pesos; exports invoiced in euros (or euro legacy currencies) feature a complete pass–through of the peso–euro (or peso–legacy currency) exchange rate to the price in pesos.

[10] Corsetti et al. [2022] find substantial differences in exchange rate pass–through for trade invoiced in different invoice currencies around the Brexit referendum in 2016. They report there are no significant changes in invoicing due to that episode, although UK firms have been gradually moving away from invoicing in sterling.

[11] Of course, Chilean exports could also be invoiced in other vehicle currencies, but we leave this possibility out of the discussion since it is not observed in the data and given the dominant role of the US dollar in global trade. Beyond the trade–offs in Amiti et al. [2022], the lack of use of the Chilean peso as an invoice currency could be related to the fact that Chilean pesos are not typically available in foreign exchange markets outside Chile.

Desired exchange rate pass–through is a function of the exposure of cost and of desired markups to exchange rates.[12] Cost exposure to the peso–euro exchange rate is a function of the ratio of imports invoiced in euros over variable cost. In the same way, cost exposure to the peso–dollar exchange rate is a function of the ratio of imports invoiced in dollars over variable cost. Exposure of the desired markup to the exchange rates depends on the markup elasticity with respect to price, and on the elasticity of competitors' prices to the exchange rates. As Amiti et al. [2019] show and following Amiti et al. [2022], markup elasticity is increasing in firm size, which we use in the empirical analysis. For firms invoicing in euros with zero cost exposure to exchange rates and zero markup elasticities, desired pass–through of the peso–euro exchange rate to the price in pesos is complete, while pass–through of the peso–dollar exchange rate to the price in pesos is zero. For firms with cost exposure to the peso–euro exchange rate (i.e. firms with some imports in euros) and also to the peso–dollar exchange rate (i.e. firms with some imports in dollars), desired pass–through of the peso–euro exchange rate to the price in pesos is incomplete, and pass–through of the peso–dollar exchange rate is also non–zero. For firms invoicing in euros with non–zero exposure of desired markups to the peso–euro and peso–dollar exchange rates, pass–through of the euro–dollar exchange rate to the price in pesos is again incomplete, and pass–through of the peso–dollar exchange rate is again non–zero. The same logic applies to firms invoicing in dollars (switching the terms dollar and euro accordingly).

When choosing invoice currencies, firms seek to minimize the variance of prices expressed in the chosen currency. Firms prefer to invoice in euros (i.e. local currency pricing) when they have high cost and desired markup exposure to euros, and low cost and desired markup exposure to dollars. Alternatively, firms prefer to invoice in dollars (i.e. dominant currency pricing) when they have high cost and desired markup exposure to dollars, and low cost and desired markup exposure to euros.[13]

Our interpretation of the effect of the introduction of the euro in terms of this theoretical framework is the following. Prior to its introduction, intra-Eurozone exports were invoiced in various legacy currencies.[14] Before the euro was introduced, a price index of competitor's prices in a specific destination (for example Spain) would not be constant in Spanish currency, as some exporters would invoice in francs, marks, etc. and the franc/peseta, mark/peseta, etc. exchange rates would fluctuate. After the introduction of the euro, with most intra–Eurozone imports (and probably a larger share of extra–Eurozone imports) invoiced in euros, the competitor price index in any Eurozone destination would be much more stable in euros than what it was before in euro legacy currencies.[15] Through the markup

[12] To avoid repetition, in the following paragraphs "euros" refers to actual euros (after its introduction) or to euro legacy currencies (prior to its introduction).

[13] Firms prefer to invoice in pesos (producer currency pricing) when they have low cost and desired markup exposure to both euros and dollars.

[14] Evidence in this regard is found in Emerson et al. [1992] (table 7.2) and in Hartmann [1998].

[15] Evidence that intra–Eurozone trade was conducted in euros after its introduction is found in Kamps [2006] and Boz et al.

exposure channel, this would give Chilean exporters a larger incentive to invoice in euros. In addition, if firms increase the use of euros in their imports, this would increase cost exposure to the euro, also providing an incentive to switch to euros the invoicing of their exports.[16]

The introduction of the euro would thus change exchange–rate pass–through by changing the invoice currency of Chilean exports and by changing desired pass–through. Through both channels, it would lead to a larger pass–through of the peso–euro exchange rate and a weaker pass–through of the peso–dollar exchange rate to prices in pesos.

3 Data sources

Our analysis is based on a unique dataset that combines export and import transactions of Chilean firms during the period 1997–2010, with characteristics for a subset of these firms obtained from a census of manufacturing firms. The three essential features of the data are that they include the invoice currency used in every single transaction, that they span the period of the introduction of the euro, and that we can observe a set of firm–level variables including revenue, variable production cost and multinational status.

Data linking firms with the invoice currencies of their international trade transactions are rare, and have not been available in long panels or for the period around the introduction of the euro for any country. In fact, in many countries these data are not collected, are collected through surveys only, or have been collected only very recently.[17] Customs records including invoice currencies have become available for a few countries including the United Kingdom [Chen et al., 2022, Crowley et al., 2020, Corsetti et al., 2022], Belgium [Amiti et al., 2022], Canada [Goldberg and Tille, 2016] and Chile [Cravino, 2017].[18] While data on invoicing currencies obtained from either customs records or surveys have led to important insights, not observing firm characteristics limits the possibilities of testing theories of currency invoicing and exchange rate pass-through. The only existing dataset on invoice currencies combined with firm characteristics we are aware of is that used by Amiti et al. [2022] for Bel-

[2022].

[16] One could consider the simultaneous choice of invoice currencies for both exports and imports, but as Amiti et al. [2022] point out, invoicing currencies for imports seem to be less of an active decision for firms.

[17] For instance, Goldberg and Tille [2008] point out that *"The U.S. Customs Service collects the data on the value of imports and exports, but do not keep any data on the currency in which trade is conducted"*. Evidence on the invoice currency of US trade is available only from the BLS survey on import and export prices, used by Gopinath and Rigobon [2008] and Gopinath et al. [2010]. Similarly, Amiti et al. [2022] indicate that "*The Belgian Customs Office only began to collect these data in a systematic way at the beginning of 2017, which were then processed by the National Bank of Belgium. Because the Customs Office only records extra–EU transactions, the currency data are only available for trade transactions with countries outside of the European Union. All international trade transactions that take place within the European Union are collected by a different authority, the Intrastat Survey, which does not report the currency of invoicing.*"

[18] Specifically, Cravino [2017] uses customs exports records with invoice currencies for the the wine sector (2003–2011) and for all sectors (2009–2011).

gium, who combine export and import customs transactions with extra–EU countries and the income statements of all incorporated firms during 2017–2020.

Export and import transactions Our main source of data is the universe of customs export and import transactions records for Chile during the period 1997–2010.[19] For each transaction, we observe the date (at a daily frequency), the identity of the Chilean exporter or importer, the value and quantity traded, the country of origin (for imports) or destination (for exports), HS 8–digit codes describing the product traded, and the invoice currency used.[20]

Our main focus is on Chilean exports to the twelve countries that adopted the euro since its inception: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.[21] This set of twelve countries represents 12 percent of Chilean exports over the 1997–2010 period, fraction which is very stable over time. In some results, we also focus on exports to European extra–Eurozone countries, as well as on exports to the rest of the world.

In the subsequent analysis, we aggregate data by exporting firm, HS 8–digit product, country of destination and quarter. We choose quarters because on one hand we want to work at the highest frequency possible and on the other hand the data are too sparse at the monthly level as many firms export sporadically. We compute unit values as the ratio between value and quantity, and refer to these unit values as prices.

The dataset of exports to Eurozone countries contains 208 thousand firm–HS8–destination–time (year–quarter) cells and 7.4 thousand exporting firms over the entire 1997–2010 period.[22] Columns 1 through 4 in Appendix Table A.1 report summary statistics.

Census of Manufactures To obtain further characteristics of these firms, we combine the customs transactions data with the Chilean Census of Manufactures (ENIA, or *Encuesta Nacional Industrial Anual*). We are able to match the customs data to ENIA using firm tax identifiers for the period 1997–2006. The variables we use from ENIA are firm revenue and variable production cost, defined as the sum of the wagebill plus the cost of materials.

[19] The data are obtained from the Chilean Customs agency. The export transactions have been used in several papers including Wagner and Zahler [2015] and Morales et al. [2019]. The import transactions data have been used by Blum et al. [2010].

[20] In the baseline sample we exclude copper exports. Copper is Chile's main export commodity and accounts for a large share in value of Chile's exports but a small share of export transactions. For example, in year 2002 copper accounts for 57.0% of exported value and 4.8% of export transactions to the Eurozone.

[21] All these countries except Greece adopted the euro in January 1999. We also include Greece in the sample because it joined the Eurozone in January 2001, before the euro was available in physical format. We exclude several other European countries that adopted the euro later on. We show later that our results are robust to excluding Greece from the sample.

[22] Below, we use indistinctly the terms "transactions" or "cells" to refer to these firm–HS8–destination–time (year–quarter) cells.

In our empirical analysis, we report results considering *all* exporters to the Eurozone, but the ENIA subsample will allow us to tie our analysis more tightly to recent theories of invoicing currency choice. Note that the results linking exchange rate pass–through to invoice currencies are based on the full sample. The availability of the variable production cost is particularly useful as it will allow us to construct the ratio between the share of imports invoiced in euros and this cost, which is a key determinant of the invoicing currency choice. In columns 5 through 7 in Appendix Table A.1 we report summary statistics for the Census of Manufactures sample. We see that the Census of Manufactures sample accounts for about half of the exports to the Eurozone in the full sample. While the firms in the Census of Manufactures sample are on average larger compared to the full sample, the table shows that both samples are remarkably similar in terms of the share of exports and imports invoiced in euros and dollars in all years.

Exchange rates and price indexes We complement our dataset with quarterly Chilean peso vs. US dollar and Chilean peso vs. euro exchange rates as well as consumer price level indexes for Chile and each Eurozone member. In some results in Section 5, we also use exchange rates between the Chilean peso and non–European countries, as well as price level indexes in those countries. These variables are obtained from the IMF's International Financial Statistics. Quarterly exchange rates are computed as the average of daily exchange rates. Before 2002, the Chilean peso–euro exchange rate is replaced by the exchange rate between the Chilean peso and each of the euro legacy currencies (French franc, German mark, Spanish peseta, Italian lira, etc) using the conversion rates between these legacy currencies upon the introduction of the euro. We plot the peso–dollar, peso–euro and euro–dollar exchange rates in Appendix Figure A.1. Panel A.1a shows that the Chilean peso depreciated relative to the US dollar from 1997 up to mid 2003, and appreciated until the 2008 global financial crisis, during which there was a spike in the value of the dollar. Panel A.1b indicates that the euro depreciated relative to the US dollar until 2003, appreciated until the beginning of 2006, and then depreciated with a spike during the 2008 global financial crisis.

Other data sources Finally, we use data from Dun and Bradstreet to identify firms that are multinational affiliates with headquarters in Eurozone countries. We also use data from the UN's COMTRADE database to construct product–level measures of intra–Eurozone import shares for each Eurozone country.

4 The adoption of the euro as a trade invoicing currency

We start our analysis by documenting patterns and determinants of the adoption of the euro as an invoice currency in Chilean trade with Eurozone countries. The euro was introduced in non-physical form in January 1999 (becoming available for bank transfers, etc.) and in physical form in January 2002. Prior to the introduction of the euro, Chilean exporters had the choice of invoicing their sales in US dollars (the primary vehicle currency of Chilean exports), euro legacy currencies (French francs, German marks, Spanish pesetas, Italian lire, etc.), other vehicle currencies (such as the British pound) or Chilean pesos.

We describe trends in the use of invoice currencies in Section 4.1 and then proceed to estimating regressions testing the product and firm–level determinants of the adoption of the euro in connection to theories of invoice currencies in Section 4.2.

4.1 Trends in invoice currencies

The first finding we document is that euro legacy currencies were rarely used for invoicing exports to Eurozone countries.[23] The Chilean peso was also almost never used, both in exports to the Eurozone or elsewhere. Other vehicle currencies were not popular either.[24] Consequently, prior to 2002 Chilean exports to the Eurozone were invoiced almost exclusively in US dollars. Once the euro was introduced in physical format in January 2002, we see a swift growth in its popularity as a trade invoice currency. Figure 1a plots the share of exported value invoiced in euros or euro legacy currencies between 1997 and 2010 at quarterly frequency. By 2004 this share was 10% and by 2010 it had reached 30%. The share of transactions invoiced in euros grows even faster, implying that euro-invoiced transactions are on average smaller (see Figure 1b). By 2010, more than 40% of transactions were invoiced in euros. We also count the share of Chilean exporting firms with at least one transaction in euros. This share reaches almost 30% by 2005 and almost 40% by 2010, as shown in Figure 1c. This implies that euro-invoicing became popular among many firms, and the large share of trade invoiced in euros is not driven by a few large exporters. Finally, the share of HS8 products with at least one transaction in euros (in Figure 1d) also increases reaching more than 40% by the end of the period. Appendix Figure A.2 shows that the adoption of the euro for export invoicing was common across all the largest Eurozone destinations.

[23] The fact that we rarely see trade invoiced in euro legacy currencies is not a matter of reporting format in customs declarations. First, we do observe *some* invoicing in legacy currencies, and second, euro invoicing after 2002 starts growing continuously from the very low level of trade previously invoiced in legacy currencies.

[24] For example, in year 2002 less than 0.003% of worldwide export transactions and exactly zero export transactions to the Eurozone were invoiced in Chilean pesos. The share of exports to Eurozone destinations invoiced in currencies other than Eurozone currencies or US dollars was 0.02% during 1997-2001 and 0.69% during 2002-2010 (measured in terms of the fraction of firm–product–destination–time (year–quarter) cells) and 0.0% and 0.01% respectively measured in terms of value.

Further, Appendix Figure A.12 in Section A.2.3 shows that the growth over time in the share of trade invoiced in euros was seen not only in the aggregate but also *within* firm–product–destination cells.[25]

The fact that the adoption of the euro as an invoicing currency is gradual is consistent with the theoretical insights in Mukhin [2022]. In that model, strategic complementarities imply that no firm wants to switch first toward the new currency. Consequently, a change in fundamentals does not lead to a large change in the invoice currency immediately. This gradual adoption is also consistent with the pattern seen as the dollar overtook the pound sterling, as described in detail by Eichengreen [2011] and discussed by Mukhin [2022] as motivation for this model.

Another point of interest regarding the timing is that the adoptiong of the euro begins in 2002, after it was introduced in physical format, and not after 1999, when it was introduced in non–physical format. Available evidence indicates that invoicing in euros became a viable alternative for Chilean firms after its introduction in physical format 2002.[26] In addition, this timing is consistent with the volume of transactions in the Chilean foreign exchange market, which shows that the share of transactions involving euros in April 2001 was *lower* than the share of transactions involving legacy currencies in April 1998. By 2010, in contrast, the share of foreign exchange transactions involving euros had increased substantially.[27]

Appendix Figure A.3 illustrates the growth of the euro as an invoicing currency across the largest HS2 sectors among Chilean exports to the Eurozone. It shows that this pattern was common across all industries, even though there are some differences in the extent to which this occurred. In fact, in the largest HS2 sector, beverages (consisting almost entirely of wine), the share of cells invoiced in Eurozone currencies jumped from zero to 20% almost immediately, reaching more than 60% by the end of the decade.[28] We also find (see Appendix Figure A.5) that the growth in exports invoiced in euros was stronger among affiliates of multinationals located in the Eurozone, among importers from the Eurozone, and among larger exporters. Further, we show in the same figure that the overall trend

[25]The aggregate share of transactions in euros shown in Figure 1b could increase because each firm–product–destination is invoicing more in euros (a within effect) or due to changes in the extensive margin (new firm–product–destination cells that invoice in euros or exit of cells that invoice in dollars). Appendix Figure A.12 captures the within effect.

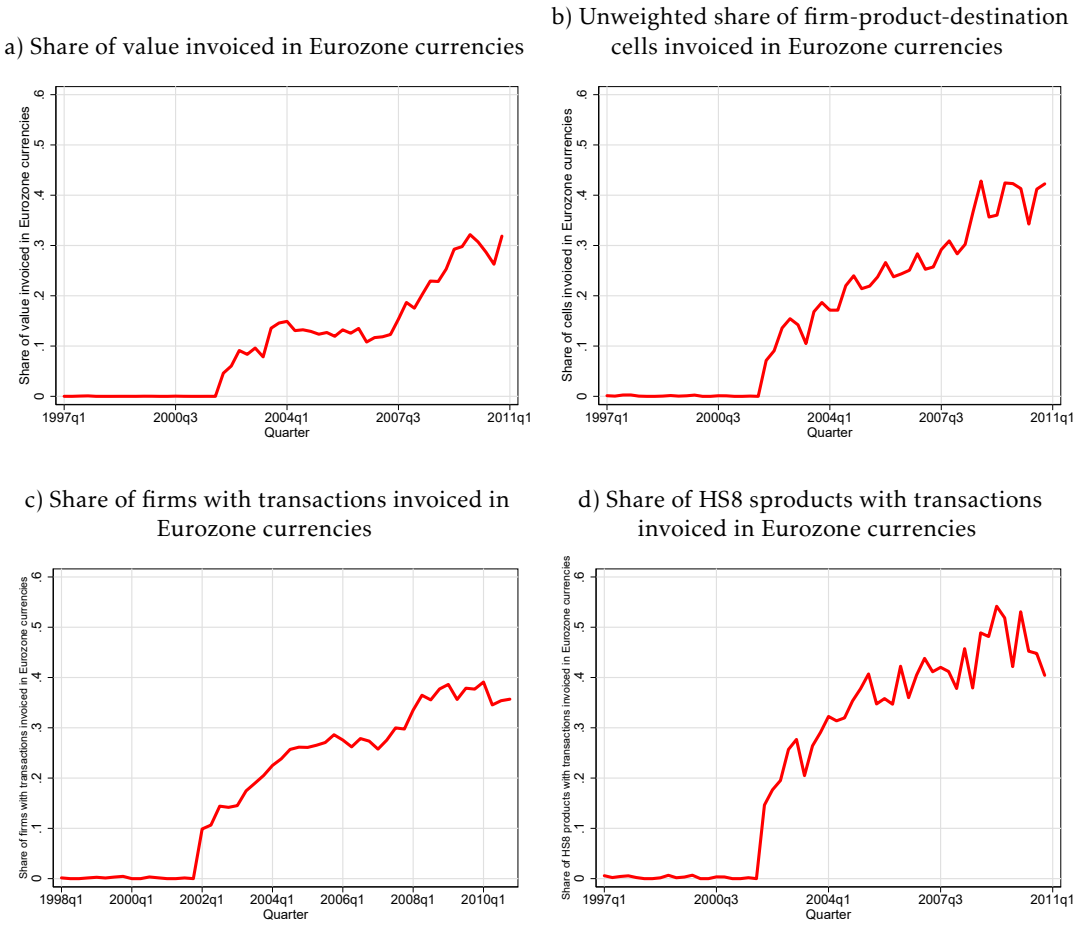
[26]Discussions with policy makers at the Central Bank of Chile suggest that the Chilean financial system and foreign exchange market had not made the euro widely available as a currency until 2002. As additional anecdotal evidence, the main Chilean newspaper published on a daily basis the value of legacy currencies, and not of the euro, until August 2001. Finally, this is consistent with evidence from balance sheet data of publicly listed firms in Chile, in which the euro starts appearing as a currency for liabilities starting in 2002.

[27]Data on the volume of foreign exchange transactions is obtained from the "Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity" which is based on Central Banks' reports and is published by the Bank of International Settlements [Bank of International Settlements, 1998, 2002, and 2010]. The share of transactions involving legacy currencies is 2% in April 1998 and the share of transactions involving euros is 1.3% in April 2001. By 2010, this share is 7.7%. We used table E-4 in the Statistical Annex of this survey. This evidence has the caveat that foreign exchange transactions related to export proceeds are only a fraction of the foreign exchange market.

[28]Appendix Figure A.4 provides an alternative version of this figure removing firm × product × destination fixed effects, which reduces the volatility in these series.

is also seen among firms in our Census of Manufactures subsample, which will be used in part of our empirical analysis.

Figure 1: Share of exports to the Eurozone invoiced in Eurozone currencies.



Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. Panels A and B report the share value and share of firm-HS8-destination cells invoiced in Eurozone currencies respectively. Panels C and D report the share of firms and HS8 products with at least one transaction invoiced in Eurozone currencies respectively.

Persistence We also document how persistent is the decision to switch to invoicing in euros. We focus on firm–product–destination cells, which is the dimension relevant to our empirical analysis later on. Appendix Figure A.7 indicates that once a firm switches to invoicing in euros for a given product–destination, this becomes a persistent decision. For each firm–product–destination cell that invoices in euros at any point in our sample, we identify the first time it does so. We then compute the share of these cells invoiced in euros several quarters before and after that switch. The figure shows that four quarters after switching to euros, 81% of these cells still invoice in euros.

Extensive margin We also ask whether the adoption of the euro occurs predominantly among entrants or among continuing firms that switch to euros. Appendix Table A.3 indicates that the share of value exported and the share of transactions accounted by entrants is fairly low. For example, in 2002, 4% of exports (12% of transactions) correspond to entrants.[29] In addition, the table shows that the share of exports accounted for by entrants is similarly low for trade invoiced in dollars and euros. Next, Table A.4 shows that exiting firms account for an equally small fraction of exports. Thus, the extensive margin does not play a large role in the overall adoption of the euro, simply because it does not play a large role in Chilean exports to the Eurozone.

Invoicing patterns among entrants and continuing firms We can also distinguish the invoicing patterns of entrants versus continuing firms. In Appendix Figure A.8, we define entrants as those firms that had not exported to the Eurozone before 2002, and continuing firms as those that had. We see the overall pattern of increasing invoicing in euros in both groups. The share of transactions invoiced in euros reaches about 50% among continuing firms and 30% among entrants by the end of the period. In addition, within the set of continuing firms, we distinguish between new versus continuing product–destination pairs. Again, we see an increasing popularity of the euro in both groups. We also see that continuing firms are somewhat more likely to invoice in euros for new product–destination pairs rather than for continuing ones (reaching shares of about 50% and 30% respectively by 2010). In Appendix Figure A.10, we see very similar patterns with an alternative definition of entrants, such that entrants are firms without exports to the Eurozone in the last three years.

Among firms that enter the Eurozone market, we can go further and distinguish between those that already export to other markets, and those that are first–time exporters. One could expect that entrants to the Eurozone market that sell to other markets using the US dollar are less likely to adopt the euro than first–time exporters. In Appendix Figure A.9 we compare these two types of firms, and do not find significant differences between them. In Section 4.2 below, we compare entrants against continuing firms in a regression framework controlling for other firm characteristics, since continuing firms and different types of entrants differ in terms of size and in other dimensions.

Non–Eurozone destinations It is also interesting to document the use of the euro in exports to the rest of the world. Figure 2 illustrates the adoption of the euro in countries outside of the twelve initial Eurozone members considered in the baseline analysis. Panel 2a considers countries that adopted the Euro later in our sample, which are Slovenia (adoption in 2007), Cyprus (2008), Malta (2008) and Slovakia

[29] In that table, we define entrants as firms which had not exported in the past three years. The overall message does not change much by switching this cutoff.

(2009).[30] We see that in this group of late adopters the growth in invoicing in euros is delayed relative to the 12 initial EZ members (shown in Figure 1) and spikes around the time of adoption, reaching about 60% of transactions by 2010. Among these late adopters, there is some use of the euro before the date of entry to the Eurozone, which is probably explained by their strong trade ties to the Eurozone. Panel 2b focuses on European countries that peg their currencies to the euro. These include Denmark, Bulgaria, Bosnia–Herzegovina and Macedonia.[31] These countries' currencies have been pegged to the euro since its introduction. In this case, we see that invoicing in euros follows a very similar pattern to the 12 initial Eurozone members, with about 50% of transactions invoiced in euros by 2010. Panel 2c considers all non–Eurozone European countries excluding the late adopters, those with pegged currencies, as well as microstates that don't have their own currency. In this set of countries, the share of transactions invoiced in euros also increases gradually, reaching almost 25% by 2010. Finally, panel 2d illustrates the use of the euro in destinations outside Europe. The use of the euro in exports outside Europe is quite small, reaching about a 2% share in 2010. This is not driven by a large adoption in a small set of countries. Instead, it is quite broad, driven by small shares of invoicing in euros across a large set of countries, including many of Chile's main trading partners.[32]

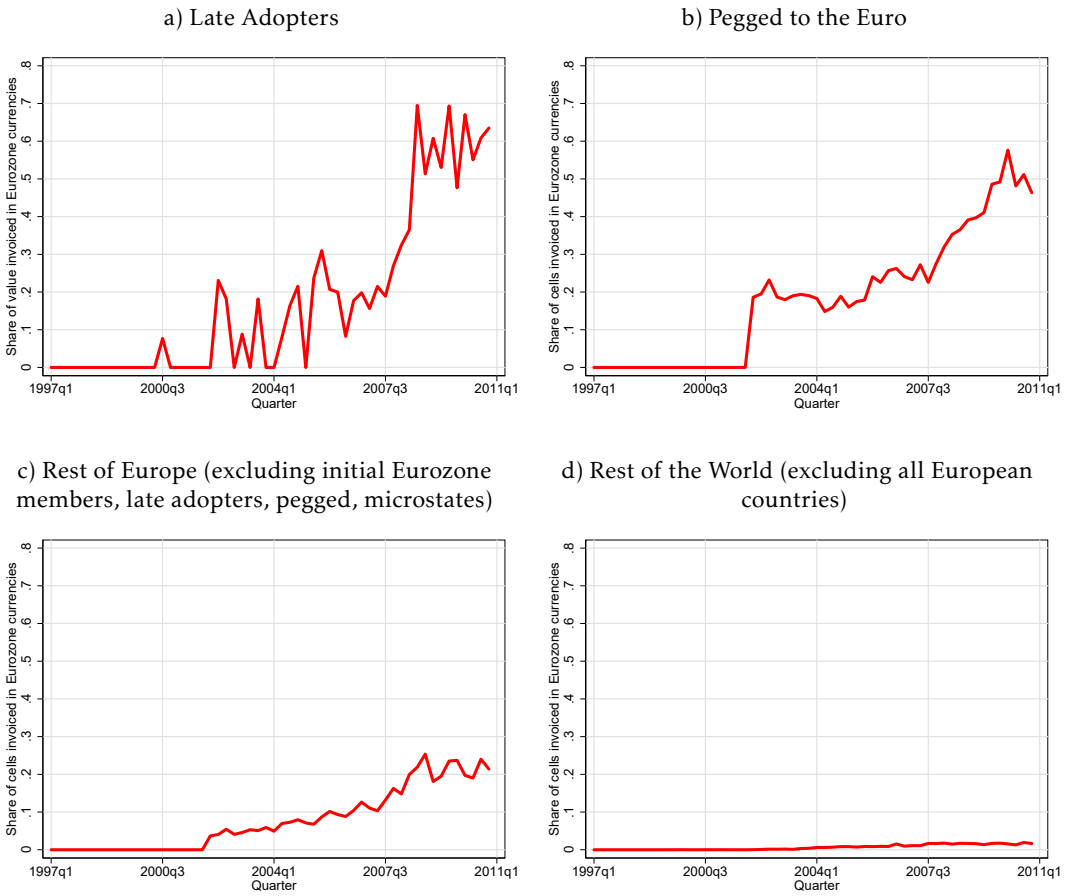
There is evidence that the adoption of the euro in exports to extra–Eurozone European destinations is driven by exporting firms that export in euros to the Eurozone. In Appendix Section A.2.2, Figure A.11, plots the share of exports invoiced in euros to extra–Eurozone European destinations splitting the sample between i) firms that have at least some exports invoiced in euros to the Eurozone and ii) the rest of firms. The share of exports invoiced in euros is substantially higher among the former. By 2010, it reaches 40% among firms with exports in euros to the Eurozone, and 5% among the rest. In the same Appendix, we confirm this result with a regression. This suggests there are spillovers working at the firm level. One possible interpretation for this result is that there is a fixed cost per currency used, such that firms there is an incentive for firms to use a single currency across all markets. This type of fixed

[30] See Goldberg [2005] for more evidence on trade invoice currencies used by Eurozone accession countries during the early years of the euro. Note that other countries have adopted the euro after the end of our sample, including Estonia (2011), Latvia (2014), Lithuania (2015) and Croatia (2023).

[31] Chilean exports to the countries labeled late adopters and to countries with currencies pegged to the euro are small. Among these countries, the largest destination is Denmark, which receives about 0.5% of Chilean exports. Some of these countries peg their currencies exactly to the Euro while others allow for fluctuations within a small band. Note that while Denmark signed the Maastricht treaty (the founding treaty of the euro) in 1992, it opted out of it following a referendum in 2000.

[32] For example, in 2010 the share of transactions invoiced in euros in Chile's exports to its largest trading partners such as Argentina, Brazil and the United States are 2.6%, 1.9% and 0.3%, respetively. The only countries to which the share of transactions invoiced in euros reached more than 10% by 2010 are Ivory Coast (34%), Cuba (18%), and Turkey (12%), which are all small trading partners of Chile, In the case of the Ivory Coast (34%), this could be due to the fact it belongs to a currency union using the West African Franc, which is pegged to the Euro. In the case of Cuba, one could speculate this is due to political reasons. In the case of Turkey, this might be due its proximity and economic ties to Europe (we do not include Turkey in the European sample given its transcontinental nature).

Figure 2: Share of exports to regions outside the Eurozone invoiced in Eurozone currencies.



Note: This figure shows the share of Chilean exports to various regions invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. Panel A (countries adopting the euro later in our sample) includes Cyprus, Slovakia, Slovenia and Malta. Panel B (countries with currencies pegged to the euro) includes Denmark, Bosnia–Herzegovina, Macedonia and Bulgaria. Panel C includes Albania, Belarus, Croatia, the Czech Republic, Estonia, Hungary, Iceland, Latvia, Lithuania, Moldova, Norway, Poland, Romania, Serbia, Sweden, Switzerland, Ukraine, and the United Kingdom. Panel D includes all countries outside Europe.

cost is featured in Amiti et al. [2022].[33]

Invoicing in local currency: Eurozone versus the rest of the world We also find that the adoption of the euro in exports to the Eurozone is specific to this region and is not driven by a broader, worldwide switch to invoicing in local (i.e. destination) currency by Chilean exporters. To show this, we use a difference in differences approach, comparing the invoicing in local currency in the Eurozone against non–European destinations before and after 2002.[34] We estimate the following regression in which the

[33]Note that in contrast to non–Eurozone European destinations, we do not find evidence of spillovers toward the rest of the world (i.e. non–European) countries, for which the use of the euro in exports toward them is very low.

[34]Invoicing in local currency in exports to the Eurozone means using euros or in the legacy currency of the destination country. Invoicing in local currency in exports to the rest of the world means using the destination country's currency.

dependent variable is a dummy variable equal to one for transactions invoiced in local currency, and zero otherwise. The regressors include a dummy variable EZ_c equal to one for Eurozone destinations, and a dummy variable $Post2002_t$ equal to one for the period 2002–2010. In the baseline specification, we include firm–product–destination fixed effects and time (year–quarter) fixed effects, but we also show our results are robust to using firm–product–destination, firm–time, and product–time fixed effects.

$$\Pr(\text{LC})_{fpct} = \beta_1 \cdot \text{EZ}_c \cdot \text{Post2002}_t + \gamma_{fpc} + \delta_t + \epsilon_{fpct} \,. \tag{1}$$

Note we exclude from the "rest of the world" group European countries outside the Eurozone in light of the previous evidence that there is a substantial adoption of the euro in exports to these destinations.

The results are shown in Table 1. The positive sign of the coefficients implies that there is an increase in invoicing in local currency after 2002 in the Eurozone relative to the rest of the world. The magnitude of these coefficients indicates a 14.6 log point (15.7%) increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

In Figure 3, we provide estimates of a more flexible specification interacting the EZ_c dummy with a set of year–quarter fixed effects, which allows us to show there are no pre–existing trends.[35] In Appendix A.2.5, we also show that the results presented also hold when restricting the sample to continuing firms (firms that already export in the pre–2002 period), when using alternative fixed effects, or when controlling for the level of the exchange rate between the Chilean peso and the local (i.e. destination) currency. Finally, because there was a (very small) amount of invoicing in euros after 2002 in the rest of the world sample, we also present results in which we restrict the set of rest of the world countries to those with zero invoicing in euros.

Further below, in Section 4.2, we extend this difference in differences regression to provide evidence that the switch toward local currency in exports to the Eurozone occurs more strongly in the industries that theories of invoicing would suggest, and does not occur in these same industries in Chilean exports to the rest of the world.

Imports from the Eurozone In Appendix Figure A.6, we show that the euro became even more popular as an invoice currency of Chilean *imports* from Eurozone countries (i.e. Eurozone exports). A key difference with the case of exports is that between 20% and 30% of the value imported and more than

[35] Specifically, we estimate the following regression:

$$\Pr(\text{LC})_{fpct} = \sum_{s=1997Q1}^{2010Q4} \beta_s \cdot \text{EZ}_c \cdot 1[t = s] + \gamma_{fpc} + \delta_t + \epsilon_{fpct} \,. \tag{2}$$

Table 1: Probability of invoicing in local currency: Eurozone versus non–European destinations.

	(1)	(2)
EZ × Post2002	0.146**	0.124**
	(0.022)	(0.014)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time F.E.	No	Yes
Observations	1357123	1234961

Notes: This table reports the estimation of equation (1). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

40% of transactions were invoiced in euro legacy currencies prior to 2002. Nevertheless, there is a sudden switching around the introduction of the euro. By 2010, the share of imports invoiced in euros had reached about 45% and the share of transactions, almost 80%. In addition, by the end of the period almost 90% of firms and 90% of products had at least some transactions invoiced in euros.[36]

4.2 Product– and firm–level determinants of the adoption of the euro

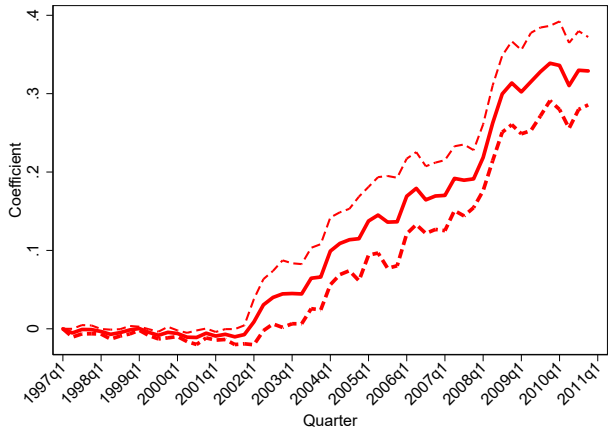
We now document the product and firm-level determinants of the adoption of the euro in Chilean exports to the Eurozone. In Appendix Table A.5 (in Section A.2.4) we show using a variance decomposition that both products and firms are important in accounting for variation in invoice currencies, and that firms are the dominant determinant.

4.2.1 Product–level determinants

As theories of trade currency invoicing highlight [Bacchetta and Van Wincoop, 2005, Devereux et al., 2004, Gopinath et al., 2010, Amiti et al., 2022], and following the discussion in Section 2, a firm is more likely to invoice in the destination currency (local currency pricing) if its competitors also do so. In our setting, we can test the role of strategic complementarities by measuring the effect of the market share of

[36] A potential explanation for the higher use of euros in Chilean imports (compared to exports) is that as Amiti et al. [2022] argue, invoice currencies are mostly an active choice of the exporting firm. Most of the sales and costs of Chilean exporters are in dollars or pesos (as they sell locally or to non-Eurozone destinations), while most of the sales and costs of Eurozone exporters are most likely in euros (or legacy currencies). Thus, European exporters have a stronger incentive to invoice in Eurozone currencies than Chilean exporters.

Figure 3: Probability of invoicing in local currency: Eurozone versus non–European destinations.



Note: This figure plots the estimated coefficients from equation (2) and 95% confidence intervals with standard errors clustered by destination and time (year–quarter) using multiway clustering.

Eurozone competitors in each destination and industry.[37] As we argued in Section 2, evidence suggests that after the introduction of the euro, all or most intra–Eurozone trade started being invoiced in euros. This implies that the Eurozone competitors' market share proxies for the degree to which competitors price in euros.[38]

We implement this notion by measuring for each HS6 product p, year y and destination country c the share of imports M_{pcsy} sourced from other Eurozone countries $s \in EZ$ out of imports from all countries s:[39]

$$\text{Destination EZ Import Share}_{pcy} = \frac{\sum_{s \in EZ} M_{pcsy}}{\sum_{s} M_{pcsy}}. \tag{3}$$

Following the literature [Goldberg and Tille, 2008, 2016], another product characteristic that influences the probability of invoicing transactions in euros is product differentiation, given that historically commodities have been usually invoiced in US dollars. To account for this, we include a dummy variable for differentiated products originally constructed by Rauch [1999].

To assess the role of product level determinants, we estimate the following equation on a 2002-2010 sample with the probability of a given transaction being invoiced in euros as the dependent variable,

[37] A corollary of the theoretical framework based on Amiti et al. [2022] and discussed in Section 2 is that the larger the market share that an exporting country has in a given industry in the destination market, the higher the probability that exports are invoiced in the producer currency. In our setting, however, the producer currency (the Chilean peso) is essentially never used, and the dollar and euro are the only options in practice.

[38] Amiti et al. [2022] study strategic complementarities in currency choice between Belgian exporters in each destination and sector. Given our setting, we focus instead on competition from within the Eurozone faced by Chilean exporters. Ideally we would also consider domestic sales as part of the purchases of a given destination from within the Eurozone, but we do not have product–level data on domestic sales at such a fine level of aggregation.

[39] Data to create this measure is obtained from COMTRADE. We use HS6 products because this is the most disaggregate measure that is internationally comparable.

and in which each observation corresponds to a firm–product (HS8)–destination–time (year–quarter) combination. Initially, we do not include the period prior to 2002 in our regressions in this section because the share of exports invoiced in euro legacy currencies prior to the introduction of the euro is almost zero.[40] We consider the pre–2002 period later in this section when comparing invoicing in exports to the Eurozone relative to the rest of the world. We estimate a linear probability model due to the inclusion of destination and time (year-quarter) fixed effects:

$$\Pr(\text{Euro})_{fpct} = \beta_1 \cdot \text{Destination EZ Import Share}_{pcy} + \beta_2 \cdot \text{Differentiated}_p + \gamma_c + \delta_t + \epsilon_{fpct} \,. \tag{4}$$

The results are reported in Table 2.[41] The positive and statistically significant coefficient on the destination's Eurozone import share is very stable across columns.[42] Based on column 3, a one standard deviation increase in this import share is associated with a 7.0 percentage point increase in the probability of invoicing in euros, thus confirming the predictions of existing theories regarding the role of strategic complementarities.[43] In addition, the probability a transaction is invoiced in euros is approximately 5.5 percentage points larger for differentiated products. In Appendix Section A.2.6 we show this result is robust to excluding the small share of observations (less than 0.6%) invoiced in currencies other than the euro or dollar, and to using a measure of the Eurozone import share that is defined at the Eurozone-wide level and does not vary by destination country.

In Section 4.1, we used a difference in differences regression to show that the growth in invoicing in euros was not due to a broader worldwide switch toward invoicing in local (i.e. destination) currencies. Using the variation across industries in destinations' Eurozone import share and in product differentiation, we can revisit and augment that regression with a triple differences approach, comparing the pre– and post–2002 periods. Appendix Section A.2.9 shows that the increase in invoicing in local currency in the Eurozone relative to the rest of the world after 2002, which we previously documented, is stronger in industries with a higher Eurozone import share as well as among differentiated industries.

4.2.2 Firm–level determinants

We now turn to documenting firm-level determinants that explain the probability of invoicing in euros. We present results based on all exporters as well as for a subset of exporters for which we have additional

[40] Specifically, only 32 firm–product–destination–time (year–quarter) cells are invoiced in Eurozone currencies during 1997–2001.

[41] Summary statistics for the variables used in the regressions in this section are provided in Appendix Table A.22.

[42] Note that column 3 replaces the destination and time fixed effects by destination × time fixed effects, with nearly identical results.

[43] These results are related to and consistent with Goldberg and Tille [2016] who studying Canadian imports find that exporting countries with larger market shares are less likely to use the destination country's currency (local currency pricing). They find that this is not in favor of the producer's currency, but of vehicle currencies (US dollars).

Table 2: Probability of invoicing in euros: Product-level determinants.

	(1)	(2)	(3)
Destination EZ Import Share	0.063*	0.070**	0.070**
	(0.026)	(0.025)	(0.025)
Differentiated		0.055*	0.055*
		(0.028)	(0.028)
Destination F.E.	Yes	Yes	No
Time F.E.	Yes	Yes	No
Destination × time F.E.	No	No	Yes
Observations	148883	147616	147616

Notes: This table reports the estimation of equation (4). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

firm characteristics drawn from the Chilean Census of Manufactures.

Amiti et al. [2022] show that differences in export invoice currency choice across firms are determined by the markup elasticity and by cost exposure to exchange rates. As we discussed in Section 2, in any given industry firms with larger markup elasticities are more likely to invoice in euros (i.e. to use local currency pricing). Also, firms with a larger ratio of imports invoiced in euros to cost should be more likely to invoice in euros, while firms with a larger ratio of imports invoiced in dollars to cost should prefer dollars. Amiti et al. [2022] provide evidence in favor of both mechanisms studying Belgian exports to extra-EU destinations during 2017-2020.

Following Amiti et al. [2022] we use firm size to proxy for markup elasticity.[44] We measure firm size using firms' world exports or revenue (the latter only in the manufacturing subsample). We are able to measure cost exposure for firms in the manufacturing subsample. We define variable cost as the sum of labor cost and materials. We then compute ratios of imports in euros and imports in dollars to variable cost.[45] As we discussed in Section 3, we are able to match the customs and manufacturing census data up to 2006. We compute time–invariant firm–level averages of each of these measures (revenue, imports in euros to cost and imports in dollars to cost ratios) using data for 2002 to 2006. We report results both for the 2002–2006 period as well as for the full 2002–2010 period.[46]

[44] Amiti et al. [2019] argue that markup elasticities are increasing in firm size in a wide class of models.

[45] Note that this is based on imports from the entire world, not just the Eurozone. However, imports invoiced in euros come almost entirely from the Eurozone. Since the manufacturing census data are annual, we use annual imports to construct this measure, and then assign it to each quarterly observation in our sample.

[46] Results for the entire 2002–2010 period use the 2002-2006 measures of revenue and imports to cost ratios and thus rely on the assumption that these variables would not have changed after 2006 in a way that would bias our results. In any case,

In addition to these mechanisms, we consider the share of a firm's exports sold to the Eurozone. We speculate that exporters have incentives to reduce the number of currencies used if there is a fixed cost per currency used.[47] If the Eurozone represents a small share of an exporter's overall export sales, it might not be willing to use a separate currency for it, and it might choose to use the currency preferred for its larger markets (presumably the dollar). We also add a dummy variable for firms that are affiliates of Eurozone multinationals. We hypothesize that multinational firms might make decisions globally and prefer to invoice in headquarter currencies.[48]

To assess the role of each of these determinants, we estimate the following linear probability model, with the dependent variable equal to the probability of invoicing in euros. The term X_{ft} represents the firm–level determinants discussed above. We include product (HS8) × destination × time (year-quarter) fixed effects in our baseline specification and discuss alternative fixed effects below. These fixed effects allow us to compare different firms exporting very similar products to the same destination in the same time period.

$$\Pr(\text{Euro})_{fpct} = \beta \cdot X_{ft} + \gamma_{pct} + \epsilon_{fpct} \,. \tag{5}$$

The results in columns 1 through 4 in Table 3 are based on the Census of Manufactures subsample, with which we can capture the markup and marginal cost channels precisely. Columns 1 and 2 include firm size (based on revenue) and the firm's Eurozone export share, while columns 3 and 4 add the ratios of imports invoiced in euros or dollars to cost. We find support for both the markup channel and the marginal cost channels of Amiti et al. [2022], as larger firms and firms with a higher ratio of imports invoiced in euros over cost are more likely to invoice in euros. In contrast, firms with a higher ratio of imports invoiced in dollars over cost have a higher probability of invoicing exports in dollars, although the coefficients are not statistically significant at conventional levels. The results are similar when considering the 2002–2006 period (in columns 1 and 3) as well as when we extend it to 2002–2010 (in columns 2 and 4). Based on column 3, a one standard deviation increase in firm revenue is associated with an 8.3 percentage point higher probability of invoicing in euros. The coefficients also indicate that a one standard deviation increase in imports in euros over cost is associated with a 14.9 p.p. higher probability of invoicing in euros.[49] We also observe that that firms with a larger fraction of exports sold in the Eurozone are more likely to invoice in euros, which, as we discussed earlier, is consistent with a

we find very similar results to those seen for 2002–2006.

[47] This is consistent with Amiti et al. [2022]'s extension to their baseline model, in which they add a fixed cost that can be per–currency. Amiti et al. [2022] also provide empirical evidence in favor of this mechanism. This is also consistent with Crowley et al. [2020]'s currency management fixed cost.

[48] In fact, Goldberg and Tille [2016] suggest that multinationals might centralize their management of exchange rate risk, in line with their findings based on Canadian imports.

[49] A one standard deviation increase in imports in dollars over cost is associated with a 11.0 p.p. lower probability of invoicing in euros, although this coefficient is not statistically significant.

fixed cost per currency. A one standard deviation increase in this share is implies a 5.1 percentage point higher probability of invoicing in euros.

In columns 5 and 6 we consider the full sample and analyze the effect of firm size (measured in terms of total (world) exports) and the share of exports to the Eurozone. We find a similar pattern relative to the previous columns. However, in this case we are not able to capture the marginal cost channel given that we don't observe cost and that only a fraction of exporters are importers. Again, the results are similar in the 2002–2006 (column 5) and 2002–2010 (column 6) samples. In addition, we add a dummy variable equal to one for firms which are affiliates of Eurozone multinationals.[50] We find that these affiliates are substantially (i.e. 22.8 p.p. based on column 5) more likely to adopt the euro.[51]

Table 3: Probability of invoicing in euros: Firm-level determinants.

	(1)	(2)	(3)	(4)	(5)	(6)
	Census of Manufactures Subsample				Full Sample	
	2002-2006	2002-2010	2002-2006	2002-2010	2002-2006	2002-2010
log Revenue	0.111**	0.110**	0.083*	0.084**		
	(0.022)	(0.015)	(0.036)	(0.026)		
EZ Export Share	0.081**	0.069**	0.051**	0.046**	0.049**	0.058**
	(0.020)	(0.010)	(0.014)	(0.013)	(0.012)	(0.011)
Euro-Invoiced Imports / Cost			0.149**	0.110**		
			(0.031)	(0.021)		
Dollar-Invoiced Imports / Cost			-0.110	-0.068		
			(0.082)	(0.053)		
EZ Multinational Affiliate					0.228**	0.167**
					(0.040)	(0.031)
log Total (World) Exports					0.060	0.078*
					(0.028)	(0.026)
Product (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13769	24463	13769	24463	66727	130371

Notes: This table reports the estimation of equation (5). Each observation is a firm-product (HS8)-destination-time (year–quarter) combination. Columns 1 through 4 refer to the Census of Manufactures subsample. Columns 5 and 6 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Our data and setting also allow us to test the existing theory further. A prediction of Amiti et al. [2022]'s model is that larger firms (i.e. firms with a higher markup elasticity) are more likely to invoice in euros (i.e. choose local currency pricing) in response to an increase in the share of competitors invoicing

[50] We did not include the multinational affiliate dummy in the Census of Manufactures subsample given that the number of such firms in that sample is very small.

[51] Amiti et al. [2022] find that in Belgian exports, firms with inward or outward FDI are more likely to use local or dominant currency pricing relative to producer currency pricing. Goldberg and Tille [2016] also find a role for foreign ownership in Canadian imports.

in euros.[52] We test this prediction by interacting our measure of each destination's share of imports sourced from the Eurozone with firm size. This is the measure introduced earlier in equation (3), which is based on the assumption that intra–Eurozone trade is invoiced in euros. We estimate the following regression using the Census of Manufactures subsample, such that we can control for cost exposure:

$$\Pr(\text{Euro})_{fpct} = \beta_1 \cdot \text{Size}_f + \beta_2 \cdot \text{Size}_f \cdot \text{Dest. EZ Imp. Share}_{pct} + \beta_3 \cdot \left(\frac{\text{Imp. Euro}}{\text{Cost}}\right)_f + \beta_4 \cdot \left(\frac{\text{Imp. USD}}{\text{Cost}}\right)_f + \gamma_{pct} + \epsilon_{fpct} \,. \tag{6}$$

The results are shown in Table 4. Columns 1 and 2 measure firm size using total world exports, while columns 3 and 4 use firm revenue. We report results both for 2002–2006 and 2002–2010. We see that, consistent with the theory, the positive and statistically significant coefficient in the interaction term in all columns implies that larger firms are more responsive to a higher share of intra–Eurozone competition. This evidence provides support for a key mechanism in Amiti et al. [2022].

In Appendix Section A.2.6 we provide several robustness checks to these results on the firm–level determinants of currency choice. First, we show that these results are robust to excluding the small share of observations invoiced in currencies other than the euro or dollar. Second, we document that the results are robust to using various alternative fixed effects. Third, we restrict the sample to permanent exporters (firms that export in all years), such that these results are not driven by entry or exit. In all cases, the results are very close to our baseline results.

[52] See lemma 3 in Amiti et al. [2022], in which the markup elasticity multiplies the derivative of the competitor's price index expressed in local currency to the local currency / producer currency exchange rate.

Table 4: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size.

	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
Destination EZ Import Share × log Total (World) Exports	0.031*	0.024**		
	(0.011)	(0.007)		
Destination EZ Import Share × log Revenue			0.025*	0.020*
			(0.010)	(0.007)
log Total (World) Exports	0.116*	0.113**		
	(0.040)	(0.034)		
log Revenue			0.066	0.073*
			(0.035)	(0.032)
Euro-Invoiced Imports / Cost	0.153**	0.116**	0.163**	0.122**
	(0.034)	(0.020)	(0.032)	(0.019)
Dollar-Invoiced Imports / Cost	-0.125	-0.089	-0.119	-0.086
	(0.088)	(0.057)	(0.084)	(0.056)
Product (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Observations	11401	19587	11181	19211

Notes: This table reports the estimation of equation (6). Each observation is a firm-product (HS8)-destination-time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Entrants vs. continuing firms We had shown earlier in Section 4.1 that the shift toward invoicing in euros occurs both among continuing firms and entrants to the Eurozone market. However, entrants are much smaller than continuing firms, and firm size is a determinant of the invoice currency choice. For this reason, we revisit this issue using our regression framework for the firm–level determinants of invoice currencies, and compare entrants and continuing firms while controlling for firm size and other firm characteristics. Specifically, we estimate equation (5) including i) a dummy variable equal to one for entrants to the Eurozone market that already export to the rest of the world, and ii) a dummy variable equal to one for entrants to the Eurozone market that are also first–time exporters (that do not export to other markets before entering the Eurozone). The results are shown in Appendix Table A.21. We find that the probability of invoicing in euros is not statistically different between continuing firms and entrants to the Eurozone market that already export to other markets. In contrast, entrants to the Eurozone market that are also first–time exporters are substantially more likely to invoice in euros (9 p.p. based on column 3). One interpretation is that a fixed cost per invoice currency used could prevent exporters from using the euro as they enter the Eurozone market if they already export to other markets using the US dollar.

Evidence from currency switchers An alternative approach to assess the determinants of the adoption of the euro is to compare firms that switch from dollars to euros against firms that stay invoicing in dollars, and link the probability that a switch is observed to the firm–level determinants of the currency choice explored earlier. To this end, we estimate equation (7), which is similar to (5), but in which the dependent variable is a categorical variable capturing these switches. This dependent variable is equal to zero when a firm invoices in dollars in a given product and destination in both the current and previous quarter. It is equal to one when a firm invoices in euros in a given product and destination in the current quarter but had invoiced in dollars in the same product and destination in the previous quarter.[53]

$$\Pr(\text{Switch})_{fpct} = \beta \cdot X_{ft} + \gamma_{pct} + \epsilon_{fpct} \,. \tag{7}$$

The results are displayed in Table 5. Overall, the coefficients point in the same direction as those obtained earlier in Table 3. This implies that the earlier results are indeed driven by firms' switching from dollars to euros. The coefficient on firm revenue is statistically significant at the 5% level in columns 2 through 4, and at the 10% level in column 1, providing evidence in favor of the markup channel. Based on column 4, a one standard deviation increase in firm revenue is associated with a 0.9 percentage point higher probability of switching to invoicing in euros. This effect is seemingly smaller than the equivalent in Table 3. However, when comparing these magnitudes to the unconditional mean of the dependent variable in each table, both effects have a similar order of magnitude.[54] The coefficient on the ratio of imports invoiced in euros to cost is statistically significant at the 5% level in column 4 and at the 10% level in column 2, providing evidence in favor of the marginal cost channel. Based on column 4, a one standard deviation increase in imports in euros over cost is associated with a 1.8 percentage point higher probability of switching to invoicing in euros. This is again of the same order of magnitude to the coefficient in Table 3 when compared to the unconditional mean of the dependent variable.

[53] We exclude observations in which the firm did not export in the previous quarter. We also exclude from the sample cases in which the firm invoices in euros in a given product and destination in both the current and previous quarter, as well as the relatively few cases in which firms switch back from euros to dollars.

[54] The unconditional mean of the dependent variable (the probability of invoicing in euros) in column 4 in Table 3 is 0.46. The unconditional mean of the dependent variable (the probability of switching to euros) in column 4 in Table 5 is 0.026.

Table 5: Probability of invoicing in euros: Firm-level determinants. *Switchers.*

	(1) 2002–2006	(2) 2002–2006	(3) 2002–2010	(4) 2002–2010
log Revenue	0.009	0.009*	0.010*	0.009**
	(0.004)	(0.003)	(0.003)	(0.002)
EZ Export Share	0.005	0.004	0.010	0.009
	(0.004)	(0.004)	(0.005)	(0.006)
Euro-Invoiced Imports / Cost		0.024		0.018*
		(0.011)		(0.007)
Dollar-Invoiced Imports / Cost		-0.053		-0.039*
		(0.030)		(0.013)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Observations	6879	6879	10314	10314

Notes: This table reports the estimation of equation (7). Each observation is a firm-product-destination-time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Adoption dynamics Next, we document the characteristics of firms that adopt the euro in earlier vs. later years. For this purpose, we extend equation (5) and interact each firm–level determinant with a set of year dummies. The results are shown in Appendix Figures A.13 (for the full sample) and A.14 (for the Census of Manufactures subsample). The results for the full sample indicate that firm size (captured by total (world) exports) becomes a more important determinant of invoicing in euros in later years. The coefficient on the interaction term between log total exports and a year 2002 dummy variable is 0.046, while the coefficient on the interaction term with a year 2010 dummy variable is almost three times larger (0.125). The figure also shows that being an affiliate of a Eurozone multinational becames a less important determinant as time goes by.[55]. The results for the Census of Manufactures subsample further show that the ratio of imports invoiced in euros to cost is substantially more important as a determinant of invoicing in euros in the initial years than in later years.[56]. The same happens with the coefficient on the ratio of imports invoiced in dollars to cost, which is negative and declines in absolute value over time.[57]

Theories of invoice currency choice do not have predictions on the relative speed of the markup and cost channels, nor is there previous empirical evidence of this in the literature. We speculate that

[55]The coefficient on the interaction term between the multinational affiliate dummy variable and a year 2002 dummy variable is 0.188 , while the coefficient on the interaction term with a year 2010 dummy variable is five times smaller (0.039).

[56]The coefficient on the interaction term between the ratio of imports invoiced in euros to cost and a year 2002 dummy variable is 0.192, while the coefficient on the interaction term with a year 2010 dummy variable is 0.051.

[57]Note that in contrast to the full sample, in the Census of Manufactures subsample we only observe a minimal increase over time in the role of firm size (measured by firm revenue).

a possible reason behind this finding is that determinants associated with the markup channel (firm size) could operate more slowly because this mechanism involves a reaction to what other firms do. As Mukhin [2022] argues, no firm has incentives to be the first to switch invoice currencies in response to a change in fundamentals. On the other hand, the cost channel could operate faster because it depends only on the firm itself (the same is true for the role of multinational affiliate status).

Firm–level determinants and invoicing in local currency: Eurozone versus the rest of the world As we did for the product–level determinants earlier, we revisit regression (5) and extend these results comparing exports to the Eurozone relative to the rest of the world before and after 2002 with a difference in differences approach.

The results for regression (1) in Section 4.1 show that the probability of invoicing in local (i.e. destination) currency is higher in exports to the Eurozone relative to the rest of the world after the euro is introduced. In addition, the results for regression (5) show that the probability of invoicing in euros in exports to the Eurozone is higher for larger firms, for firms with a larger share of exports sold in the Eurozone, and firms with a higher ratio of imports invoiced in euros over cost. Here, we augment regression (5), showing that the growth in invoicing in local currency in exports to the Eurozone relative to the rest of the world after 2002 is higher among firms with those characteristics.

To this end, we estimate equation (8), in which the first regressor of interest is the triple interaction between the dummy variable EZ_c, equal to one for exports to Eurozone destinations; the dummy variable $\mathrm{Post2002}_t$, equal to one for periods during and after 2002; and the firm characteristics, represented by X_{ft}. We focus on the Census of Manufactures subsample, in which we can measure the cost channel. Recall that firm revenue and the ratios of imports invoiced in euros to cost and imports invoiced in dollars to cost are time–invariant averages computed over 2002–2006. The regression includes product (HS8) × destination × time (year–quarter) as well as firm × time fixed effects.

$$\Pr(\mathrm{LC})_{fpct} = \beta_1 \cdot \mathrm{EZ}_c \cdot \mathrm{Post2002}_t \cdot \mathrm{X}_{ft} + \beta_3 \cdot \mathrm{EZ}_c \cdot \mathrm{X}_{ft} + \gamma_{pct} + \nu_{ft} + \epsilon_{fpct} \,. \tag{8}$$

The results are shown in Table 6, and indicate that there is an increase in invoicing in local currency in exports to the Eurozone that is stronger for larger firms and for firms with a higher share of exports sold to the Eurozone. In addition, this effect is stronger for firms with a higher ratio of imports invoiced in euros over cost, and it is lower for firms with a higher ratio of imports invoiced in dollars over cost. Thus, these results stand in line with those found in Table 3. To interpret the magnitude of these coefficients, recall first that in Table 1 we had found a 14.6 log point increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010. In Table 6, we find that

comparing the 75th and 25th percentiles of firm revenue, the former has a 7.5 larger log point (14.5%) increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.[58] These p75/p25 differentials are 3.5 log points for the share of exports sold to the Eurozone, 10.5 log points for the ratio of imports invoiced in euros to cost, and -18.5 log points for the ratio of imports invoiced in dollars to cost.

Table 6: Probability of invoicing in euros: Firm-level determinants. *Triple interaction.*

	(1)	(2)	(3)	(4)
EZ × Post2002 × log Revenue	0.055*	0.052**	0.047	0.043
	(0.021)	(0.014)	(0.033)	(0.022)
EZ × Post2002 × EZ Export Share	0.034**	0.035**	0.026*	0.029**
	(0.013)	(0.005)	(0.012)	(0.006)
EZ × Post2002 × Euro-Invoiced Imports / Cost			0.173**	0.107**
			(0.040)	(0.021)
EZ × Post2002 × Dollar-Invoiced Imports / Cost			-0.518	-0.285
			(0.314)	(0.166)
Product (HS8) × Destination × Time F.E.	Yes	Yes	Yes	Yes
Firm × Time F.E.	Yes	Yes	Yes	Yes
Observations	104466	162903	104466	162903

Notes: This table reports the estimation of equation (8). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The terms EZ × log Revenue; EZ × EZ Export Share; EZ × Euro-Invoiced Imports / Cost; and EZ × Dollar-Invoiced Imports / Cost , are included in the regression but the coefficients are not reported. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

5 The effect of the euro on exchange rate pass–through

We have shown that after the introduction of the euro there was a partial shift in the invoice currencies used in exports to the Eurozone, away from the US dollar and toward the euro. We now move on to showing that this led to a large change in the pass–through of the peso–euro and peso–dollar exchange rates to export prices.

Our goal is to measure the causal effect of invoice currency choice on exchange rate pass–through. This is an important relationship because assumptions in this regard shape the international transmission of shocks in macroeconomic models of the global economy. The key difficulty found in the

[58] Note that while the coefficient on firm revenue in column 3 is not statistically significant at conventional levels, the coefficient in column 4 is statistically significant at the 10% level.

literature is that firm characteristics can determine both currency choice and desired exchange rate pass–through. In a context in which firms' invoice currencies are very persistent and there is almost no currency switching (which is the type of data available in the literature so far), the state–of–the–art approach consists of estimating an exchange rate pass–through regression in which the regressors are both the invoice currency and the firm–level determinants of desired pass–through [Amiti et al., 2022]. This structural approach is model–dependent, in the sense that the firm–level determinants of desired pass–through are dictated by a theoretical model.

Instead, our approach relies on a natural experiment setting with substantial variation over time in invoice currencies. Instead of controlling for the firm–level determinants dictated by a model, this allows us to control for firm × product × destination fixed effects. These fixed effects can only be included if there is a substantial within-firm change of invoice currencies over time, and they capture *any* firm–level determinants that shape pass–through. Further, to address the possibility of changes in desired exchange rate pass–through over time that differ between firms that switch to euros and firms that keep using dollars, we estimate regressions that additionally include firm × year fixed effects. Thus, the coefficient on the invoice currency is identified based on variation across quarters within a year, making it much more unlikely that the desired pass–through would change over these short within–year intervals. In addition, toward the end of this section we provide further evidence that our results are not driven by within–firm changes in desired pass–through by i) focusing on industries with more sticky prices (as price changes in this sample would be less driven by desired pass–through) and ii) focusing on firms with no imports from Eurozone countries (as these firms would be less likely to experience changes in desired pass–through).

We present our results following a gradual approach. We start with overall exchange rate pass–through results. We then distinguish between the pre–and post periods as well as by invoice currency, to establish that the introduction of the euro indeed led to large changes in exchange rate pass–through.

We estimate standard pass–through regressions as shown in equation (9) in which each observation corresponds to a firm (f)–product (HS8) (p)–destination (c)–time (year–quarter) (t) combination and the sample consists of Chilean exports to the twelve Eurozone countries which adopted the euro since its inception and spans the fourteen-year period 1997–2010. Our regressions follow the literature closely. The dependent variable is the log change in the price (expressed in Chilean pesos) between periods $t-1$ and t.[59] We include firm–product (HS8)–destination fixed effects.[60] The regressors of interest are the

[59] Following the literature, in our baseline results we exclude extreme price changes, which can be due to mismeasurement or the fact that there can be different products within each HS8 product code. We drop observations with quarter–to–quarter price ratios above 3 or below 1/3, which represent 2.5% of our observations. However, we also show that our key results are robust to using all observations.

[60] We use the HS8 level as the product definition in these fixed effects because unit values are comparable within HS8

log change in the peso–euro and peso–dollar nominal exchange rates.[61] These are defined such that an increase in these variables implies a depreciation of the peso. Recall that in the case of the euro, prior to 2002 we use the exchange rate between the peso and the euro legacy currencies (francs, marks, pesetas, etc.).[62] We are not able to include time (year–quarter) fixed effects, given that the coefficients on the exchange rates are identified based on variation over time. We do include dummies for quarters to account for seasonality (not shown in eq. 9). In addition, in some results we include year fixed effects, such that the identification is based on variation *across* quarters *within* years. We also control for log changes in the consumer price index in the exporting country (Chile) and each destination country. Finally, we cluster standard errors by time period (year–quarter). Note that, like Gopinath et al. [2020], we estimate this regression at quarterly frequency taking advantage of the disaggregated nature of our data.

$$\Delta p_{fpct} = \gamma_{fpc} + \beta_1 \cdot \Delta e_t^{USD} + \beta_2 \cdot \Delta e_{ct}^{EURO} + \epsilon_{fpct} \,. \tag{9}$$

The results are shown in Table 7.[63] In column 1 we include only the peso-dollar exchange rate, and find a pass–through coefficient close to one (0.807). In column 2 we instead include only the peso–euro exchange rate, and again find a high pass–through coefficient (0.709). When we include both exchange rates simultaneously (see column 3), we find a higher pass–through coefficient for the peso–dollar exchange rate (0.615) than for the peso–euro exchange rate (0.313). Finding that *both* exchange rates have a contemporaneous pass–through to prices is consistent with the fact that in our sample part of the transactions are invoiced in dollars and part in euros. Given the fact that the introduction of the euro could have induced general equilibrium effects, we show in columns 4, 5 and 6 that our results are very similar when we add year fixed effects to our baseline equation. This implies that the identification is solely based on variation across quarters but *within* years, and differences in the macroeconomic environment pre and post 2002 are absorbed by the year fixed effects.

categories, but not within HS6 categories. The reason for this is that the units in which quantities are expressed are common within but HS8 categories, but not within HS6 categories.

[61] Because there is a substantial change in the invoice currencies used, a concern with these regressions would be a potential endogeneity of the exchange rates. The fact that export revenue accounts for a very small fraction of the foreign exchange market in Chile mitigates this concern. Specifically, in 2007, exports invoiced in euros account for 1% of the total turnover of euros against all other currencies in the Chilean foreign exchange market, as reported by the Bank of International Settlements' "Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity" [Bank of International Settlements, 1998, 2002, and 2010]. Furthermore, our key conclusion in this section relies primarily on the differential pass–through for firms that invoice in different currencies. A potential endogeneity could bias the the overall pass–through coefficient of each exchange rate, but should not bias the differential impact by invoice currency.

[62] For that reason, the peso–euro exchange rate has a subscript ct, even though after 2002 it does not vary by destination.

[63] Summary statistics for the variables used in the regressions in this section are provided in Appendix Table A.24.

Table 7: Exchange rate pass–through.

	(1)	(2)	(3)	(4)	(5)	(6)
Δe^{USD}	0.807**		0.615**	0.766**		0.593**
	(0.083)		(0.057)	(0.078)		(0.068)
Δe^{EUR}		0.709**	0.313**		0.805**	0.383**
		(0.087)	(0.052)		(0.127)	(0.084)
Firm × Product × Dest. F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	No	No	No	Yes	Yes	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	79323	79323	79323	79323	79323	79323

Notes: This table reports the estimation of equation (9). All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

As we documented earlier, prior to 2002 Chilean exports to Eurozone countries are almost entirely invoiced in dollars. Our next step is allowing for different pass–through coefficients for the pre–2002 and post–2002 periods. We augment equation (9) and estimate the following equation in which we interact the exchange rates with a dummy variable equal to zero during 1997–2001 and equal to one during 2002–2010. Once again, we sometimes include year fixed effects (such that the estimation is based on variation across quarters within years). The control variables and estimation details are otherwise the same as above.

$$\Delta p_{fpct} = \gamma_{fpc} + \beta_1 \cdot \Delta e_t^{USD} + \beta_2 \cdot \Delta e_t^{USD} \cdot \text{Post2002}_t + \beta_3 \cdot \Delta e_{ct}^{EURO} + \beta_4 \cdot \Delta e_{ct}^{EURO} \cdot \text{Post2002}_t + \epsilon_{fpct} \,. \quad (10)$$

As we report in the first two columns in Table 9, we indeed find a substantial change in the pass–through coefficients between the 1997–2001 and 2002–2010 periods.[64] The pass–through coefficient for the peso-dollar exchange rate is very close to one (1.068, based on column 2) for the pre–2002 period and significantly lower (0.543 = 1.068 - 0.525) for the post–2002 period. The coefficient for the peso–euro exchange rate, on the other hand, is zero pre–2002 (-0.014) and 0.489 (=-0.014 + 0.503) after the introduction of the euro. This matches the theory [Gopinath et al., 2010, Amiti et al., 2022] closely. Pass–through of the peso–dollar exchange rate is nearly complete and pass–through of the peso–euro exchange rate is zero when trade is invoiced almost entirely in dollars. After the introduction of the euro, with trade invoiced partly in dollars and partly in euros, both exchange rates have a more symmetric

[64]The only difference between columns 1 and 2 is that column 2 includes year fixed effects and column 1 does not. We find very similar coefficients in both cases.

impact on prices.[65,66]

We showed in the previous section that the adoption of the euro is gradual over time. Consequently, we would expect the change in pass–through to also be gradual. In Appendix Table A.25, we show that this is indeed the case. For this purpose, we estimate equation (10) replacing the Post2002_t dummy variable (equal to one from 2002 to 2010) by two different dummy variables, marking the periods 2002–2006 and 2007–2010. We observe that the patterns discussed earlier hold in both periods and, as expected, are stronger in the later part of our sample.[67]

An important check to our results consists in using data on exports to non–European destinations, to show that the change in pass–through of the peso–dollar and peso–euro exchange rates are unique to exports to the Eurozone. Because there was not a change in invoice patterns in exports to non–European destinations, we would expect to find no changes in pass–through there. To test this, our first approach consists in estimating an equation similar to (10) separately for non–European destinations, distinguishing between the peso–dollar and the peso–local currency exchange rates before and after 2002.[68] As an alternative approach, we augment the sample to include exports to both Eurozone as well as non–European destinations and include triple interactions between a dummy for Eurozone exports, the Post2002_t dummy, and each exchange rate.[69] The results corresponding to both approaches, shown in Table 8, clearly indicate that the change in pass–through patterns are only seen in exports to the Eurozone, and is not present in exports to non–European destinations.[70]

Given that our data include the invoice currency used in each firm–product–destination–time (year–quarter) cell, we can now go one step further and allow the pass–through coefficients to differ based on

[65] Note that between 2002 and 2010, 27.7% of firm–product–destination–time (year–quarter) cells are invoiced in euros.

[66] Given that there is entry and exit of exporting firms in our panel, we conduct a robustness check to verify that these results hold if we focus on "permanent exporters", as shown in Appendix Table A.26.

[67] For example, in column 2 in Appendix Table A.25 the coefficient on the interaction between the peso–euro exchange rate and a dummy variable for the period 2002–2006 is 0.308, while the interaction with a dummy variable for the period 2007–2010 is 0.675.

[68] Note that in the sample of non–European destinations, there is nearly zero use of vehicle currencies other than the dollar. In other words, the invoice currency is almost always either the dollar or the local (i.e. destination) currency.

[69] We also include double interactions between the Eurozone dummy (EZ_c) and the Post2002_t dummy, as well as between the Eurozone dummy and each exchange rate. Specifically, we estimate:

$$\begin{aligned}\Delta p_{fpct} = \gamma_{fpc} + \beta_1 \cdot \Delta e_t^{USD} + \beta_2 \cdot \text{EZ}_c \cdot \Delta e_t^{USD} + \beta_3 \cdot \text{EZ}_c \cdot \text{Post2002}_t + \beta_4 \cdot \text{EZ}_c \cdot \Delta e_t^{USD} \cdot \text{Post2002}_t \\ + \beta_5 \cdot \Delta e_t^{LC} + \beta_6 \cdot \text{EZ}_c \cdot \Delta e_t^{LC} + \beta_7 \cdot \text{EZ}_c \cdot \text{Post2002}_t + \beta_8 \cdot \text{EZ}_c \cdot \Delta e_t^{LC} \cdot \text{Post2002}_t + \epsilon_{fpct} \,. \qquad (11)\end{aligned}$$

We include the peso–dollar exchange rate and the peso–local currency exchange rate. Note that we don't include in this sample extra–Eurozone European destinations. These are not a good control group because of the patterns of adoption of the euro documented in Section 4.1.

[70] Specifically, columns 1 an 2 Table 8 report the results for equation (10) estimated using the sample of non–European destinations, and show that the coefficients on the interactions between the exchange rates and the Post2002_t dummy are not significant. Columns 3 and 4 in the same table report the results for equation (11) estimated using the sample of Eurozone destinations and non–European destinations, and show that the coefficients on the triple interactions between the Eurozone dummy, the Post2002_t dummy and each exchange rate are statistically significant. These coefficients, as expected, have a negative sign in the case of the peso–dollar exchange rate and a positive sign in the case of the peso–local currency exchange rate.

Table 8: Exchange rate pass–through in Eurozone and non–European destinations.

	(1) ROW	(2) ROW	(3) ROW+EZ	(4) ROW+EZ
Δe^{USD}	0.878***	0.815***	0.871***	0.808***
	(0.080)	(0.079)	(0.080)	(0.080)
Δe^{LC}	0.074*	0.083**	0.077*	0.086**
	(0.042)	(0.040)	(0.041)	(0.041)
Post2002 × Δe^{USD}	0.094	0.103	0.105	0.113
	(0.091)	(0.090)	(0.094)	(0.094)
Post2002 × Δe^{LC}	-0.058	-0.039	-0.061	-0.039
	(0.042)	(0.051)	(0.042)	(0.052)
EZ × Δe^{USD}			0.011	0.121
			(0.189)	(0.163)
EZ × Δe^{LC}			-0.037	-0.086
			(0.107)	(0.108)
Post2002 × EZ × Δe^{USD}			-0.482**	-0.540***
			(0.204)	(0.186)
Post2002 × EZ × Δe^{LC}			0.520***	0.511***
			(0.168)	(0.174)
Firm × Prod. × Dest. F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Quarter F.E.	Yes	Yes	Yes	Yes
Observations	565549	359426	646437	440314

Notes: Columns 1 and 2 report the results of the estimation of equation (10) using a sample of non–European destinations. Columns 3 and 4 correspond to equation (11) in a sample of Eurozone destinations and non–European destinations. Columns 2 and 4 control for changes in exporting and importing country price levels (which are available for all Eurozone destinations and most non–European destinations). Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

the invoice currency used. We go back to focusing exclusively on exports to Eurozone destinations. As a first step, columns 3 through 6 in Table 9 go back to equation (9) splitting the sample between cells invoiced in dollars and cells invoiced in euros (or euro legacy currencies). In dollar-invoiced transactions (columns 3 and 4), the pass–through coefficient for the peso–dollar exchange rate is close to one (0.940 in column 4), while the pass–through for the peso–euro exchange rate is close to zero (0.114) and not statistically significant. In stark contrast, for transactions invoiced in euros (columns 5 and 6), the coefficient for the peso–dollar exchange rate is very low and not statistically significant (0.085 in column 6) while the pass–through for the peso–euro exchange rate is now close to one (1.019). Next, we also estimate a single regression allowing for different pass–through coefficients based on invoice currency:

$$\begin{aligned}\Delta p_{fpct} = \gamma_{fpc} + \beta_1 \cdot \Delta e_t^{USD} \cdot \text{USD}_{fpct} + \beta_2 \cdot \Delta e_t^{USD} \cdot \text{EUR}_{fpct} \\ + \beta_3 \cdot \Delta e_{ct}^{EUR} \cdot \text{USD}_{fpct} + \beta_4 \cdot \Delta e_{ct}^{EUR} \cdot \text{EUR}_{fpct} + \epsilon_{fpct} \,. \end{aligned} \tag{12}$$

The dummy variables USD_{fpct} and EURO_{fpct} are equal to one for cells invoiced in dollars and euros (or euro legacy currencies) respectively, and zero otherwise. The results are shown in columns 7 and 8 in Table 9.[71] Both columns produce very similar estimates to the split sample approach used in columns 3 through 6. In other words, in line with the recent theoretical developments, the pass–through estimates for dollar-invoiced and euro-invoiced transactions are polar opposites. Based on column 8, the coefficient on the peso–dollar exchange rate is 0.953 (and statistically significant) for transactions invoiced in dollars and 0.117 (and not statistically significant) for transactions in euros. In the same way, the coefficient on the peso–euro exchange rate is 0.116 (and not statistically significant) for transactions invoiced in dollars and 0.914 (and statistically significant) for transactions in euros.

Table 9: Exchange rate pass–through and invoice currencies.

	(1) All	(2) All	(3) Invoiced in USD	(4) Invoiced in USD	(5) Invoiced in Euro	(6) Invoiced in Euro	(7) All	(8) All
Δe^{USD}	0.846**	1.068**	0.941**	0.940**	0.125	0.085		
	(0.293)	(0.232)	(0.041)	(0.048)	(0.080)	(0.091)		
Δe^{EUR}	0.043	-0.014	0.071	0.114	0.864**	1.019**		
	(0.068)	(0.082)	(0.039)	(0.065)	(0.098)	(0.118)		
Post2002 × Δe^{USD}	-0.267	-0.525*						
	(0.294)	(0.236)						
Post2002 × Δe^{EUR}	0.328**	0.503**						
	(0.088)	(0.126)						
USD × Δe^{USD}							0.947**	0.953**
							(0.046)	(0.062)
EURO × Δe^{USD}							0.146	0.117
							(0.073)	(0.077)
USD × Δe^{EUR}							0.066	0.116
							(0.044)	(0.069)
EURO × Δe^{EUR}							0.828**	0.914**
							(0.104)	(0.112)
Firm × Prod. × Dest. F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	No	Yes	No	Yes	No	Yes	No	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	79323	79323	53821	53821	19999	19997	74938	74938

Notes: Columns 1 and 2 report the results of the estimation of equation (10). Columns 3 through 6 correspond to equation (9), splitting the sample into cells invoiced in USD (cols. 3 and 4) or in euros (cols. 5 and 6). Columns 7 and 8 correspond to equation (12). All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

We can go even further and allow for different pass–through coefficients based on invoice currencies *and* the pre/post periods. We thus extend equation (12) by including a triple interaction term. It is

[71] The only difference between the two columns is that column 8 includes year fixed effects (so estimates are based on variation across quarters within years) while column 7 does not.

important to note that because the number of observations invoiced in euro legacy currencies prior to 2002 was almost zero, we are not able to estimate a pass–through coefficient for transactions invoiced in Eurozone currencies in the "pre" period.[72] We *are* able to allow the effect of the peso–dollar exchange rate to differ between both periods, as shown in the following equation:

$$\Delta p_{fpct} = \gamma_{fpc} + \beta_1 \cdot \Delta e_t^{USD} \cdot \text{USD}_{fpct} + \beta_2 \cdot \Delta e_t^{USD} \cdot \text{USD}_{fpct} \cdot \text{Post2002}_t + \beta_3 \cdot \Delta e_t^{USD} \cdot \text{EUR}_{fpct} + \beta_4 \cdot \Delta e_{ct}^{EUR} \cdot \text{USD}_{fpct} + \beta_5 \cdot \Delta e_t^{EUR} \cdot \text{USD}_{fpct} \cdot \text{Post2002}_t + \beta_6 \cdot \Delta e_{ct}^{EUR} \cdot \text{EUR}_{fpct} + \epsilon_{fpct} \,. \quad (13)$$

Table 10 shows the results, which constitute our strongest evidence on the impact invoice currencies have on exchange rate pass–through. For transactions invoiced in dollars, the pass–through of the peso–dollar exchange rate is close to one both before and after 2002, while the pass–through of the peso–euro exchange rate is close to zero in both periods. For transactions invoiced in euros (which only occur after 2002), the pass–through of the peso–dollar exchange rate is close to zero, while the pass–through of the peso–euro exchange rate is close to one (0.934 based on column 2). The results are very similar in columns 1 and 2 (which adds year fixed effects, such that the identification is based on variation across quarters within years).

As we argued in our theoretical discussion in Section 2, short–run pass–through depends both on the invoice currency and on desired pass–through. We have shown that the peso–euro exchange rate coefficient is statistically significant and close to one *only* for transactions invoiced in euros, which implies it is likely that these results are driven by invoice currencies, and not by changes in *desired* (i.e. flexible–price) pass–through. However, it might be the case that desired pass–through changed *differently* for firms switching to euros than for firms that kept using the dollar after 2002. We now show that changes in desired pass–through are not driving the observed differences in pass–through. We do so in three different ways. First, we replace the year fixed effects by firm × year fixed effects. These absorb any differential change in desired pass–through across firms between pre and post 2002.[73] These results are shown in column 3 in Table 10 and the coefficients are similar to those reported earlier. Our second approach is to focus on industries with more sticky prices. As the theoretical discussion indicates, pass–through for these goods would be driven more by invoice currencies and less by desired pass-through. We merge to our data Nakamura and Steinsson [2008]'s measure of the frequency of price changes in

[72] During the pre–2002 period, only 32 firm–product–destination–time (year–quarter) cells are invoiced in Eurozone currencies, 19 of which are in the regression sample (i.e. have non–missing quarter–to–quarter price changes). Given that these are far too few observations to be able to estimate a pass–through coefficient for transactions invoiced in Eurozone currencies in the "pre" period, we now drop these observations from the sample. We obtain nearly identical results if these observations remain in our sample.

[73] Even further, these firm–year fixed effects absorb any differential change in pass–through across firms between different years.

different industries.[74] Among products with non–missing measures of price change frequencies, we restrict the sample to those with below median frequencies (i.e. those with more sticky prices). These results are shown in columns 4 and 5, and again convey the same message than our baseline results. Last, firms that import in euros would be more likely to see changes in desired pass-through. If firms that switch to euros and firms that remain using the dollar differ in terms of their imports in euros, this could lead to a differential change in desired pass–through. For this reason, our third approach consists of limiting the sample to firms with zero imports from Eurozone countries.[75] These results are shown in columns 6 and 7, and once again, are very similar to the baseline results.

Table 10: Exchange rate pass–through and invoice currencies.

	(1) All	(2) All	(3) All	(4) Sticky Prices	(5) Sticky Prices	(6) Non Importers	(7) Non Importers
USD × Δe^{USD}	0.772*	1.052**	0.872**	0.909**	0.803*	0.932**	0.794**
	(0.300)	(0.231)	(0.258)	(0.320)	(0.373)	(0.235)	(0.239)
USD × Post2002 × Δe^{USD}	0.173	-0.125	0.063	0.099	0.143	-0.004	0.135
	(0.302)	(0.238)	(0.266)	(0.328)	(0.379)	(0.245)	(0.252)
EURO × Δe^{USD}	0.144	0.110	0.069	0.043	0.035	0.122	0.081
	(0.074)	(0.078)	(0.079)	(0.079)	(0.087)	(0.078)	(0.084)
USD × Δe^{EUR}	0.037	-0.028	-0.039	-0.029	-0.054	-0.087	-0.100
	(0.073)	(0.082)	(0.102)	(0.130)	(0.132)	(0.089)	(0.109)
USD × Post2002 × Δe^{EUR}	0.035	0.195	0.210	0.088	0.179	0.249	0.295
	(0.092)	(0.125)	(0.149)	(0.163)	(0.180)	(0.131)	(0.150)
EURO × Δe^{EUR}	0.830**	0.934**	0.914**	1.015**	0.965**	0.900**	0.841**
	(0.104)	(0.114)	(0.137)	(0.120)	(0.153)	(0.118)	(0.145)
Firm × Prod. × Dest. F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	No	Yes	No	Yes	No	Yes	No
Firm × Year F.E.	No	No	Yes	No	Yes	No	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	74917	74917	72797	39922	38806	65709	63538

Notes: This table reports the results of the estimation of equation (13). The sticky prices sample in columns 4 and 5 refers to observations with a below–median frequency of price change according to Nakamura and Steinsson [2008]'s measure. The non–importers sample in columns 6 and 7 refers to observations corresponding to exporting firms that do not import from Eurozone countries in the year associated with the observation. All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

Finally, Table 11 presents a set of robustness checks to these core results. First, we exclude the 2008–2009 global financial crisis, restricting our sample to 1997–2007. Column 1 shows the results are

[74] We obtain these data from Fajgelbaum et al. [2020], who have created a measure for NAICS 4–digit industries. We then use a concordance provided by the Census Bureau to translate it to HS6 codes.

[75] We find similar results if instead we analyze firms with zero imports invoiced in euros.

very similar to the baseline estimates. Second, recall that the euro was introduced in physical format in 2002, but in non–physical format (for bank transfers, etc.) in 1999. Our baseline results took 2002 as the relevant pre/post cutoff, because that is when firms start adopting the euro as an invoice currency, while we don't observe a change in 1999. However, column 2 shows that our results are robust to excluding the period 1999–2001 from the regressions (thus leaving 1997–1998 and 2002–2010 in the sample). Third, we find very similar results when we exclude Greece, which adopted the euro in non–physical format in 2001 instead of 1999 (see column 3). Fourth, it could be that multinational firms' international prices are less responsive to market forces. We show in column 4, however, that our results are robust to excluding multinational affiliates of Eurozone corporations. We also check that our results are robust to including destination × year and product × year fixed effects (see column 5). These absorb any destination–specific or product–specific shock at annual frequencies. In this case, the identification of the pass–through coefficients uses variation across quarters within years.[76] We also explore alternative types of clustering. Specifically, column 6 shows the results are robust to clustering by firm, HS6 product, destination, and time (year–quarter) using multiway clustering. Last, while our baseline results drop observations with extreme price changes (in line with the literature), column 7 shows our results are robust to including all observations.

Summing up, our findings indicate that invoice currencies have a drastic impact on short–run exchange rate pass–through, such that there is complete pass-through to export prices in pesos of the peso–dollar exchange rate for transactions invoiced in dollars, and complete pass-through of the peso–euro exchange rate for transactions invoiced in euros. Given our empirical setting, we believe our results can be interpreted as a causal effect of invoice currencies on pass–through, and are not driven by other confounders, such as changes in desired pass–through. We believe the evidence derived from this unique natural experiment validates the most recent theoretical framework [Amiti et al., 2022] and the literature on which it builds. In addition, it shows that large and fast changes in invoice currencies are possible, and that they come with equally large changes in exchange rate pass–through.

[76] Note that we cannot include destination × time (year–quarter) or product × time (year–quarter) fixed effects as they would absorb all the variation used to identify the pass–through coefficients.

Table 11: Exchange rate pass–through and invoice currencies: Robustness checks.

	(1) Up to 2007	(2) Exclude 1999–2001	(3) Exclude Greece	(4) Exclude MNs	(5) Alternative F.E.	(6) Alternative Clustering	(7) Incl. Extreme Price Changes
USD × Δe^{USD}	1.154**	1.109**	1.069**	1.073**	0.961**	1.052*	1.010**
	(0.244)	(0.240)	(0.247)	(0.227)	(0.240)	(0.385)	(0.349)
USD × Post2002 × Δe^{USD}	-0.106	-0.185	-0.136	-0.141	-0.042	-0.125	-0.208
	(0.275)	(0.251)	(0.254)	(0.234)	(0.248)	(0.426)	(0.388)
EURO × Δe^{USD}	0.005	0.109	0.110	0.114	0.080	0.110	0.135
	(0.158)	(0.078)	(0.075)	(0.077)	(0.074)	(0.073)	(0.126)
USD × Δe^{EUR}	-0.036	-0.110	-0.035	-0.014	-0.036	-0.028	-0.017
	(0.091)	(0.138)	(0.089)	(0.081)	(0.097)	(0.066)	(0.132)
USD × Post2002 × Δe^{EUR}	0.149	0.283	0.199	0.180	0.200	0.195	0.356
	(0.145)	(0.165)	(0.130)	(0.123)	(0.139)	(0.095)	(0.374)
EURO × Δe^{EUR}	0.974**	0.933**	0.930**	0.933**	0.943**	0.934**	0.964**
	(0.155)	(0.114)	(0.106)	(0.114)	(0.123)	(0.091)	(0.219)
Firm × Prod. × Dest. F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Prod.(HS6) × Dest. F.E.	No	No	No	No	No	No	No
Year F.E.	Yes	Yes	Yes	Yes	No	Yes	Yes
Country × Year F.E.	No	No	No	No	Yes	No	No
Product (HS8) × Year F.E.	No	No	No	No	Yes	No	No
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51578	65209	72783	74540	73679	74917	76437

Notes: This table reports the results of the estimation of equation (13). All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter), except in column 6 in which they are clustered by time (year–quarter), firm, product (HS6) and country using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

6 Conclusions

We have used the introduction of the euro as a unique natural experiment to test the theory of trade currency invoicing and exchange rate pass-through. We have done so by using novel transaction-level data including the invoice currencies of the universe of export and import transactions of a small open economy – Chile – trading with the Eurozone over the period 1997-2010.

We first document that while euro legacy currencies were almost never used to invoice exports to the Eurozone, starting in 2002 a substantial fraction of exporters switched to invoicing in euros, at the expense of the US dollar. While the literature has found invoice currencies to be a very persistent firm-level choice, we find that a large policy shock can indeed generate fast and large adjustments by exporting firms in this regard, in line with the conjecture of Amiti et al. [2022].

In this unique context, we start by studying the determinants behind firms' choice to switch to invoicing in euros. We first establish an important role for strategic complementarities: switching to euros was more likely for firms in industries facing more competition from within the Eurozone, and for larger firms. In addition, we find support for a cost channel, such that firms with a higher share of cost in euros were more likely to adopt the euro as their invoice currency. Third, we also see more switching

to euros among firms for which the Eurozone represented a larger share of its total exports (suggesting a per–currency fixed cost) and affiliates of Eurozone multinationals (suggesting that multinational firms might make decisions globally and prefer to invoice in headquarter currencies).

The second part of our analysis shows that this large change in invoice currencies matters: we document a substantial change in exchange rate pass-through once the euro was introduced. Prior to 2002, the pass-through of the peso–dollar exchange rate to prices is close to one, while the coefficient corresponding to the peso–euro exchange rate is close to zero. After 2002, prices respond to both exchange rates similarly. In addition, we see that the pass-through of the peso-dollar exchange rate to prices is close to one for transactions invoiced in dollars, and close to zero for transactions invoiced in euros, while the opposite is true for the peso–euro exchange rate.

Our strongest evidence of the effect of the introduction of the euro on exchange rate pass-through comes from comparing pass–through coefficients based on the invoice currency used and the pre and post periods. For transactions invoiced in dollars the pass–through of the peso–dollar exchange rate is close to one in both periods, while the pass–through of the peso–euro exchange rate is near zero in both periods. For transactions invoiced in euros, in contrast, the peso–dollar exchange rate pass–through is close to zero, while the peso–euro exchange rate pass–through is close to one.

Looking at an event of the past, our findings carry important implications for the future. Our evidence suggests that future policy changes implemented by large economies can lead to fast and substantial changes in invoice currencies, and consequently on the transmission of exchange rate shocks.

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Online Appendix

Trade Invoicing Currencies and Exchange Rate Pass-through: The Introduction of the Euro as a Natural Experiment

Felipe Benguria and Rodrigo Wagner

A Appendix

A.1 Appendix to Section 3: Data

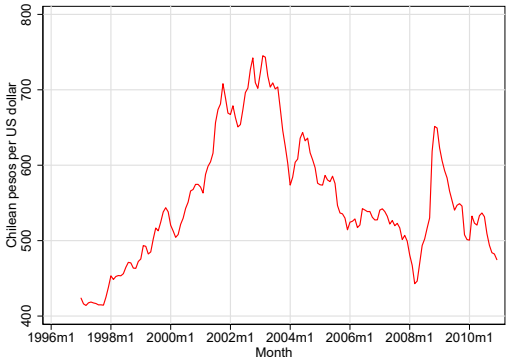
Table A.1: Descriptive Statistics

	Full sample				Census of Manufactures Subsample		
	1997	2002	2006	2010	2002	2006	2010
Total exports to EZ (million USD)	1222	1254.3	2707.7	2719.7	597.3	1346.7	1150.9
Number of firms	1235	1545	1818	1800	274	254	189
Mean number of products exported to EZ	2.6	3.9	3.7	3.7	3.9	4.3	4.3
Mean number of EZ destinations	1.8	1.8	2	2.1	2.3	2.6	2.7
Mean export value to EZ	989.4	811.8	1489.4	1511	2179.9	5302.1	6089.5
Median export value to EZ	65.5	47.2	66.2	93.8	132.3	184.9	337.9
Mean share of EZ exports	0.477	0.488	0.491	0.436	0.274	0.287	0.264
Mean share of EZ exports invoiced in Eurozone currencies	0.002	0.079	0.2	0.275	0.115	0.237	0.337
Number of importers	427	505	562	510	139	145	118
Number of importers from EZ	306	361	367	356	123	125	103
Mean import value from world among importers from world	8619.4	8061.8	6208.2	7753	9405.6	11257.1	9294
Median import value from world among importers from world	224.7	173.1	127.8	201.7	1192.7	1512.5	1480.9
Mean import value from EZ among importers from EZ	1703.6	1982.5	2019.8	2232.3	1892.6	1945.5	2570
Median import value from EZ among importers from EZ	163.7	157.9	154.5	177.3	453.9	518.1	496.3
Mean share of imports invoiced in Eurozone currencies among importers from world	0.172	0.217	0.218	0.241	0.217	0.226	0.208
Mean share of imports invoiced in dollars among importers from world	0.772	0.719	0.738	0.706	0.705	0.717	0.743

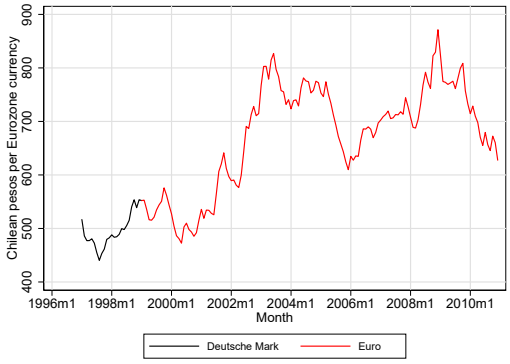
Notes: This table reports descriptive statistics for the sample of Chilean exporters to Eurozone destinations described in Section 3. All values are in thousands of US dollars of 1997 unless noted otherwise.

Figure A.1: Exchange rates.

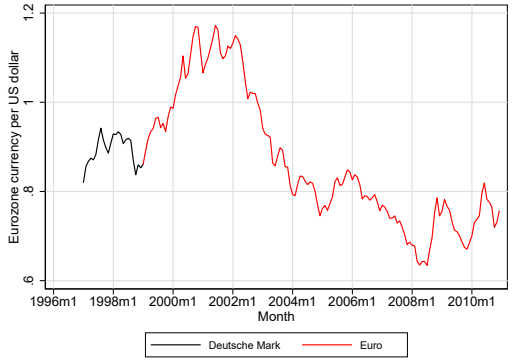
a) Chilean pesos per US dollar



b) Chilean pesos per Eurozone currency



c) Eurozone currency per US dollar

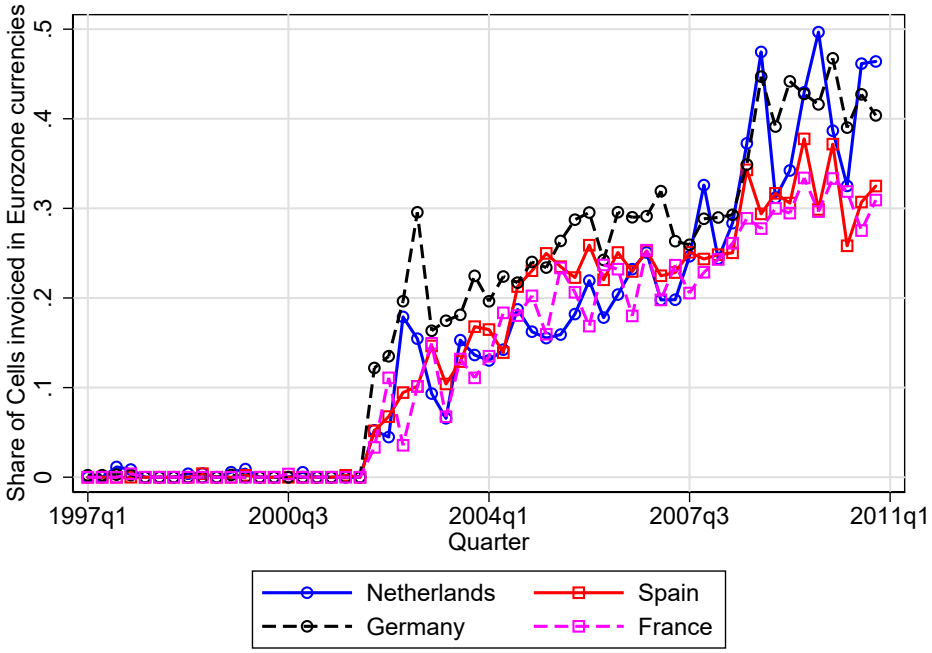


Note: This figure shows the exchange rates between the Chilean peso and the US dollar in panel a), between the Chilean peso and Eurozone currency in panel b) and between Eurozone currency and the US dollar in panel c). Eurozone currency refers to the euro from January 1999 onwards, and to the Deutsche mark up to December 1998.

A.2 Appendix to Section 4: The adoption of the euro as a trade invoicing currency

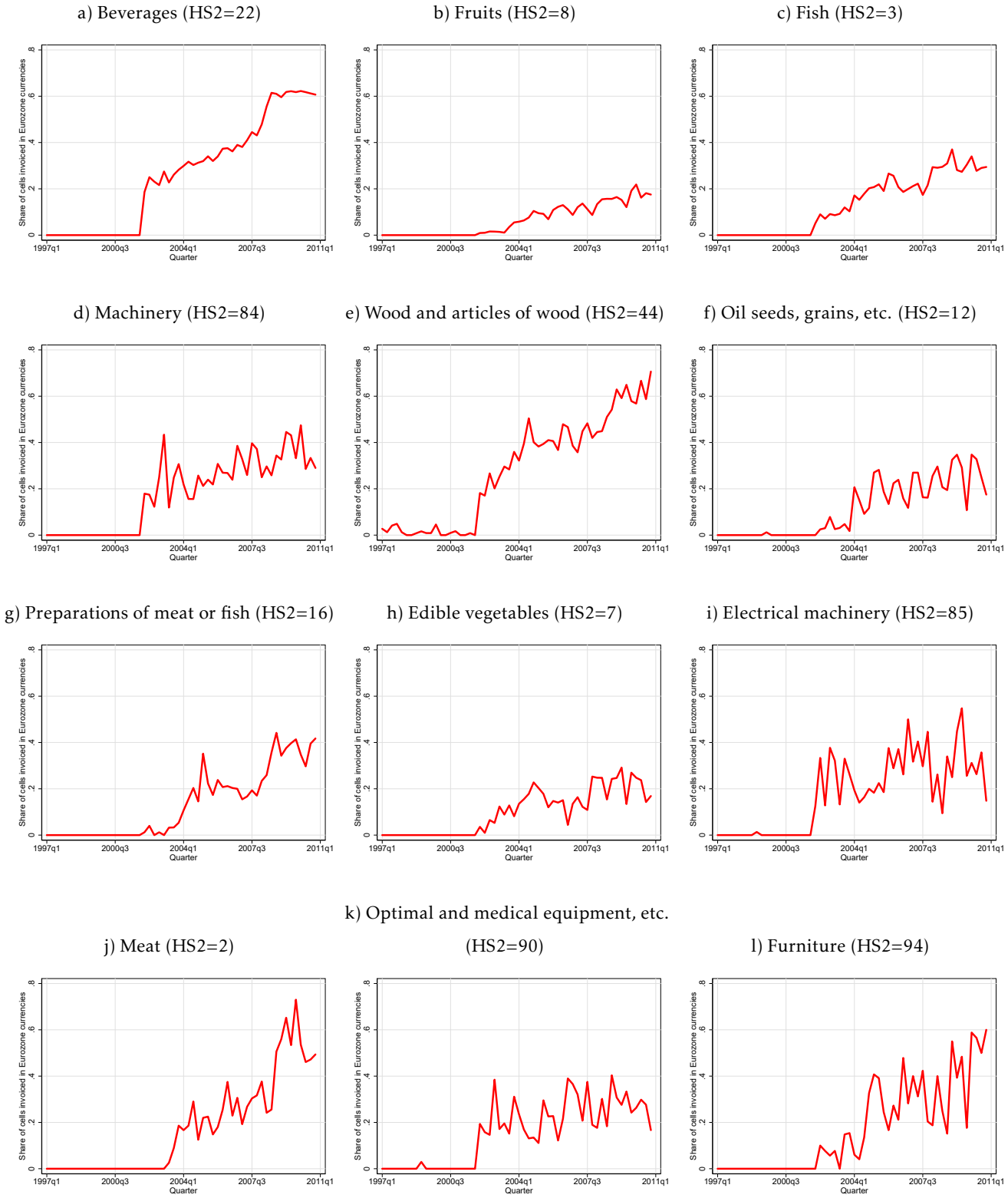
A.2.1 Trends in the adoption of the euro as an invoice currency

Figure A.2: Share of exports to main Eurozone destinations invoiced in Eurozone currencies.



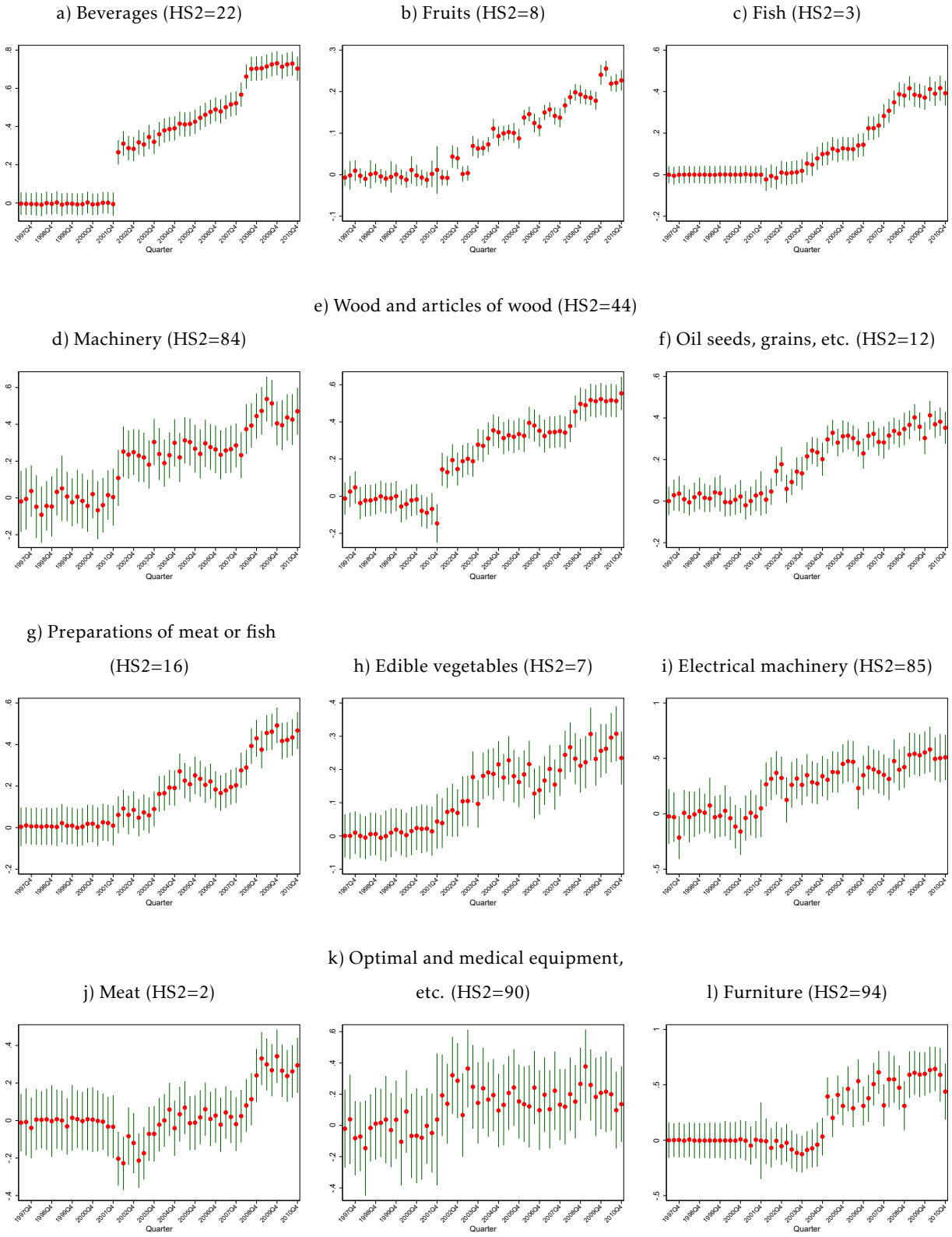
Notes: This figure reports the share of firm-product-time (year-quarter) cells invoiced in Eurozone currencies for each of the largest Eurozone destinations of Chilean exports.

Figure A.3: Share of exports to the Eurozone invoiced in Eurozone currencies by sector.



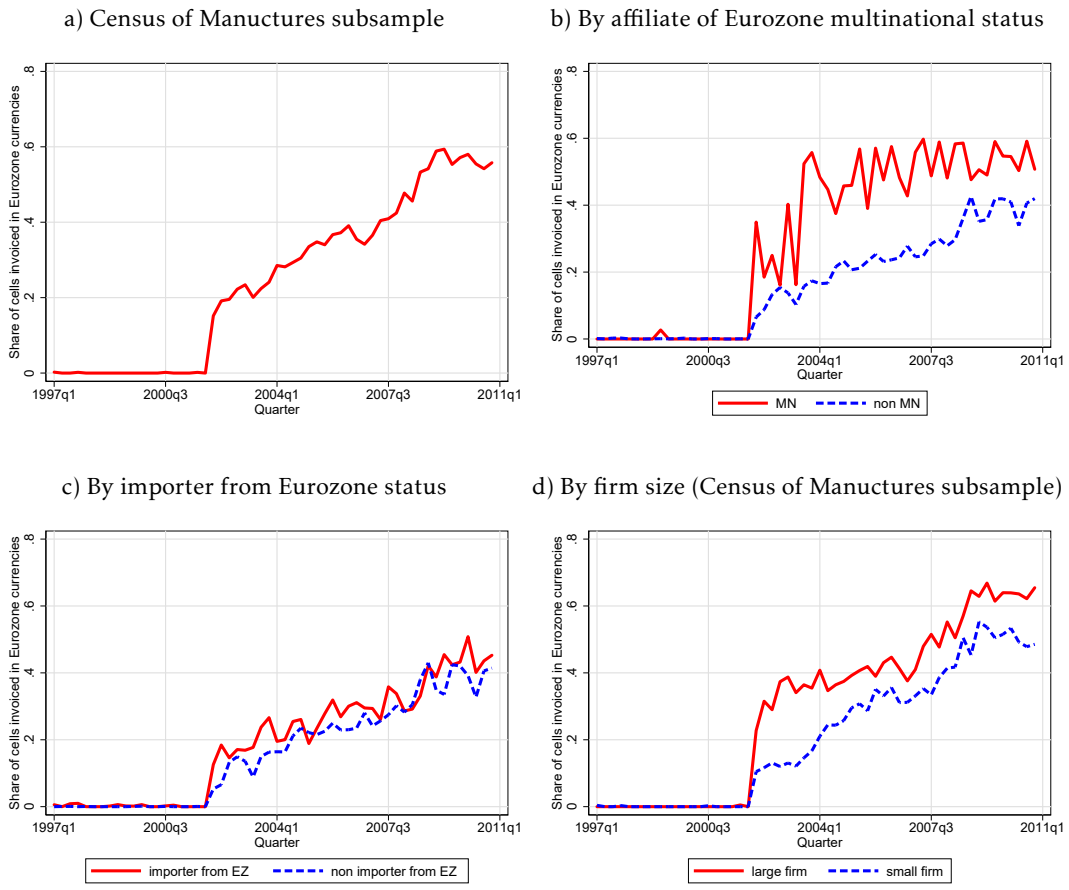
Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. Each panel consists of an HS2 sector, and we report data for the twelve largest sectors measured in terms of the number of firm–product (HS8)–destination–time (year–quarter) cells over 1997–2010.

Figure A.4: Probability of invoicing exports to the Eurozone in Eurozone currencies by sector removing firm × product × destination fixed effects.



Note: This figure shows the probability of invoicing Chilean exports to the Eurozone in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. We plot estimated coefficients on time dummies after removing firm × product × destination fixed effects as described in Appendix Section A.2.3. Each panel consists of an HS2 sector, and we report data for the twelve largest sectors measured in terms of the number of firm–product (HS8)–destination–time (year–quarter) cells over 1997–2010.

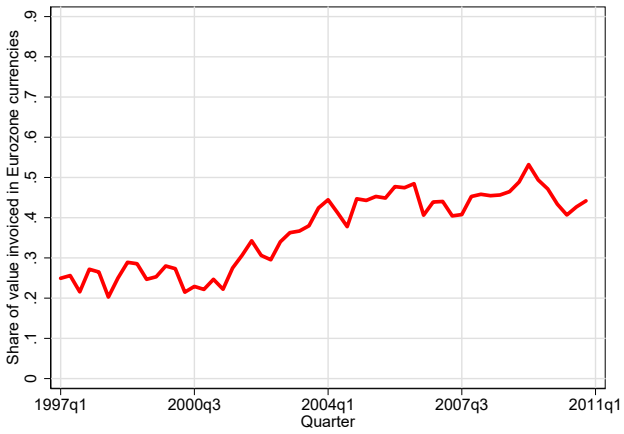
Figure A.5: Share of exports to the Eurozone invoiced in Eurozone currencies.



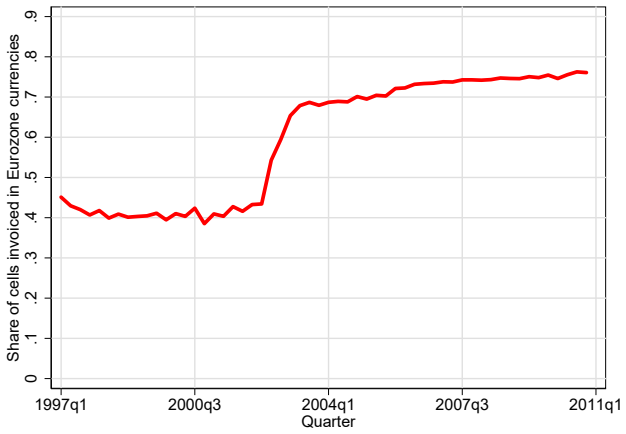
Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. Panel A is restricted to the Census of Manufactures sample. Panel B splits the sample between fims that are affiliates of Eurozone multinationals and the rest. Panel C splits the sample between firms that are importers from the Eurozone in the current period and the rest. Panel D is restricted to the Census of Manufactures sample and splits this sample between firms with above and below median size, measured in terms of revenue, using average revenue over 2002—2006 as in Section 4.

Figure A.6: Share of imports from the Eurozone invoiced in Eurozone currencies.

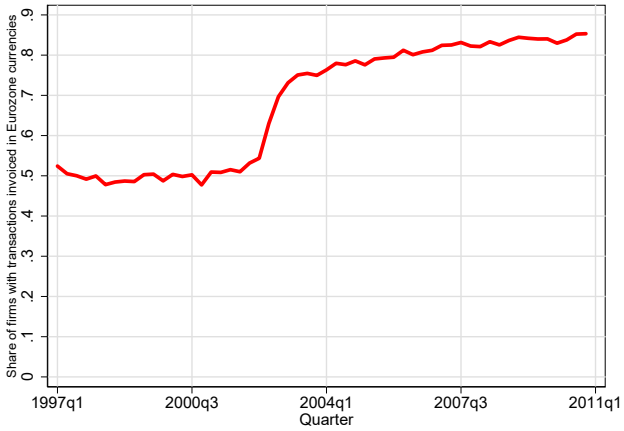
a) Share of value invoiced in Eurozone currencies



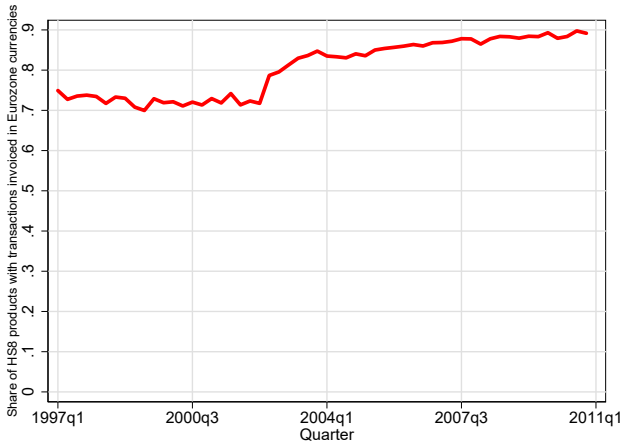
b) Unweighted share of firm-product-source country cells in Eurozone currencies



c) Share of firms with transactions in Eurozone currencies

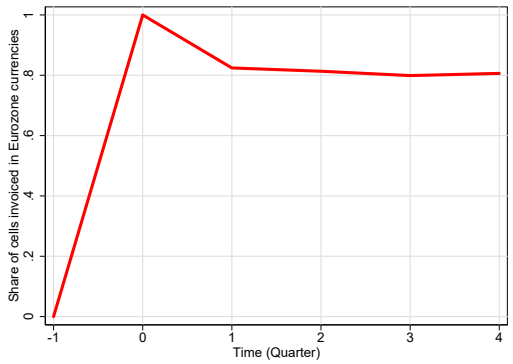


d) Share of HS8 products with transactions in Eurozone currencies



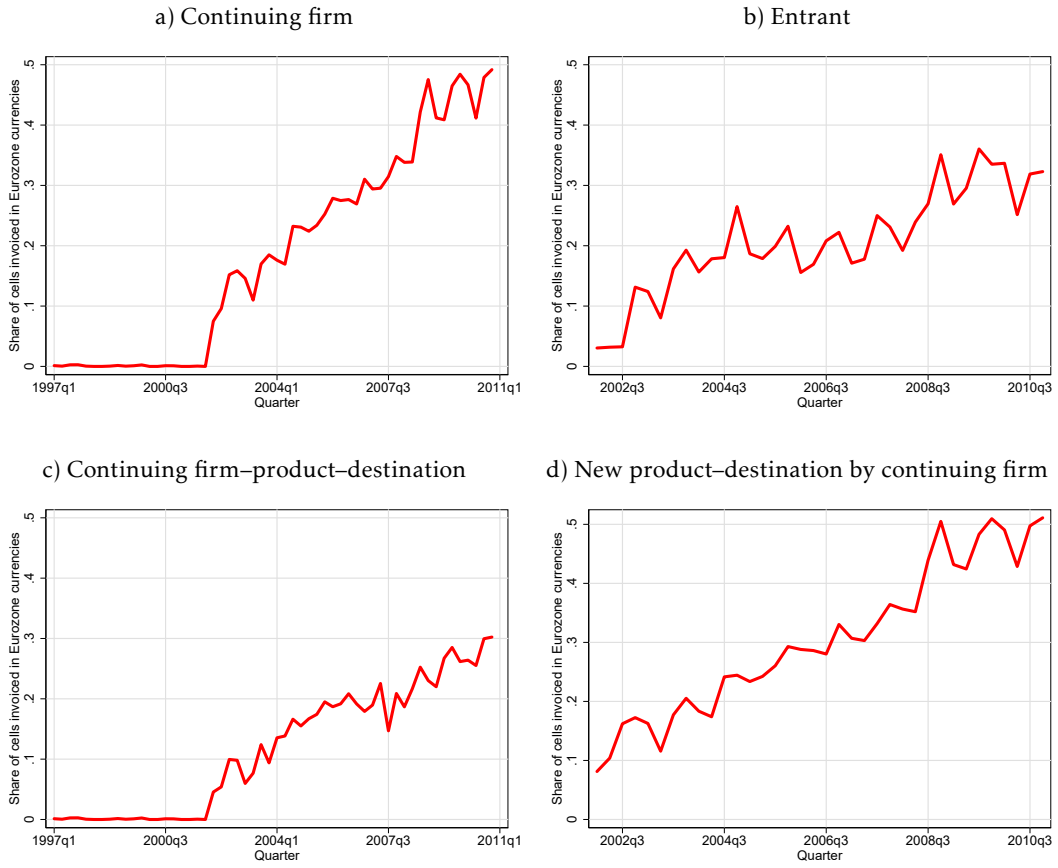
Note: This figure shows the share of Chilean imports from Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. Panels A and B report the share value and share of firm-HS8-source country cells invoiced in Eurozone currencies respectively. Panels C and D report the share of firms and HS8 products with at least one transaction invoiced in Eurozone currencies respectively.

Figure A.7: Persistence in the switch to euros.



Note: This figure describes the invoice currency in firm–product–destination cells that switch for the first time from US dollars to euros in their exports to the Eurozone four quarters after the switch. For each firm–product–destination cell, quarter 0 corresponds to the first quarter in which the invoice currency is the euro. We then compute the share of firm–product–destination cells invoicing in euros in each period.

Figure A.8: Share of exports to the Eurozone invoiced in Eurozone currencies: Entrants vs. continuing firms.

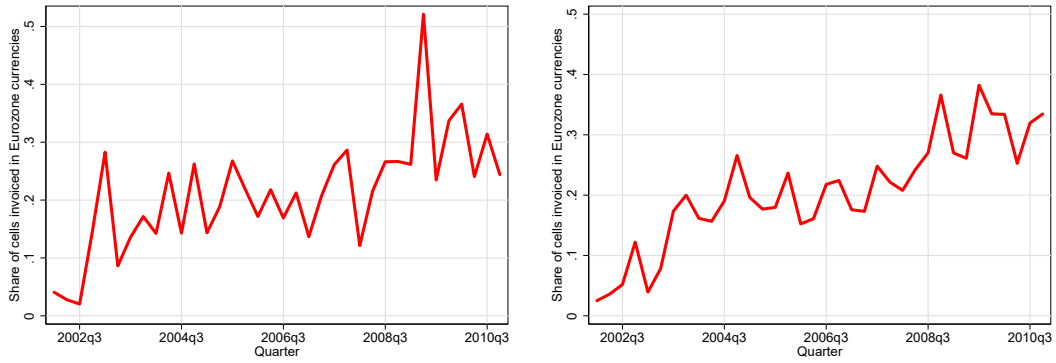


Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of continuing firms (firms with exports to the Eurozone before 2002). In panel B, the sample consists of entrants (firms without exports to the Eurozone before 2002). In panel C, the sample consists of continuing product-destination pairs by continuing firms (firms that were exporting the same product to the same Eurozone destination before 2002). In panel D, the sample consists of new product–destination pairs by continuing firms (firms with exports to the Eurozone before 2002, but without having exported the same product–destination combination).

Figure A.9: Share of exports to the Eurozone invoiced in Eurozone currencies among entrants to the Eurozone market

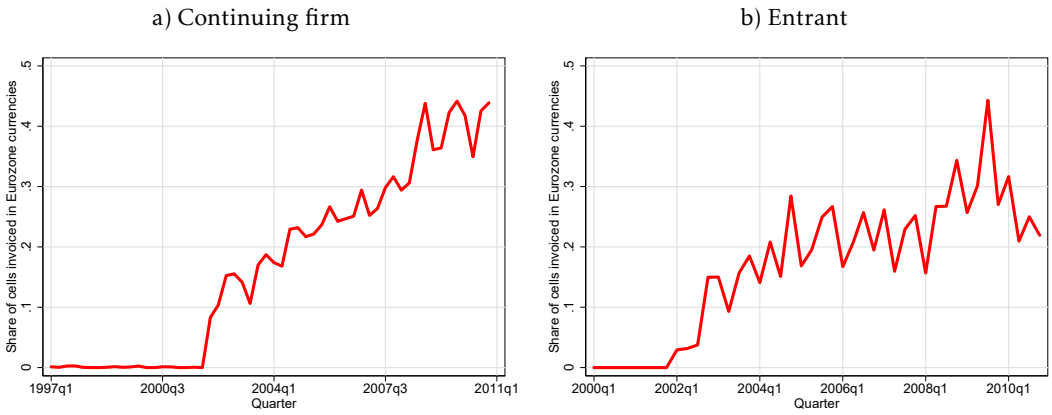
a) Entrant to the Eurozone market: not first–time exporter

b) Entrant to the Eurozone market: first–time exporter



Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of entrants to the Eurozone market (firms without exports to the Eurozone before 2002) that are not first–time exporters (that is, they export to the rest of the world before 2002). In panel B, the sample consists of entrants to the Eurozone market that are also first–time exporters (firms without exports to the Eurozone or the rest of the world before 2002).

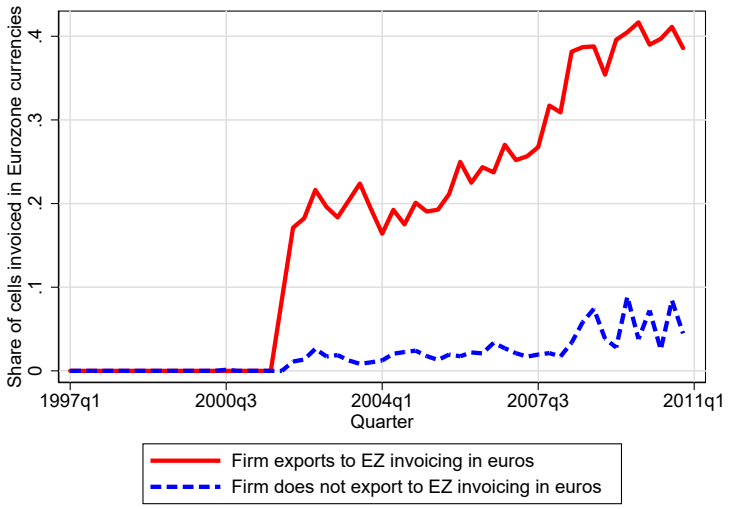
Figure A.10: Share of exports to the Eurozone invoiced in Eurozone currencies: Entrants vs. continuing firms (alternative definition).



Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. Both panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of continuing firms (firms with exports to the Eurozone within the previous three years). In panel B, the sample consists of entrants (firms without exports to the Eurozone within the previous three years).

A.2.2 Invoicing in euros in exports to European destinations outside the Eurozone: Spillovers.

Figure A.11: Invoicing in euros in exports to destinations outside the Eurozone.



Note: This figure shows the share of Chilean exports to non–Eurozone European countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. The figure reports the share of firm-HS8-destination cells invoiced in Eurozone currencies. The red solid line corresponds to firms that export to the Eurozone and invoice at least some of their exports to the Eurozone in euros. The blue dashed line corresponds to firms that do not export to the Eurozone invoicing in euros (so they either do not export to the Eurozone, or they export to the Eurozone but do not invoice in euros).

■ We assess whether exporting firms invoicing in euros to the Eurozone are more likely to also use the euro in exports to non–Eurozone European destinations. For this purpose, we estimate the following regression on the sample of exports to non–Eurozone European destinations over 2002–2010. The dependent variable is a dummy equal to one for transactions invoiced in euros. The right hand side variable is a dummy EZ EURO EXPORTER equal to one firms firms that also export to the Eurozone invoicing at least some trade in euros in the current period. This implies that this dummy variable is zero if the firm does not export to the Eurozone, or if the firm exports to the Eurozone but does not invoice in euros at all. We include fixed effects by product (HS8) × destination and time (year–quarter).

$$\Pr(\text{EURO})_{fpct} = \beta_1 \cdot \text{EZ EURO EXPORTER}_{ft} + \gamma_{pc} + \delta_t + \epsilon_{fpct} \,. \tag{A.1}$$

The results are shown in Table A.2. Column 1 includes all non–Eurozone European destinations, while column 2 excludes countries joining the Eurozone in the last years of the sample (Cyprus, Malta, Slovakia, and Slovenia). The results indicate that firms that have exports to the Eurozone invoiced in euros are 17.6 log points (19.2%) more likely to invoice in euros to non–Eurozone European destinations. Note that an equivalent regression for countries outside Europe yields no statistically significant relationship.

Table A.2: Invoicing in euros in exports to European destinations outside the Eurozone. *Spillovers.*

	(1)	(2)
EZ EURO EXPORTER	0.176**	0.175**
	(0.042)	(0.043)
Product (HS8) × Destination F.E.	Yes	Yes
Time F.E.	Yes	Yes
Observations	93563	90461

Notes: This table reports the estimation of equation (A.1). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.3: Descriptive statistics: Share of exports by entrants.

	2002			2006			2010		
	ALL	US	EURO	ALL	USD	EURO	ALL	USD	EURO
Share of value by entrants	0.04	0.04	0.02	0.04	0.02	0.14	0.02	0.02	0.01
Share of transactions by entrants	0.12	0.13	0.07	0.08	0.09	0.07	0.06	0.08	0.04

Notes: This table reports the share of exported value or transactions in Chilean exports to the Eurozone accounted for by entrants. Entrants are defined as those which did not export to the Eurozone during the previous three years.

Table A.4: Descriptive statistics: Share of exports by exiting firms.

	2002			2006		
	ALL	US	EURO	ALL	USD	EURO
Share of value by exiting firms	0.04	0.04	0.01	0.01	0.01	0.02
Share of transactions by exiting firms	0.09	0.09	0.09	0.07	0.08	0.05

Notes: This table reports the share of exported value or transactions in Chilean exports to the Eurozone accounted for by exiting firms. Exiting firms are defined as those which do not export to the Eurozone during the next three years.

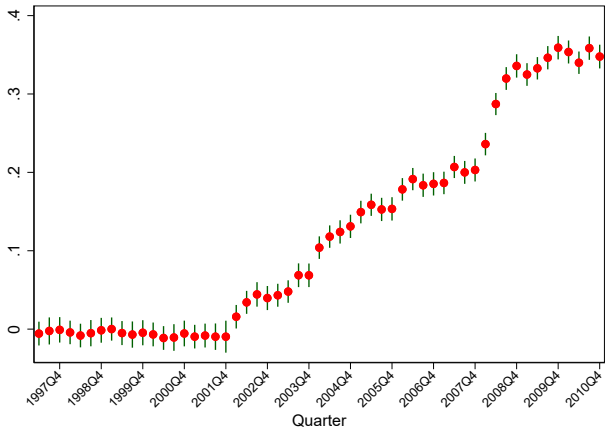
A.2.3 Trends in invoice currencies: removing firm × product × destination fixed effects

Here we show that the increasing popularity of the euro as an export invoicing currency was, to a large extent, a *within* firm-product-destination phenomenon. To this end, we estimate a regression of the probability of invoicing in euros on product × destination × firm fixed effects and year-quarter dummy variables. We plot the estimated coefficients on these year-quarter dummy variables to reflect the evolution of the within firm-product-destination probability of euro invoicing.

$$Pr(Euro)_{fpct} = \sum_{s=1997Q1}^{2010Q4} \beta_s \cdot 1[t = s] + \gamma_{fpc} + \epsilon_{fpct} \,. \tag{A.2}$$

The results are shown graphically in Figure A.12. We can see an increase in the probability of invoicing in euros over time of similar magnitude than that shown earlier in Figure 1.

Figure A.12: Within firm-product-destination probability of invoicing exports in Eurozone currencies.



Notes: This figure plots the estimated coefficients on time (year-quarter) dummies in equation (A.2).

A.2.4 Variance Decomposition

To get an initial sense of the importance of products and firms in accounting for invoicing choices, we report a simple variance decomposition. Specifically, we estimate regressions of the probability of invoicing in euros as a function of various sets of fixed effects introduced by turn, and report the R-squared statistic in each case. These results, computed separately for 2002 and 2010 are shown in Table A.5. They indicate that firms explain a much larger share of the variance than products or destinations. Focusing on the second column, corresponding to year 2010, product fixed effects account for 35% of the variance, destinations for 6% and firms for 76%.[77] Finally, introducing product × destination × firm fixed effects accounts for 96% of the variance. This pattern is quite similar for year 2002.

Table A.5: Probability of invoicing in euros: Variance decomposition.

	2002	2010
Product	0.23	0.35
Firm	0.66	0.76
Destination	0.04	0.06
Product × Firm × Destination	0.90	0.96

Notes: This table reports the R-squared statistic from linear regressions of the probability of invoicing a firm × product × destination × time (year–quarter) observation in euros on various sets of fixed effects in each row for years 2002 and 2010.

[77] Note that by construction these percentages are not intended to add up to 100%

A.2.5 Robustness checks and extensions to Table 1

■ Table A.6 reports the results of estimating equation (1) on a sample of firms that were already exporting to the Eurozone prior to 2002. Note that the coefficients are the same as those in Table 1 in the main text up to the fourth decimal.

■ Table A.7 reports the results of estimating equation (1) controlling for the level of the (log) exchange rate between the Chilean peso and the local (i.e. destination) currency.

■ Table A.8 reports the results of estimating equation (1) with alternative fixed effects.

■ Table A.9 reports the results of estimating equation (1) restricting the group of rest of the world countries to those with zero invoicing in euros.

Table A.6: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Continuing firms.*

	(1)	(2)
EZ × Post2002	0.146**	0.124**
	(0.022)	(0.014)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time (year–quarter) F.E.	No	Yes
Observations	1158878	1059833

Notes: This table reports the estimation of equation (1) among continuing firms. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.7: Probability of invoicing in local currency: Eurozone versus non–European destinations.
Controlling for the peso to local (i.e. destination) currency exchange rate.

	(1)	(2)
EZ × Post2002	0.147**	0.124**
	(0.022)	(0.014)
e^{LC}	0.000	0.001
	(0.004)	(0.002)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time F.E.	No	Yes
Observations	1261856	1139935

Notes: This table reports the estimation of equation (1) controlling for the (log) exchange rate between the Chilean peso and the local (i.e. destination) currency. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.8: Probability of invoicing in local currency: Eurozone versus non–European destinations.
Alternative fixed effects.

	(1)	(2)	(3)	(4)
EZ × Post2002	0.202**	0.197**	0.206**	0.200**
	(0.024)	(0.025)	(0.025)	(0.025)
Firm × product (HS6) × destination F.E.	Yes	Yes	No	No
Firm × product (HS4) × destination F.E.	No	No	Yes	Yes
Time F.E.	Yes	No	Yes	No
Product (HS6) × time F.E.	No	Yes	No	No
Product (HS4) × time F.E.	No	No	No	Yes
Firm × time F.E.	No	Yes	No	Yes
Observations	1480268	1412058	1480268	1412058

Notes: This table reports the estimation of equation (1) with alternative fixed effects. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.9: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Alternative set of rest of the world countries.*

	(1)	(2)
EZ × Post2002	0.154**	0.305**
	(0.025)	(0.070)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time F.E.	No	Yes
Observations	193994	157653

Notes: This table reports the estimation of equation (1) restricting the set of rest of the world countries to those with zero invoicing in euros. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

A.2.6 Robustness checks to Tables 2, 3 and 4

s ■ Tables A.10 and A.11 reproduce the results in Tables 2 and 3 dropping the small number of observations (less than 0.6%) that are not invoiced in euros nor dollars.

Table A.10: Probability of invoicing in euros: Product-level determinants.

	(1)	(2)	(3)
Destination EZ Import Share	0.063*	0.070**	0.070**
	(0.026)	(0.025)	(0.026)
Differentiated		0.059*	0.059*
		(0.029)	(0.029)
Destination F.E.	Yes	Yes	No
Time F.E.	Yes	Yes	No
Destination × time F.E.	No	No	Yes
Observations	147786	146532	146532

Notes: This table reports the estimation of equation (4). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered at the HS6 product level. ** and * indicate statistical significance at the 1% and 5% level.

Table A.11: Probability of invoicing in euros: Firm-level determinants.

	(1)	(2)	(3)	(4)	(5)	(6)
	Census of Manufactures Subsample				Full Sample	
	2002-2006	2002-2010	2002-2006	2002-2010	2002-2006	2002-2010
log Revenue	0.111**	0.110**	0.081*	0.083**		
	(0.023)	(0.015)	(0.036)	(0.026)		
EZ Export Share	0.082**	0.075**	0.052**	0.051**	0.049**	0.058**
	(0.021)	(0.011)	(0.015)	(0.012)	(0.012)	(0.011)
Euro-Invoiced Imports / Cost			0.154**	0.114**		
			(0.033)	(0.022)		
Dollar-Invoiced Imports / Cost			-0.114	-0.072		
			(0.086)	(0.057)		
EZ Multinational Affiliate					0.237**	0.174**
					(0.045)	(0.031)
log Total (World) Exports					0.061	0.080*
					(0.029)	(0.028)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11149	19597	11149	19597	59944	118338

Notes: This table reports the estimation of equation (5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Columns 1 through 4 refer to the Census of Manufactures subsample. Columns 5 and 6 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.12 shows the results of estimating equation (4) using an alternative measure of the Eurozone Import Share that varies by product and year but not by country. Specifically,the Eurozone import share is now defined as follows. For each HS6 product p and year y, we compute the share of imports M_{psy} of the entire Eurozone sourced from within the Eurozone (i.e. from Eurozone countries $s \in EZ$) out of imports from all countries s:

$$\text{Destination EZ Import Share}_{py} = \frac{\sum_{s \in EZ} M_{psy}}{\sum_{s} M_{psy}} . \tag{A.3}$$

Table A.12: Probability of invoicing in euros: Product-level determinants. *Alternative Eurozone Import Share measure*

	(1)	(2)	(3)
Destination EZ Import Share	0.063*	0.074**	0.074**
	(0.025)	(0.025)	(0.025)
Differentiated		0.075*	0.075*
		(0.026)	(0.025)
Destination F.E.	Yes	Yes	No
Time F.E.	Yes	Yes	No
Destination × time F.E.	No	No	Yes
Observations	149144	147876	147872

Notes: This table reports the estimation of equation (4). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.13 reproduces the results in columns 4 and 6 in Table 3 using fixed effects by i) HS6 x destination x time (columns 1 and 2), ii) HS4 x destination x time (columns 3 and 4), iii) HS8, destination and time (columns 5 and 6), iv) HS6, destination and time (columns 7 and 8), and v) HS4, destination and time (columns 9 and 10).

■ Table A.14 reproduces the results in column 2 in Table 4 using fixed effects by i) HS6 x destination x time (column 1), ii) HS4 x destination x time (column 2), iii) HS8, destination and time (column 3), iv) HS6, destination and time (column 4), and v) HS4, destination and time (column 5).

Table A.13: Probability of invoicing in euros: Firm-level determinants. *Alternative fixed effects*.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log Revenue	0.087**		0.093**		0.080**		0.082**		0.090**	
	(0.027)		(0.024)		(0.022)		(0.021)		(0.025)	
EZ Export Share	0.046**	0.058**	0.053**	0.052**	0.049**	0.056**	0.053**	0.059**	0.058**	0.055**
	(0.012)	(0.011)	(0.015)	(0.012)	(0.011)	(0.010)	(0.010)	(0.009)	(0.012)	(0.010)
Euro-Invoiced Imports / Cost	0.118**		0.094*		0.130**		0.126**		0.093**	
	(0.021)		(0.038)		(0.030)		(0.029)		(0.027)	
Dollar-Invoiced Imports / Cost	-0.098		-0.062		-0.059		-0.057		-0.056*	
	(0.074)		(0.066)		(0.030)		(0.027)		(0.019)	
EZ Multinational Affiliate		0.176**		0.180**		0.130*		0.139*		0.150*
		(0.040)		(0.048)		(0.045)		(0.045)		(0.050)
log Total (World) Exports		0.080*		0.076*		0.069*		0.070*		0.065*
		(0.027)		(0.028)		(0.026)		(0.026)		(0.026)
Census of Mftg. Sample	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Full Sample	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Prod. (HS6) × Dest. × Time F.E.	Yes	Yes	No	No	No	No	No	No	No	No
Prod. (HS4) × Dest. × Time F.E.	No	No	Yes	Yes	No	No	No	No	No	No
Prod. (HS8) F.E.	No	No	No	No	Yes	Yes	No	No	No	No
Prod. (HS6) F.E.	No	No	No	No	No	No	Yes	Yes	No	No
Prod. (HS4) F.E.	No	No	No	No	No	No	No	No	Yes	Yes
Dest. F.E.	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24463	130371	27669	142538	33832	159424	34073	159814	34406	160357

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1, 3, 5, 7 and 9 refer to the Census of Manufactures subsample. Columns 2,4 ,6 ,8 and 10 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.14: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Alternative fixed effects.*

	(1)	(2)	(3)	(4)	(5)
Destination EZ Import Share × log Total (World) Exports	0.022*	0.018*	0.029*	0.031*	0.032*
	(0.008)	(0.007)	(0.010)	(0.010)	(0.010)
log Total (World) Exports	0.111**	0.112**	0.081*	0.081*	0.085*
	(0.033)	(0.030)	(0.027)	(0.027)	(0.028)
Euro-Invoiced Imports / Cost	0.123**	0.098*	0.136**	0.132**	0.097**
	(0.020)	(0.038)	(0.032)	(0.031)	(0.028)
Dollar-Invoiced Imports / Cost	-0.128	-0.088	-0.074	-0.072*	-0.070*
	(0.082)	(0.077)	(0.034)	(0.030)	(0.023)
Prod. (HS6) × Dest. × Time F.E.	Yes	No	No	No	No
Prod. (HS4) × Dest. × Time F.E.	No	Yes	No	No	No
Prod. (HS8) F.E.	No	No	Yes	No	No
Prod. (HS6) F.E.	No	No	No	Yes	No
Prod. (HS4) F.E.	No	No	No	No	Yes
Dest. F.E.	No	No	Yes	Yes	Yes
Time F.E.	No	No	Yes	Yes	Yes
Observations	23638	26396	31830	32033	32306

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.15 reproduces the results in columns 4 and 6 in Table 3 using fixed effects by i) HS8 and time (columns 1 and 2), ii) HS6 and time (columns 3 and 4), and iii) HS4 and time (columns 5 and 6).

■ Table A.16 reproduces the results in column 2 in Table 4 using fixed effects by i) HS8 and time (column 1), ii) HS6 and time (column 2), and iii) HS4 and time (column 3).

Table A.15: Probability of invoicing in euros: Firm-level determinants. *Excluding destination fixed effects*.

	(1)	(2)	(3)	(4)	(5)	(6)
log Revenue	0.091**		0.092**		0.100**	
	(0.024)		(0.024)		(0.028)	
EZ Export Share	0.054**	0.056**	0.062**	0.059**	0.068**	0.056**
	(0.012)	(0.009)	(0.011)	(0.009)	(0.014)	(0.010)
Euro-Invoiced Imports / Cost	0.136**		0.133**		0.098**	
	(0.033)		(0.032)		(0.030)	
Dollar-Invoiced Imports / Cost	-0.060		-0.057		-0.056*	
	(0.032)		(0.029)		(0.021)	
EZ Multinational Affiliate		0.135*		0.145*		0.154*
		(0.046)		(0.047)		(0.052)
log Total (World) Exports		0.074*		0.075*		0.069*
		(0.029)		(0.029)		(0.029)
Census of Mftg. Sample	Yes	No	Yes	No	Yes	No
Full Sample	No	Yes	No	Yes	No	Yes
Prod. (HS8) F.E.	Yes	Yes	No	No	No	No
Prod. (HS6) F.E.	No	No	Yes	Yes	No	No
Prod. (HS4) F.E.	No	No	No	No	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33832	159424	34073	159814	34406	160357

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1, 3 and 5 refer to the Census of Manufactures subsample. Columns 2, 4 and 6 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.16: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Excluding destination fixed effects.*

	(1)	(2)	(3)
Destination EZ Import Share × log Total (World) Exports	0.026**	0.029**	0.032**
	(0.007)	(0.007)	(0.006)
log Total (World) Exports	0.087*	0.084*	0.088*
	(0.029)	(0.028)	(0.029)
Euro-Invoiced Imports / Cost	0.146**	0.142**	0.104**
	(0.036)	(0.036)	(0.032)
Dollar-Invoiced Imports / Cost	-0.075	-0.072*	-0.071*
	(0.036)	(0.032)	(0.024)
Prod. (HS8) F.E.	Yes	No	No
Prod. (HS6) F.E.	No	Yes	No
Prod. (HS4) F.E.	No	No	Yes
Time F.E.	Yes	Yes	Yes
Observations	31830	32033	32306

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Tables A.17 and A.18 reproduce the results in Tables 3 and 4 using fixed effects by the industry reported in the Census of Manufactures.

Table A.17: Probability of invoicing in euros: Firm-level determinants. *Including Census industry fixed effects*

	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
log Revenue	0.120**	0.117**	0.097	0.094*
	(0.020)	(0.013)	(0.049)	(0.034)
EZ Export Share	0.083**	0.071**	0.045**	0.044**
	(0.018)	(0.010)	(0.011)	(0.014)
Euro-Invoiced Imports / Cost			0.177**	0.128**
			(0.024)	(0.015)
Dollar-Invoiced Imports / Cost			-0.171	-0.106
			(0.102)	(0.069)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Census Industry F.E.	Yes	Yes	Yes	Yes
Observations	11291	20020	11291	20020

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.18: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Including Census industry fixed effects*

	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
Destination EZ Import Share × log Total (World) Exports	0.046**	0.034**		
	(0.009)	(0.008)		
Destination EZ Import Share × log Revenue			0.026*	0.019*
			(0.008)	(0.007)
log Total (World) Exports	0.133*	0.134*		
	(0.055)	(0.048)		
log Revenue			0.083	0.086
			(0.050)	(0.043)
Euro-Invoiced Imports / Cost	0.185**	0.135**	0.191**	0.140**
	(0.025)	(0.014)	(0.023)	(0.013)
Dollar-Invoiced Imports / Cost	-0.182	-0.131	-0.173	-0.125
	(0.105)	(0.074)	(0.097)	(0.071)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Census Industry F.E.	Yes	Yes	Yes	Yes
Observations	11155	19193	11155	19193

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Tables A.19 and A.20 reproduce the results in columns 1, 3 and 5 in Tables 3 and columns 1 and 3 in Table 4 restricting the sample to firms that export in all years.

Table A.19: Probability of invoicing in euros: Firm-level determinants. *Permanent exporters.*

	(1)	(2)	(3)
log Revenue	0.118**	0.101*	
	(0.018)	(0.046)	
EZ Export Share	0.083**	0.048**	0.041**
	(0.016)	(0.011)	(0.009)
Euro-Invoiced Imports / Cost		0.174**	
		(0.027)	
Dollars-Invoiced Imports / Cost		-0.145	
		(0.093)	
EZ Multinational Affiliate			0.241**
			(0.031)
log Total (World) Exports			0.060
			(0.029)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes
Observations	10274	10274	43013

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1 and 2 refer to the Census of Manufactures subsample. Column 3 refers to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.20: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Permanent exporters.*

	(1)	(2)
Destination EZ Import Share × log Total (World) Exports	0.029*	
	(0.010)	
Destination EZ Import Share × log Revenue		0.027*
		(0.012)
log Total (World) Exports	0.130*	
	(0.046)	
log Revenue		0.083
		(0.047)
Euro-Invoiced Imports / Cost	0.176**	0.184**
	(0.029)	(0.026)
Dollar-Invoiced Imports / Cost	-0.157	-0.151
	(0.098)	(0.095)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes
Observations	10373	10176

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.21: Probability of invoicing in euros: Firm-level determinants. *Entrants vs. continuing firms*

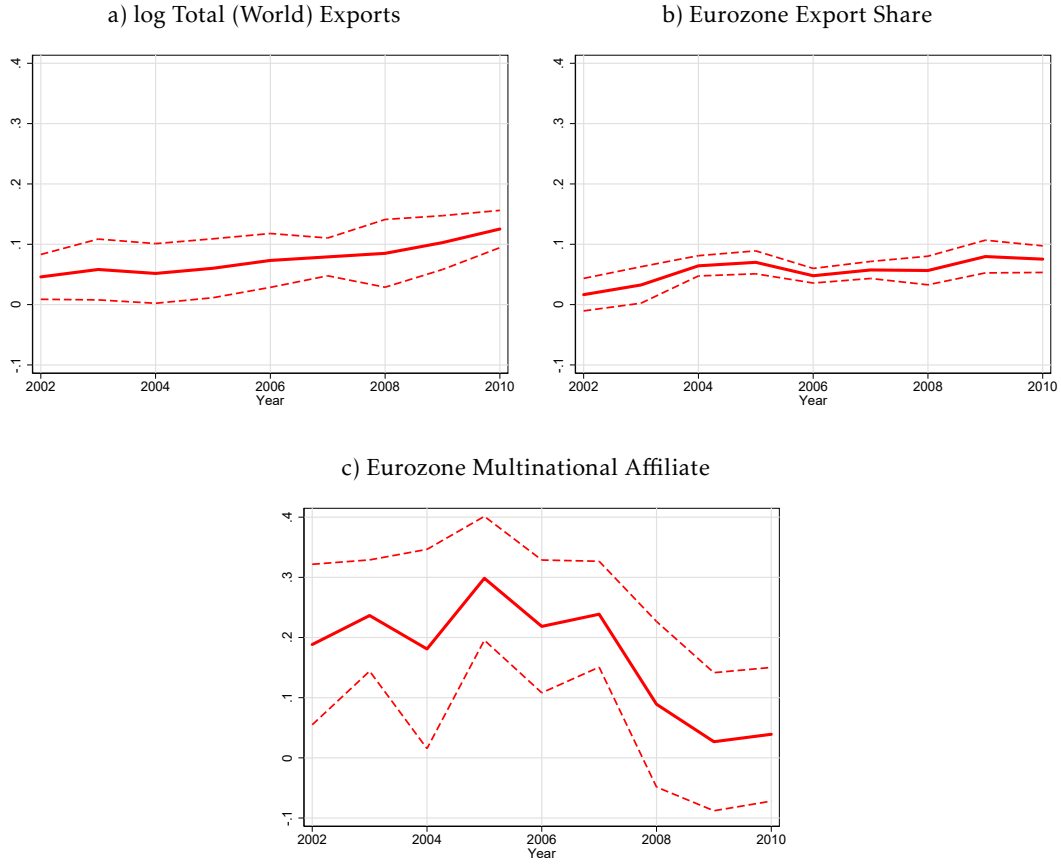
	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
log Revenue	0.113**	0.113**	0.086*	0.087**
	(0.023)	(0.015)	(0.036)	(0.024)
EZ Export Share	0.080**	0.068**	0.051**	0.045**
	(0.021)	(0.010)	(0.014)	(0.013)
Euro-Invoiced Imports / Cost			0.149**	0.110**
			(0.031)	(0.021)
Dollar-Invoiced Imports / Cost			-0.110	-0.068
			(0.083)	(0.054)
Entrant to EZ market (not first–time exporter)	-0.039	-0.061	0.006	-0.040
	(0.030)	(0.042)	(0.035)	(0.039)
Entrant to EZ market (first–time exporter)	0.129**	0.294**	0.090**	0.265**
	(0.028)	(0.082)	(0.024)	(0.080)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Observations	11321	20044	11321	20044

Notes: This table reports the estimation of equation (5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

A.2.7 Determinants of the adoption of the euro: Dynamics

As described under the heading "Adoption Dynamics" in Section 4.2, the following two figures report the results of estimating equation (5) modified to include the interaction of each firm–level determinant with a set of year dummies. Appendix Figure A.13 corresponds to the full sample and Appendix Figure A.14 corresponds to the Census of Manufactures subsample.

Figure A.13: Probability of invoicing in euros: Firm-level determinants. *Dynamics; Full sample.*



Note: This solid lines in each panel correspond to the estimated coefficients from an augmented version of equation (5), in which firm–level determinants are interacted with year dummy variables. As in equation (5), we include product (HS8) × destination × time (year–quarter) fixed effects and cluster standard errors by firm, product (HS6) destination and time using multiway clustering. The dotted lines correspond to 95% confidence intervals.

Figure A.14: Probability of invoicing in euros: Firm-level determinants. *Dynamics; Census of Manufactures subsample.*

Note: This solid lines in each panel correspond to the estimated coefficients from an augmented version of equation (5), in which firm–level determinants are interacted with year dummy variables. As in equation (5), we include product (HS8) × destination × time (year–quarter) fixed effects and cluster standard errors by firm, product (HS6) destination and time using multiway clustering. The dotted lines correspond to 95% confidence intervals.

A.2.8 Summary statistics for regressions in Tables 2, 3 and 4

Table A.22: Summary statistics for invoicing regressions.

	Mean	St. Dev.	10th pct.	50th pct.	90th pct.
Column 3 in Table 2:					
Dep. var: 1[Euro]	0.28	0.45	0.00	0.00	1.00
Destination EZ Import Share	0.35	0.22	0.07	0.31	0.71
Differentiated	0.19	0.39	0.00	0.00	1.00
Column 3 in Table 3:					
Dep. var: 1[Euro]	0.34	0.47	0.00	0.00	1.00
log Revenue	16.62	1.25	15.10	16.58	18.23
EZ Export Share	0.30	0.24	0.08	0.24	0.62
Euro-invoiced imports over Cost	0.02	0.04	0.00	0.00	0.11
Dollar-invoiced imports over Cost	0.02	0.05	0.00	0.00	0.06
Column 5 in Table 3:					
Dep. var: 1[Euro]	0.20	0.40	0.00	0.00	1.00
EZ Multinational Affiliate	0.02	0.14	0.00	0.00	0.00
EZ Export Share	0.40	0.30	0.08	0.30	1.00
log Total (World) Exports	14.03	2.03	11.39	14.19	16.56

Notes: This table reports summary statistics for the invoicing regressions in Section 4.

A.2.9 Product–level determinants: Invoicing in local currency in exports to the Eurozone versus the rest of the world

The results for regression (1) in Section 4.1 show that the probability of invoicing in local (i.e. destination) currency is higher in exports to the Eurozone relative to the rest of the world after the euro is introduced. In addition, the results for regression (4) in Section 4.2 show that the probability of invoicing in euros in exports to the Eurozone is higher in industries facing a higher Eurozone import share (i.e. more competition from within the Eurozone) and among differentiated industries. Here, we augment regression (4), showing that the growth in invoicing in local currency in exports to the Eurozone relative to the rest of the world after 2002 is higher among industries facing a higher Eurozone import share (i.e. more competition from within the Eurozone) and among differentiated industries.

To this end, we estimate equation (A.5), in which the first regressor of interest is the triple interaction between the dummy variable EZ_c, equal to one for exports to Eurozone destinations; the dummy variable Post2002_t, equal to one for periods during and after 2002; and the destination's Eurozone import share. While in the main text the Eurozone import share measure varied across industries and destinations, here we construct an alternative measure that varies only by industry, such that it can be assigned to exports to any destination and is constant across destinations.[78] The second regressor of interest is the triple interaction between EZ_c, Post2002_t, and a dummy variable for differentiated industries. The regression includes both country × time (year–quarter) and product × time fixed effects. In addition, standard errors are clustered by HS6 product, destination and time (year–quarter) using multiway clustering.

$$\begin{aligned}\Pr(\text{LC})_{fpct} = {} & \beta_1 \cdot \text{EZ}_c \cdot \text{Post2002}_t \cdot \text{EZ Import Share}_{py} + \beta_2 \cdot \text{EZ}_c \cdot \text{Post2002}_t \cdot \text{Differentiated}_p \\ & + \beta_3 \cdot \text{EZ}_c \cdot \text{EZ Import Share}_{py} + \beta_4 \cdot \text{EZ}_c \cdot \text{Differentiated}_p + \gamma_{ct} + \nu_{pt} + \epsilon_{fpct} \,. \end{aligned} \tag{A.5}$$

The results are shown in Appendix Table A.23, and indicate that there is an increase in invoicing in local currency in exports to the Eurozone that is stronger in industries facing stronger competition from within the Eurozone. To interpret the magnitude of these coefficients, recall first that in Table 1 we had found a 14.6 log point increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

In Appendix Table A.23, we find that comparing the 75th and 25th percentiles of the Eurozone

[78] Specifically,the Eurozone import share is now defined as follows. For each HS6 product p and year y, we compute the share of imports M_{psy} of the entire Eurozone sourced from within the Eurozone (i.e. from Eurozone countries $s \in EZ$) out of imports from all countries s:

$$\text{Destination EZ Import Share}_{py} = \frac{\sum_{s \in EZ} M_{psy}}{\sum_s M_{psy}} \,. \tag{A.4}$$

import share variable, the former has a 13.6 larger log point increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

In addition, comparing differentiated and nondifferentiated industries, the former have a 8.4 log point larger increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

Furthermore, we can replace Post2002_t by a set of time (year–quarter) dummy variables. Focusing on the Eurozone import share, we estimate:[79]

$$\Pr(\text{LC})_{fpct} = \sum_{s=1997Q1}^{2010Q4} \beta_{1,s} \cdot \text{EZ}_c \cdot \text{EZ Import Share}_{py} \cdot 1[t = s] + \gamma_{ct} + \nu_{pt} + \epsilon_{fpct} \,. \tag{A.6}$$

The results are shown graphically in Appendix Figure A.15 and corroborate the previous findings.

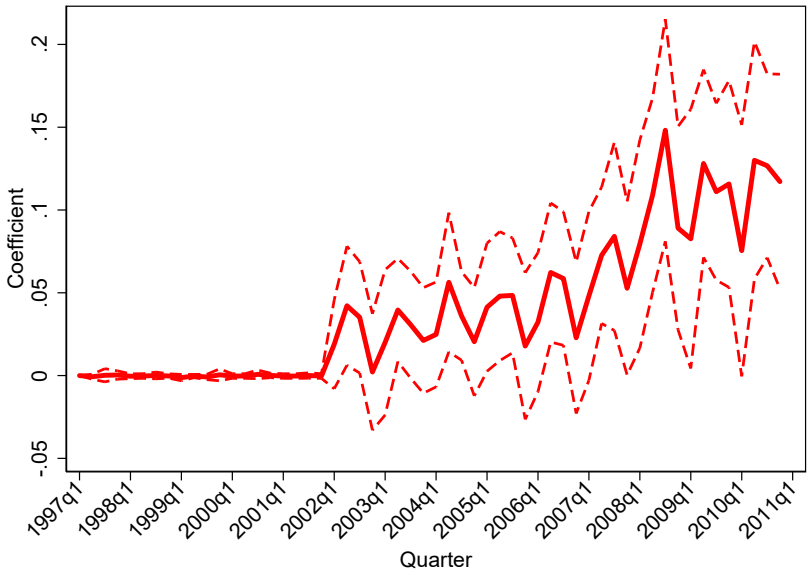
Table A.23: Probability of invoicing in euros: Product-level determinants. *Triple interaction.*

	(1)	(2)
EZ × Post2002 × Destination EZ Import Share	0.063**	0.076**
	(0.024)	(0.024)
EZ × Post2002 × Differentiated		0.085*
		(0.034)
Destination × Time F.E.	Yes	Yes
Product (HS8) × Time F.E.	Yes	Yes
Observations	1406534	1406534

Notes: This table reports the estimation of equation (A.5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The terms EZ × Destination EZ Import Share and EZ × Differentiated are included in the regression but the coefficients are not reported. Standard errors are clustered by product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

[79] Note that this regression also includes the double interaction between EZ_c and EZ import share_{py}, not shown for conciseness.

Figure A.15: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Triple interaction.*



Note: This figure plots the estimated coefficients from equation (A.6) and 95% confidence intervals with standard errors clustered by destination and time (year–quarter) using multiway clustering.

A.3 Appendix to Section 5: The effect of the euro on exchange rate pass–through

Table A.24: Summary Statistics for exchange rate pass–through regressions.

	Mean	St. Dev.	10th pct.	50th pct.	90th pct.
Dep. var: Δp_{fpct}	0.00	0.27	-0.23	0.00	0.23
Δe^{USD}	-0.00	0.06	-0.06	-0.00	0.07
Δe^{EUR}	0.00	0.05	-0.06	0.00	0.05
1[USD]	0.73	0.45	0.00	1.00	1.00
1[EURO]	0.27	0.45	0.00	0.00	1.00
1[Post2002]	0.81	0.39	0.00	1.00	1.00

Notes: This table reports summary statistics for the exchange rate pass–through regressions in Section 5.

Table A.25: Exchange rate pass–through: Heterogeneity within the *post* period.

	(1)	(2)
Δe^{USD}	0.824***	1.027***
	(0.285)	(0.213)
1[2002-2006] $\times \Delta e^{USD}$	-0.122	-0.264
	(0.295)	(0.246)
1[2007-2010] $\times \Delta e^{USD}$	-0.292	-0.560**
	(0.290)	(0.224)
Δe^{EUR}	0.044	-0.019
	(0.071)	(0.076)
1[2002-2006] $\times \Delta e^{EUR}$	0.222**	0.308*
	(0.106)	(0.164)
1[2007-2010] $\times \Delta e^{EUR}$	0.458***	0.675***
	(0.114)	(0.128)
Firm × Prod. × Dest. F.E.	Yes	Yes
Year F.E.	No	Yes
Quarter F.E.	Yes	Yes
Observations	79323	79323

Notes: This table reports the results of the estimation of equation (10), replacing the Post2002$_t$ variable into two categorical variables marking the periods 2002–2006 and 2006–2010. All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

Table A.26: Exchange rate pass–through: Permanent exporters.

	(1)	(2)
Δe^{USD}	0.764*	0.958**
	(0.348)	(0.349)
Post2002 × Δe^{USD}	-0.267	-0.435
	(0.350)	(0.355)
Δe^{EUR}	-0.115	-0.106
	(0.101)	(0.108)
Post2002 × Δe^{EUR}	0.728**	0.712**
	(0.168)	(0.174)
Firm × Prod. × Dest. F.E.	Yes	Yes
Year F.E.	Yes	Yes
Quarter F.E.	Yes	Yes
Observations	35052	38613

Notes: This table reports the results of the estimation of equation (10). The sample is restricted to firms that export in all years (column 1) or firms that export at least in the initial (1997) and final (2010) years (column 2). All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

Online Appendix

Trade Invoicing Currencies and Exchange Rate Pass-through: The Introduction of the Euro as a Natural Experiment

Felipe Benguria and Rodrigo Wagner

A Appendix

A.1 Appendix to Section 3: Data

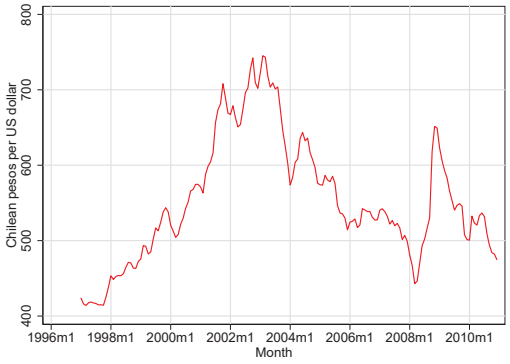
Table A.1: Descriptive Statistics

	Full sample				Census of Manufactures Subsample		
	1997	2002	2006	2010	2002	2006	2010
Total exports to EZ (million USD)	1222	1254.3	2707.7	2719.7	597.3	1346.7	1150.9
Number of firms	1235	1545	1818	1800	274	254	189
Mean number of products exported to EZ	2.6	3.9	3.7	3.7	3.9	4.3	4.3
Mean number of EZ destinations	1.8	1.8	2	2.1	2.3	2.6	2.7
Mean export value to EZ	989.4	811.8	1489.4	1511	2179.9	5302.1	6089.5
Median export value to EZ	65.5	47.2	66.2	93.8	132.3	184.9	337.9
Mean share of EZ exports	0.477	0.488	0.491	0.436	0.274	0.287	0.264
Mean share of EZ exports invoiced in Eurozone currencies	0.002	0.079	0.2	0.275	0.115	0.237	0.337
Number of importers	427	505	562	510	139	145	118
Number of importers from EZ	306	361	367	356	123	125	103
Mean import value from world among importers from world	8619.4	8061.8	6208.2	7753	9405.6	11257.1	9294
Median import value from world among importers from world	224.7	173.1	127.8	201.7	1192.7	1512.5	1480.9
Mean import value from EZ among importers from EZ	1703.6	1982.5	2019.8	2232.3	1892.6	1945.5	2570
Median import value from EZ among importers from EZ	163.7	157.9	154.5	177.3	453.9	518.1	496.3
Mean share of imports invoiced in Eurozone currencies among importers from world	0.172	0.217	0.218	0.241	0.217	0.226	0.208
Mean share of imports invoiced in dollars among importers from world	0.772	0.719	0.738	0.706	0.705	0.717	0.743

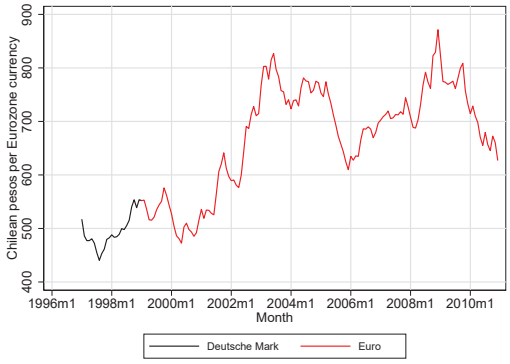
Notes: This table reports descriptive statistics for the sample of Chilean exporters to Eurozone destinations described in Section 3. All values are in thousands of US dollars of 1997 unless noted otherwise.

Figure A.1: Exchange rates.

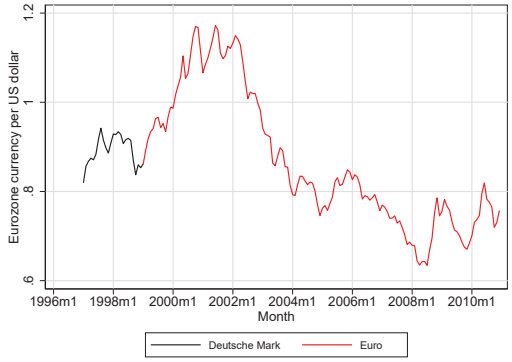
a) Chilean pesos per US dollar



b) Chilean pesos per Eurozone currency



c) Eurozone currency per US dollar

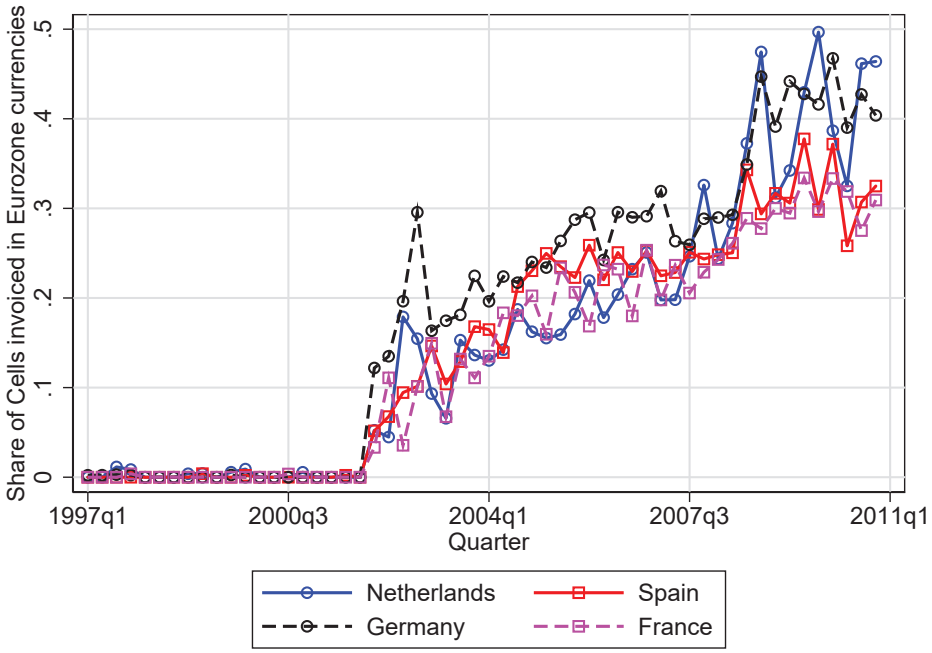


Note: This figure shows the exchange rates between the Chilean peso and the US dollar in panel a), between the Chilean peso and Eurozone currency in panel b) and between Eurozone currency and the US dollar in panel c). Eurozone currency refers to the euro from January 1999 onwards, and to the Deutsche mark up to December 1998.

A.2 Appendix to Section 4: The adoption of the euro as a trade invoicing currency

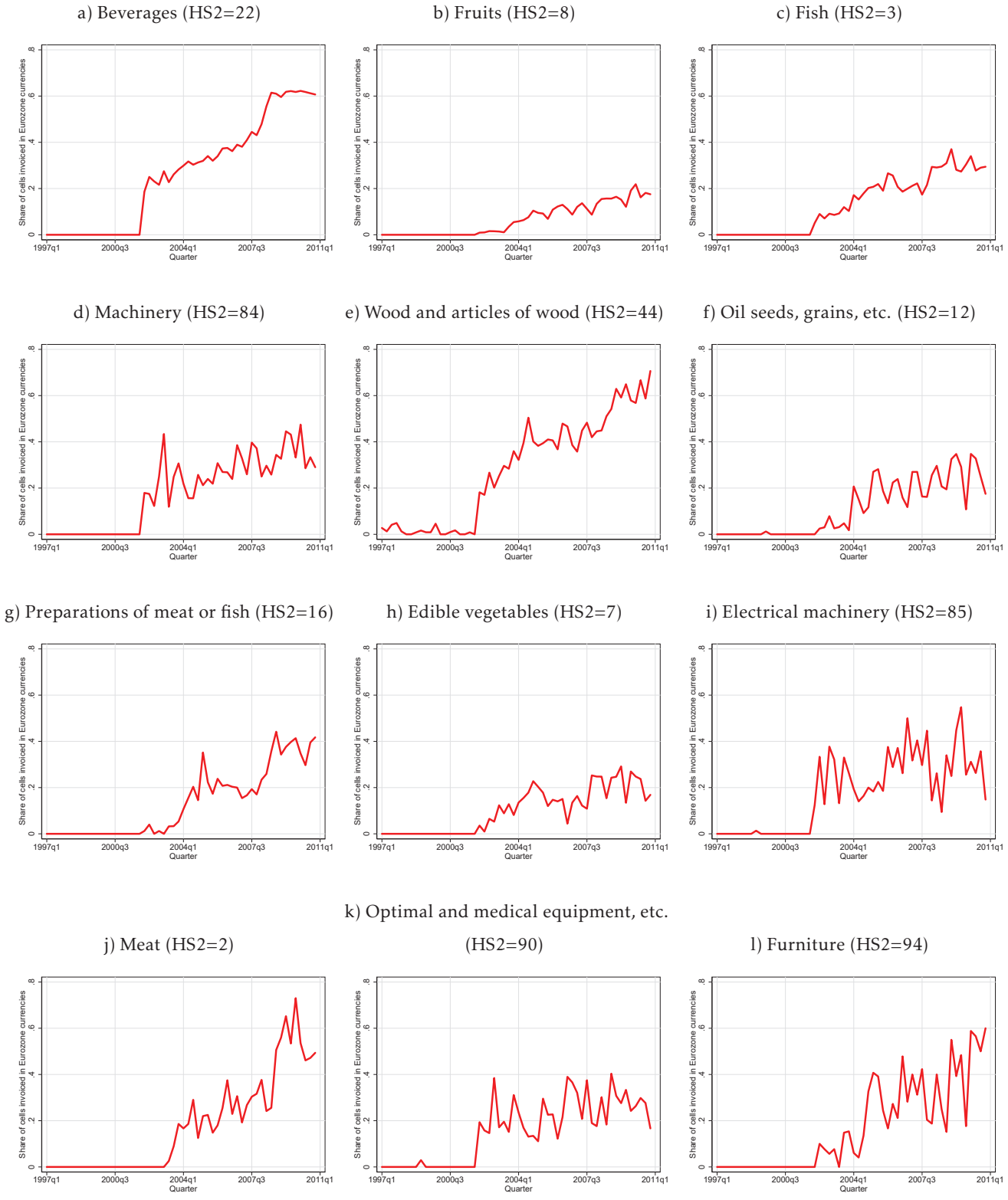
A.2.1 Trends in the adoption of the euro as an invoice currency

Figure A.2: Share of exports to main Eurozone destinations invoiced in Eurozone currencies.



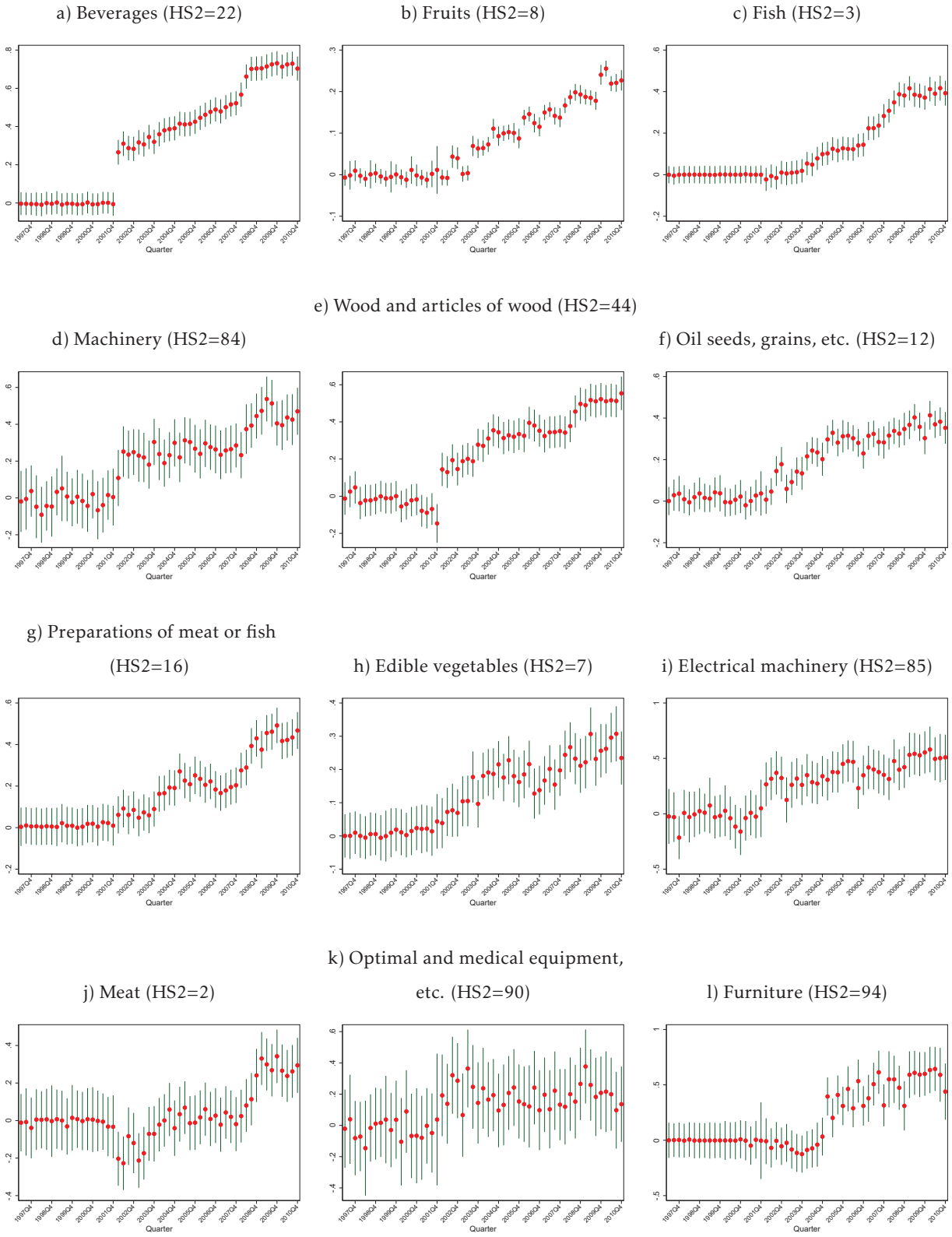
Notes: This figure reports the share of firm-product-time (year-quarter) cells invoiced in Eurozone currencies for each of the largest Eurozone destinations of Chilean exports.

Figure A.3: Share of exports to the Eurozone invoiced in Eurozone currencies by sector.



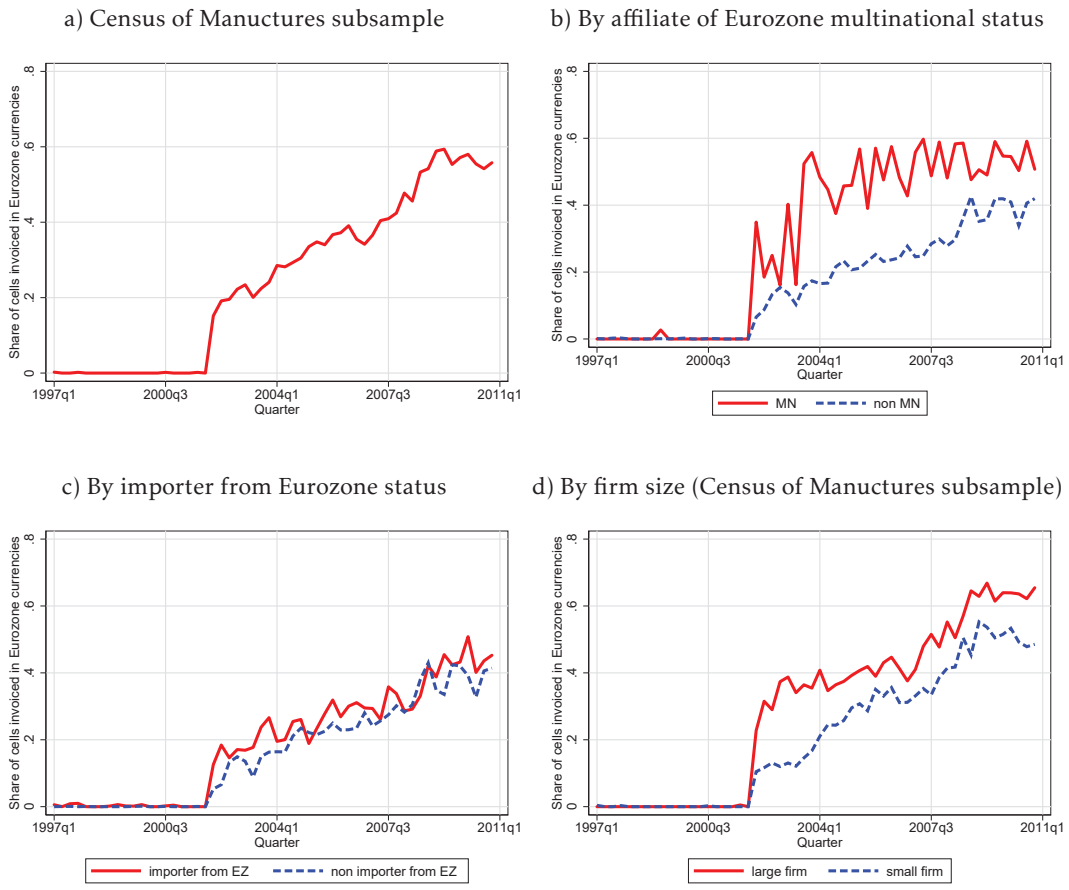
Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. Each panel consists of an HS2 sector, and we report data for the twelve largest sectors measured in terms of the number of firm–product (HS8)–destination–time (year–quarter) cells over 1997–2010.

Figure A.4: Probability of invoicing exports to the Eurozone in Eurozone currencies by sector removing firm × product × destination fixed effects.



Note: This figure shows the probability of invoicing Chilean exports to the Eurozone in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. We plot estimated coefficients on time dummies after removing firm × product × destination fixed effects as described in Appendix Section A.2.3. Each panel consists of an HS2 sector, and we report data for the twelve largest sectors measured in terms of the number of firm–product (HS8)–destination–time (year–quarter) cells over 1997–2010.

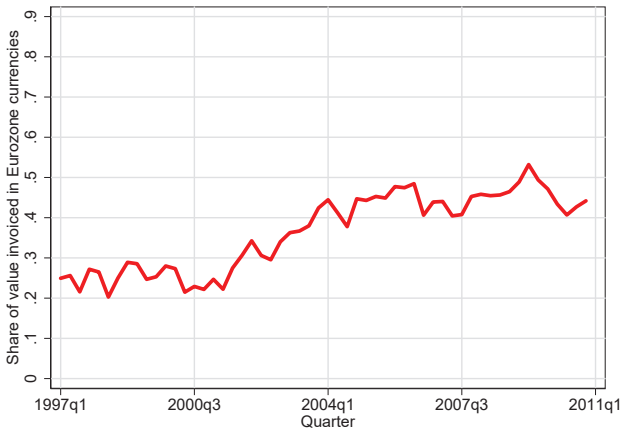
Figure A.5: Share of exports to the Eurozone invoiced in Eurozone currencies.



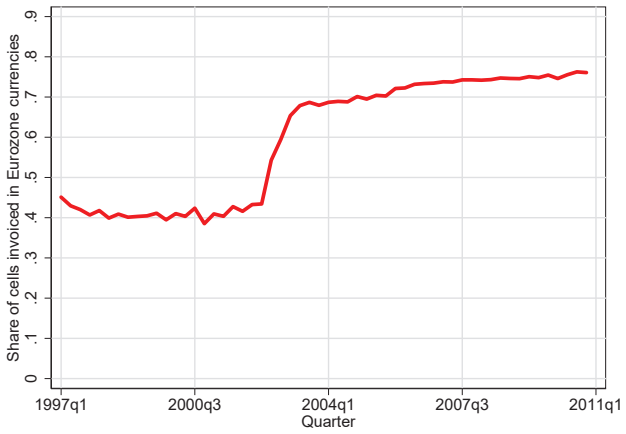
Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. Panel A is restricted to the Census of Manufactures sample. Panel B splits the sample between fims that are affiliates of Eurozone multinationals and the rest. Panel C splits the sample between firms that are importers from the Eurozone in the current period and the rest. Panel D is restricted to the Census of Manufactures sample and splits this sample between firms with above and below median size, measured in terms of revenue, using average revenue over 2002—2006 as in Section 4.

Figure A.6: Share of imports from the Eurozone invoiced in Eurozone currencies.

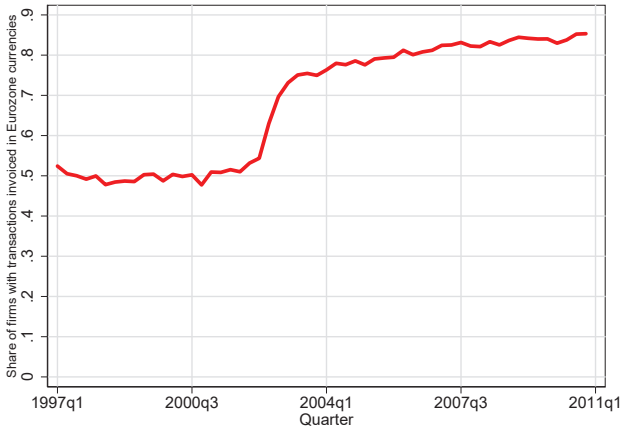
a) Share of value invoiced in Eurozone currencies



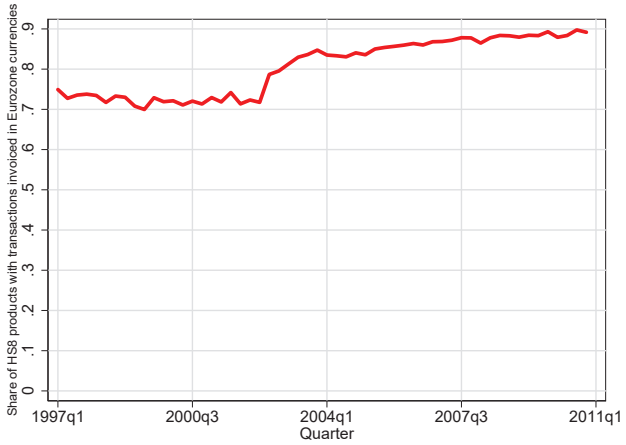
b) Unweighted share of firm-product-source country cells in Eurozone currencies



c) Share of firms with transactions in Eurozone currencies

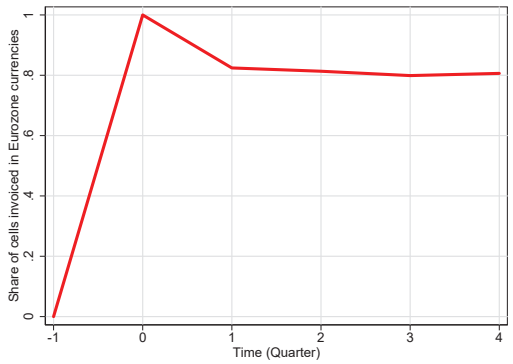


d) Share of HS8 products with transactions in Eurozone currencies



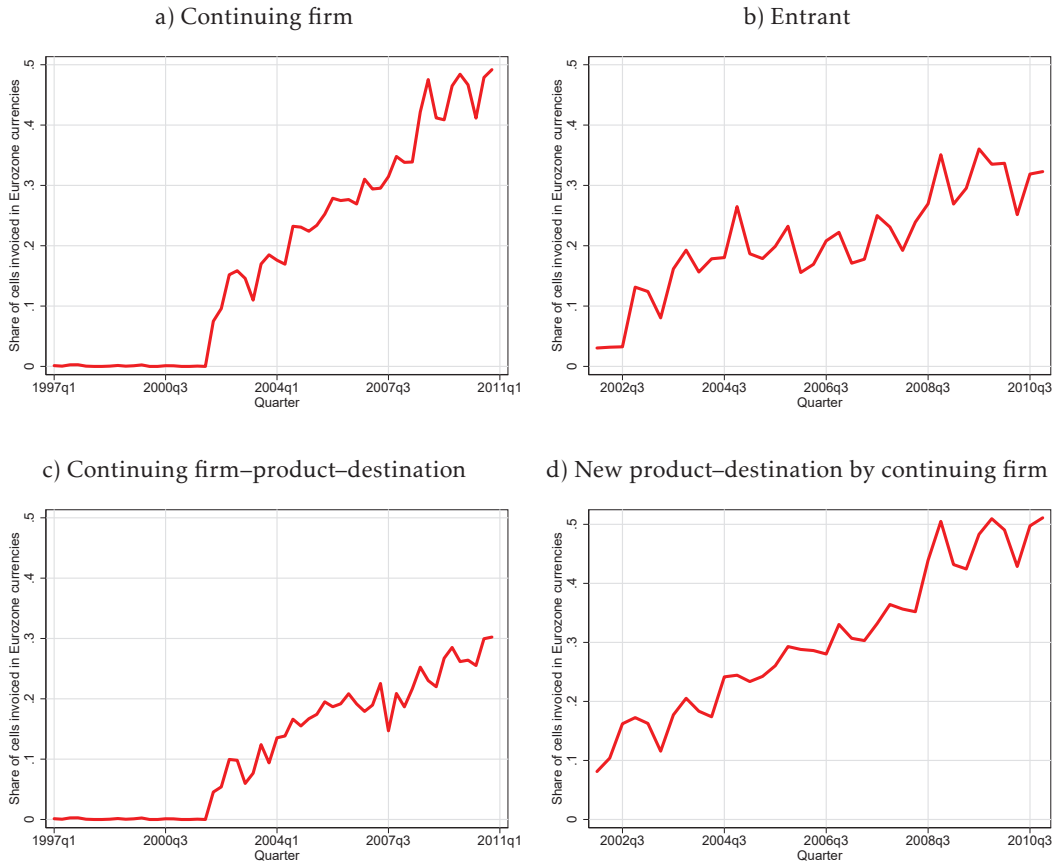
Note: This figure shows the share of Chilean imports from Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. Panels A and B report the share value and share of firm-HS8-source country cells invoiced in Eurozone currencies respectively. Panels C and D report the share of firms and HS8 products with at least one transaction invoiced in Eurozone currencies respectively.

Figure A.7: Persistence in the switch to euros.



Note: This figure describes the invoice currency in firm–product–destination cells that switch for the first time from US dollars to euros in their exports to the Eurozone four quarters after the switch. For each firm–product–destination cell, quarter 0 corresponds to the first quarter in which the invoice currency is the euro. We then compute the share of firm–product–destination cells invoicing in euros in each period.

Figure A.8: Share of exports to the Eurozone invoiced in Eurozone currencies: Entrants vs. continuing firms.

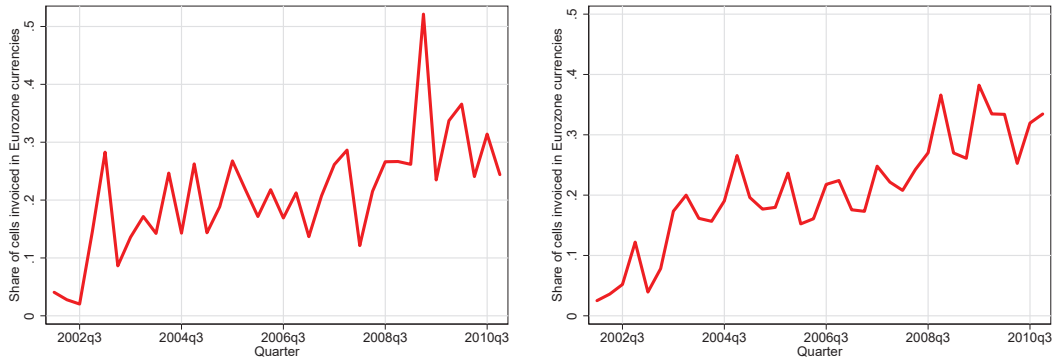


Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of continuing firms (firms with exports to the Eurozone before 2002). In panel B, the sample consists of entrants (firms without exports to the Eurozone before 2002). In panel C, the sample consists of continuing product-destination pairs by continuing firms (firms that were exporting the same product to the same Eurozone destination before 2002). In panel D, the sample consists of new product–destination pairs by continuing firms (firms with exports to the Eurozone before 2002, but without having exported the same product–destination combination).

Figure A.9: Share of exports to the Eurozone invoiced in Eurozone currencies among entrants to the Eurozone market

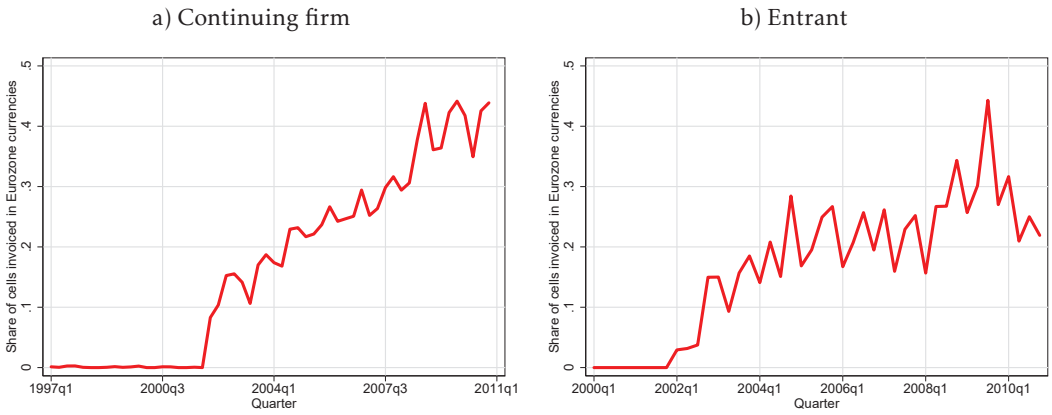
a) Entrant to the Eurozone market: not first–time exporter

b) Entrant to the Eurozone market: first–time exporter



Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. All panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of entrants to the Eurozone market (firms without exports to the Eurozone before 2002) that are not first–time exporters (that is, they export to the rest of the world before 2002). In panel B, the sample consists of entrants to the Eurozone market that are also first–time exporters (firms without exports to the Eurozone or the rest of the world before 2002).

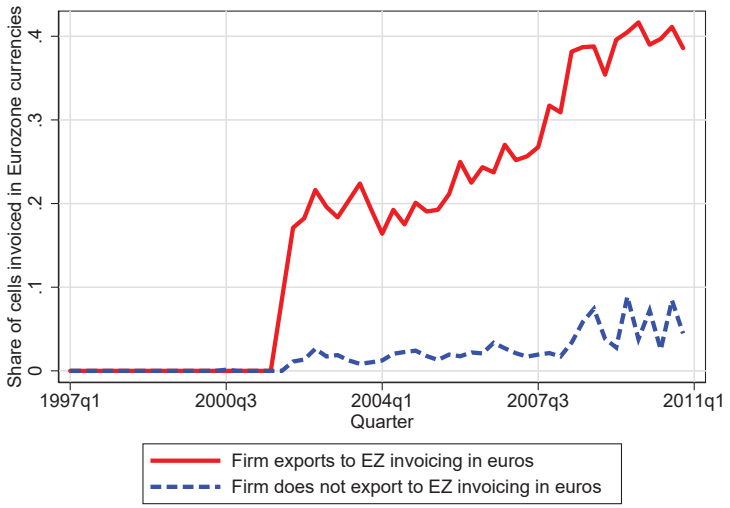
Figure A.10: Share of exports to the Eurozone invoiced in Eurozone currencies: Entrants vs. continuing firms (alternative definition).



Note: This figure shows the share of Chilean exports to Eurozone countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. Both panels report the share of firm-HS8-destination cells invoiced in Eurozone currencies. In panel A, the sample consists of continuing firms (firms with exports to the Eurozone within the previous three years). In panel B, the sample consists of entrants (firms without exports to the Eurozone within the previous three years).

A.2.2 Invoicing in euros in exports to European destinations outside the Eurozone: Spillovers.

Figure A.11: Invoicing in euros in exports to destinations outside the Eurozone.



Note: This figure shows the share of Chilean exports to non–Eurozone European countries invoiced in Eurozone currencies (i.e. euros or legacy currencies) by quarter between 1997 and 2010. The figure reports the share of firm-HS8-destination cells invoiced in Eurozone currencies. The red solid line corresponds to firms that export to the Eurozone and invoice at least some of their exports to the Eurozone in euros. The blue dashed line corresponds to firms that do not export to the Eurozone invoicing in euros (so they either do not export to the Eurozone, or they export to the Eurozone but do not invoice in euros).

■ We assess whether exporting firms invoicing in euros to the Eurozone are more likely to also use the euro in exports to non–Eurozone European destinations. For this purpose, we estimate the following regression on the sample of exports to non–Eurozone European destinations over 2002–2010. The dependent variable is a dummy equal to one for transactions invoiced in euros. The right hand side variable is a dummy EZ EURO EXPORTER equal to one firms firms that also export to the Eurozone invoicing at least some trade in euros in the current period. This implies that this dummy variable is zero if the firm does not export to the Eurozone, or if the firm exports to the Eurozone but does not invoice in euros at all. We include fixed effects by product (HS8) × destination and time (year–quarter).

$$\Pr(\text{EURO})_{fpct} = \beta_1 \cdot \text{EZ EURO EXPORTER}_{ft} + \gamma_{pc} + \delta_t + \epsilon_{fpct} \,. \tag{A.1}$$

The results are shown in Table A.2. Column 1 includes all non–Eurozone European destinations, while column 2 excludes countries joining the Eurozone in the last years of the sample (Cyprus, Malta, Slovakia, and Slovenia). The results indicate that firms that have exports to the Eurozone invoiced in euros are 17.6 log points (19.2%) more likely to invoice in euros to non–Eurozone European destinations. Note that an equivalent regression for countries outside Europe yields no statistically significant relationship.

Table A.2: Invoicing in euros in exports to European destinations outside the Eurozone. *Spillovers.*

	(1)	(2)
EZ EURO EXPORTER	0.176**	0.175**
	(0.042)	(0.043)
Product (HS8) × Destination F.E.	Yes	Yes
Time F.E.	Yes	Yes
Observations	93563	90461

Notes: This table reports the estimation of equation (A.1). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.3: Descriptive statistics: Share of exports by entrants.

	2002			2006			2010		
	ALL	US	EURO	ALL	USD	EURO	ALL	USD	EURO
Share of value by entrants	0.04	0.04	0.02	0.04	0.02	0.14	0.02	0.02	0.01
Share of transactions by entrants	0.12	0.13	0.07	0.08	0.09	0.07	0.06	0.08	0.04

Notes: This table reports the share of exported value or transactions in Chilean exports to the Eurozone accounted for by entrants. Entrants are defined as those which did not export to the Eurozone during the previous three years.

Table A.4: Descriptive statistics: Share of exports by exiting firms.

	2002			2006		
	ALL	US	EURO	ALL	USD	EURO
Share of value by exiting firms	0.04	0.04	0.01	0.01	0.01	0.02
Share of transactions by exiting firms	0.09	0.09	0.09	0.07	0.08	0.05

Notes: This table reports the share of exported value or transactions in Chilean exports to the Eurozone accounted for by exiting firms. Exiting firms are defined as those which do not export to the Eurozone during the next three years.

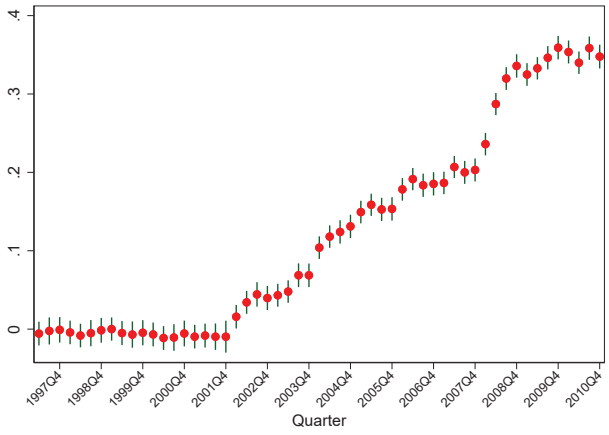
A.2.3 Trends in invoice currencies: removing firm × product × destination fixed effects

Here we show that the increasing popularity of the euro as an export invoicing currency was, to a large extent, a *within* firm-product-destination phenomenon. To this end, we estimate a regression of the probability of invoicing in euros on product × destination × firm fixed effects and year-quarter dummy variables. We plot the estimated coefficients on these year-quarter dummy variables to reflect the evolution of the within firm-product-destination probability of euro invoicing.

$$Pr(Euro)_{fpct} = \sum_{s=1997Q1}^{2010Q4} \beta_s \cdot 1[t = s] + \gamma_{fpc} + \epsilon_{fpct} \,. \tag{A.2}$$

The results are shown graphically in Figure A.12. We can see an increase in the probability of invoicing in euros over time of similar magnitude than that shown earlier in Figure 1.

Figure A.12: Within firm-product-destination probability of invoicing exports in Eurozone currencies.



Notes: This figure plots the estimated coefficients on time (year-quarter) dummies in equation (A.2).

A.2.4 Variance Decomposition

To get an initial sense of the importance of products and firms in accounting for invoicing choices, we report a simple variance decomposition. Specifically, we estimate regressions of the probability of invoicing in euros as a function of various sets of fixed effects introduced by turn, and report the R-squared statistic in each case. These results, computed separately for 2002 and 2010 are shown in Table A.5. They indicate that firms explain a much larger share of the variance than products or destinations. Focusing on the second column, corresponding to year 2010, product fixed effects account for 35% of the variance, destinations for 6% and firms for 76%.[77] Finally, introducing product × destination × firm fixed effects accounts for 96% of the variance. This pattern is quite similar for year 2002.

Table A.5: Probability of invoicing in euros: Variance decomposition.

	2002	2010
Product	0.23	0.35
Firm	0.66	0.76
Destination	0.04	0.06
Product × Firm × Destination	0.90	0.96

Notes: This table reports the R-squared statistic from linear regressions of the probability of invoicing a firm × product × destination × time (year–quarter) observation in euros on various sets of fixed effects in each row for years 2002 and 2010.

[77] Note that by construction these percentages are not intended to add up to 100%

A.2.5 Robustness checks and extensions to Table 1

■ Table A.6 reports the results of estimating equation (1) on a sample of firms that were already exporting to the Eurozone prior to 2002. Note that the coefficients are the same as those in Table 1 in the main text up to the fourth decimal.

■ Table A.7 reports the results of estimating equation (1) controlling for the level of the (log) exchange rate between the Chilean peso and the local (i.e. destination) currency.

■ Table A.8 reports the results of estimating equation (1) with alternative fixed effects.

■ Table A.9 reports the results of estimating equation (1) restricting the group of rest of the world countries to those with zero invoicing in euros.

Table A.6: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Continuing firms.*

	(1)	(2)
EZ × Post2002	0.146**	0.124**
	(0.022)	(0.014)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time (year–quarter) F.E.	No	Yes
Observations	1158878	1059833

Notes: This table reports the estimation of equation (1) among continuing firms. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.7: Probability of invoicing in local currency: Eurozone versus non–European destinations.
Controlling for the peso to local (i.e. destination) currency exchange rate.

	(1)	(2)
EZ × Post2002	0.147**	0.124**
	(0.022)	(0.014)
e^{LC}	0.000	0.001
	(0.004)	(0.002)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time F.E.	No	Yes
Observations	1261856	1139935

Notes: This table reports the estimation of equation (1) controlling for the (log) exchange rate between the Chilean peso and the local (i.e. destination) currency. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.8: Probability of invoicing in local currency: Eurozone versus non–European destinations.
Alternative fixed effects.

	(1)	(2)	(3)	(4)
EZ × Post2002	0.202**	0.197**	0.206**	0.200**
	(0.024)	(0.025)	(0.025)	(0.025)
Firm × product (HS6) × destination F.E.	Yes	Yes	No	No
Firm × product (HS4) × destination F.E.	No	No	Yes	Yes
Time F.E.	Yes	No	Yes	No
Product (HS6) × time F.E.	No	Yes	No	No
Product (HS4) × time F.E.	No	No	No	Yes
Firm × time F.E.	No	Yes	No	Yes
Observations	1480268	1412058	1480268	1412058

Notes: This table reports the estimation of equation (1) with alternative fixed effects. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.9: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Alternative set of rest of the world countries.*

	(1)	(2)
EZ × Post2002	0.154**	0.305**
	(0.025)	(0.070)
Firm × product (HS8) × destination F.E.	Yes	Yes
Time F.E.	Yes	No
Product (HS8) × time F.E.	No	Yes
Firm × time F.E.	No	Yes
Observations	193994	157653

Notes: This table reports the estimation of equation (1) restricting the set of rest of the world countries to those with zero invoicing in euros. Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

A.2.6 Robustness checks to Tables 2, 3 and 4

s ■ Tables A.10 and A.11 reproduce the results in Tables 2 and 3 dropping the small number of observations (less than 0.6%) that are not invoiced in euros nor dollars.

Table A.10: Probability of invoicing in euros: Product-level determinants.

	(1)	(2)	(3)
Destination EZ Import Share	0.063*	0.070**	0.070**
	(0.026)	(0.025)	(0.026)
Differentiated		0.059*	0.059*
		(0.029)	(0.029)
Destination F.E.	Yes	Yes	No
Time F.E.	Yes	Yes	No
Destination × time F.E.	No	No	Yes
Observations	147786	146532	146532

Notes: This table reports the estimation of equation (4). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered at the HS6 product level. ** and * indicate statistical significance at the 1% and 5% level.

Table A.11: Probability of invoicing in euros: Firm-level determinants.

	(1)	(2)	(3)	(4)	(5)	(6)
	Census of Manufactures Subsample				Full Sample	
	2002-2006	2002-2010	2002-2006	2002-2010	2002-2006	2002-2010
log Revenue	0.111**	0.110**	0.081*	0.083**		
	(0.023)	(0.015)	(0.036)	(0.026)		
EZ Export Share	0.082**	0.075**	0.052**	0.051**	0.049**	0.058**
	(0.021)	(0.011)	(0.015)	(0.012)	(0.012)	(0.011)
Euro-Invoiced Imports / Cost			0.154**	0.114**		
			(0.033)	(0.022)		
Dollar-Invoiced Imports / Cost			-0.114	-0.072		
			(0.086)	(0.057)		
EZ Multinational Affiliate					0.237**	0.174**
					(0.045)	(0.031)
log Total (World) Exports					0.061	0.080*
					(0.029)	(0.028)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11149	19597	11149	19597	59944	118338

Notes: This table reports the estimation of equation (5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Columns 1 through 4 refer to the Census of Manufactures subsample. Columns 5 and 6 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.12 shows the results of estimating equation (4) using an alternative measure of the Eurozone Import Share that varies by product and year but not by country. Specifically,the Eurozone import share is now defined as follows. For each HS6 product p and year y, we compute the share of imports M_{psy} of the entire Eurozone sourced from within the Eurozone (i.e. from Eurozone countries $s \in EZ$) out of imports from all countries s:

$$\text{Destination EZ Import Share}_{py} = \frac{\sum_{s \in EZ} M_{psy}}{\sum_{s} M_{psy}} . \tag{A.3}$$

Table A.12: Probability of invoicing in euros: Product-level determinants. *Alternative Eurozone Import Share measure*

	(1)	(2)	(3)
Destination EZ Import Share	0.063*	0.074**	0.074**
	(0.025)	(0.025)	(0.025)
Differentiated		0.075*	0.075*
		(0.026)	(0.025)
Destination F.E.	Yes	Yes	No
Time F.E.	Yes	Yes	No
Destination × time F.E.	No	No	Yes
Observations	149144	147876	147872

Notes: This table reports the estimation of equation (4). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. Standard errors are clustered by product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.13 reproduces the results in columns 4 and 6 in Table 3 using fixed effects by i) HS6 x destination x time (columns 1 and 2), ii) HS4 x destination x time (columns 3 and 4), iii) HS8, destination and time (columns 5 and 6), iv) HS6, destination and time (columns 7 and 8), and v) HS4, destination and time (columns 9 and 10).

■ Table A.14 reproduces the results in column 2 in Table 4 using fixed effects by i) HS6 x destination x time (column 1), ii) HS4 x destination x time (column 2), iii) HS8, destination and time (column 3), iv) HS6, destination and time (column 4), and v) HS4, destination and time (column 5).

Table A.13: Probability of invoicing in euros: Firm-level determinants. *Alternative fixed effects*.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log Revenue	0.087**		0.093**		0.080**		0.082**		0.090**	
	(0.027)		(0.024)		(0.022)		(0.021)		(0.025)	
EZ Export Share	0.046**	0.058**	0.053**	0.052**	0.049**	0.056**	0.053**	0.059**	0.058**	0.055**
	(0.012)	(0.011)	(0.015)	(0.012)	(0.011)	(0.010)	(0.010)	(0.009)	(0.012)	(0.010)
Euro-Invoiced Imports / Cost	0.118**		0.094*		0.130**		0.126**		0.093**	
	(0.021)		(0.038)		(0.030)		(0.029)		(0.027)	
Dollar-Invoiced Imports / Cost	-0.098		-0.062		-0.059		-0.057		-0.056*	
	(0.074)		(0.066)		(0.030)		(0.027)		(0.019)	
EZ Multinational Affiliate		0.176**		0.180**		0.130*		0.139*		0.150*
		(0.040)		(0.048)		(0.045)		(0.045)		(0.050)
log Total (World) Exports		0.080*		0.076*		0.069*		0.070*		0.065*
		(0.027)		(0.028)		(0.026)		(0.026)		(0.026)
Census of Mftg. Sample	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Full Sample	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Prod. (HS6) × Dest. × Time F.E.	Yes	Yes	No	No	No	No	No	No	No	No
Prod. (HS4) × Dest. × Time F.E.	No	No	Yes	Yes	No	No	No	No	No	No
Prod. (HS8) F.E.	No	No	No	No	Yes	Yes	No	No	No	No
Prod. (HS6) F.E.	No	No	No	No	No	No	Yes	Yes	No	No
Prod. (HS4) F.E.	No	No	No	No	No	No	No	No	Yes	Yes
Dest. F.E.	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24463	130371	27669	142538	33832	159424	34073	159814	34406	160357

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1, 3, 5, 7 and 9 refer to the Census of Manufactures subsample. Columns 2,4 ,6 ,8 and 10 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.14: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Alternative fixed effects.*

	(1)	(2)	(3)	(4)	(5)
Destination EZ Import Share × log Total (World) Exports	0.022*	0.018*	0.029*	0.031*	0.032*
	(0.008)	(0.007)	(0.010)	(0.010)	(0.010)
log Total (World) Exports	0.111**	0.112**	0.081*	0.081*	0.085*
	(0.033)	(0.030)	(0.027)	(0.027)	(0.028)
Euro-Invoiced Imports / Cost	0.123**	0.098*	0.136**	0.132**	0.097**
	(0.020)	(0.038)	(0.032)	(0.031)	(0.028)
Dollar-Invoiced Imports / Cost	-0.128	-0.088	-0.074	-0.072*	-0.070*
	(0.082)	(0.077)	(0.034)	(0.030)	(0.023)
Prod. (HS6) × Dest. × Time F.E.	Yes	No	No	No	No
Prod. (HS4) × Dest. × Time F.E.	No	Yes	No	No	No
Prod. (HS8) F.E.	No	No	Yes	No	No
Prod. (HS6) F.E.	No	No	No	Yes	No
Prod. (HS4) F.E.	No	No	No	No	Yes
Dest. F.E.	No	No	Yes	Yes	Yes
Time F.E.	No	No	Yes	Yes	Yes
Observations	23638	26396	31830	32033	32306

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Table A.15 reproduces the results in columns 4 and 6 in Table 3 using fixed effects by i) HS8 and time (columns 1 and 2), ii) HS6 and time (columns 3 and 4), and iii) HS4 and time (columns 5 and 6).

■ Table A.16 reproduces the results in column 2 in Table 4 using fixed effects by i) HS8 and time (column 1), ii) HS6 and time (column 2), and iii) HS4 and time (column 3).

Table A.15: Probability of invoicing in euros: Firm-level determinants. *Excluding destination fixed effects*.

	(1)	(2)	(3)	(4)	(5)	(6)
log Revenue	0.091**		0.092**		0.100**	
	(0.024)		(0.024)		(0.028)	
EZ Export Share	0.054**	0.056**	0.062**	0.059**	0.068**	0.056**
	(0.012)	(0.009)	(0.011)	(0.009)	(0.014)	(0.010)
Euro-Invoiced Imports / Cost	0.136**		0.133**		0.098**	
	(0.033)		(0.032)		(0.030)	
Dollar-Invoiced Imports / Cost	-0.060		-0.057		-0.056*	
	(0.032)		(0.029)		(0.021)	
EZ Multinational Affiliate		0.135*		0.145*		0.154*
		(0.046)		(0.047)		(0.052)
log Total (World) Exports		0.074*		0.075*		0.069*
		(0.029)		(0.029)		(0.029)
Census of Mftg. Sample	Yes	No	Yes	No	Yes	No
Full Sample	No	Yes	No	Yes	No	Yes
Prod. (HS8) F.E.	Yes	Yes	No	No	No	No
Prod. (HS6) F.E.	No	No	Yes	Yes	No	No
Prod. (HS4) F.E.	No	No	No	No	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33832	159424	34073	159814	34406	160357

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1, 3 and 5 refer to the Census of Manufactures subsample. Columns 2, 4 and 6 refer to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.16: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Excluding destination fixed effects.*

	(1)	(2)	(3)
Destination EZ Import Share × log Total (World) Exports	0.026**	0.029**	0.032**
	(0.007)	(0.007)	(0.006)
log Total (World) Exports	0.087*	0.084*	0.088*
	(0.029)	(0.028)	(0.029)
Euro-Invoiced Imports / Cost	0.146**	0.142**	0.104**
	(0.036)	(0.036)	(0.032)
Dollar-Invoiced Imports / Cost	-0.075	-0.072*	-0.071*
	(0.036)	(0.032)	(0.024)
Prod. (HS8) F.E.	Yes	No	No
Prod. (HS6) F.E.	No	Yes	No
Prod. (HS4) F.E.	No	No	Yes
Time F.E.	Yes	Yes	Yes
Observations	31830	32033	32306

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Tables A.17 and A.18 reproduce the results in Tables 3 and 4 using fixed effects by the industry reported in the Census of Manufactures.

Table A.17: Probability of invoicing in euros: Firm-level determinants. *Including Census industry fixed effects*

	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
log Revenue	0.120**	0.117**	0.097	0.094*
	(0.020)	(0.013)	(0.049)	(0.034)
EZ Export Share	0.083**	0.071**	0.045**	0.044**
	(0.018)	(0.010)	(0.011)	(0.014)
Euro-Invoiced Imports / Cost			0.177**	0.128**
			(0.024)	(0.015)
Dollar-Invoiced Imports / Cost			-0.171	-0.106
			(0.102)	(0.069)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Census Industry F.E.	Yes	Yes	Yes	Yes
Observations	11291	20020	11291	20020

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.18: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Including Census industry fixed effects*

	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
Destination EZ Import Share × log Total (World) Exports	0.046**	0.034**		
	(0.009)	(0.008)		
Destination EZ Import Share × log Revenue			0.026*	0.019*
			(0.008)	(0.007)
log Total (World) Exports	0.133*	0.134*		
	(0.055)	(0.048)		
log Revenue			0.083	0.086
			(0.050)	(0.043)
Euro-Invoiced Imports / Cost	0.185**	0.135**	0.191**	0.140**
	(0.025)	(0.014)	(0.023)	(0.013)
Dollar-Invoiced Imports / Cost	-0.182	-0.131	-0.173	-0.125
	(0.105)	(0.074)	(0.097)	(0.071)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Census Industry F.E.	Yes	Yes	Yes	Yes
Observations	11155	19193	11155	19193

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

■ Tables A.19 and A.20 reproduce the results in columns 1, 3 and 5 in Tables 3 and columns 1 and 3 in Table 4 restricting the sample to firms that export in all years.

Table A.19: Probability of invoicing in euros: Firm-level determinants. *Permanent exporters.*

	(1)	(2)	(3)
log Revenue	0.118**	0.101*	
	(0.018)	(0.046)	
EZ Export Share	0.083**	0.048**	0.041**
	(0.016)	(0.011)	(0.009)
Euro-Invoiced Imports / Cost		0.174**	
		(0.027)	
Dollars-Invoiced Imports / Cost		-0.145	
		(0.093)	
EZ Multinational Affiliate			0.241**
			(0.031)
log Total (World) Exports			0.060
			(0.029)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes
Observations	10274	10274	43013

Notes: This table reports the estimation of equation (5). Each observation is a firm-product-destination-time (year–quarter) combination. Columns 1 and 2 refer to the Census of Manufactures subsample. Column 3 refers to the full sample. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.20: Probability of invoicing in euros: Interaction between destination intra–Eurozone import share and firm size. *Permanent exporters.*

	(1)	(2)
Destination EZ Import Share × log Total (World) Exports	0.029*	
	(0.010)	
Destination EZ Import Share × log Revenue		0.027*
		(0.012)
log Total (World) Exports	0.130*	
	(0.046)	
log Revenue		0.083
		(0.047)
Euro-Invoiced Imports / Cost	0.176**	0.184**
	(0.029)	(0.026)
Dollar-Invoiced Imports / Cost	-0.157	-0.151
	(0.098)	(0.095)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes
Observations	10373	10176

Notes: This table reports the estimation of equation (6). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

Table A.21: Probability of invoicing in euros: Firm-level determinants. *Entrants vs. continuing firms*

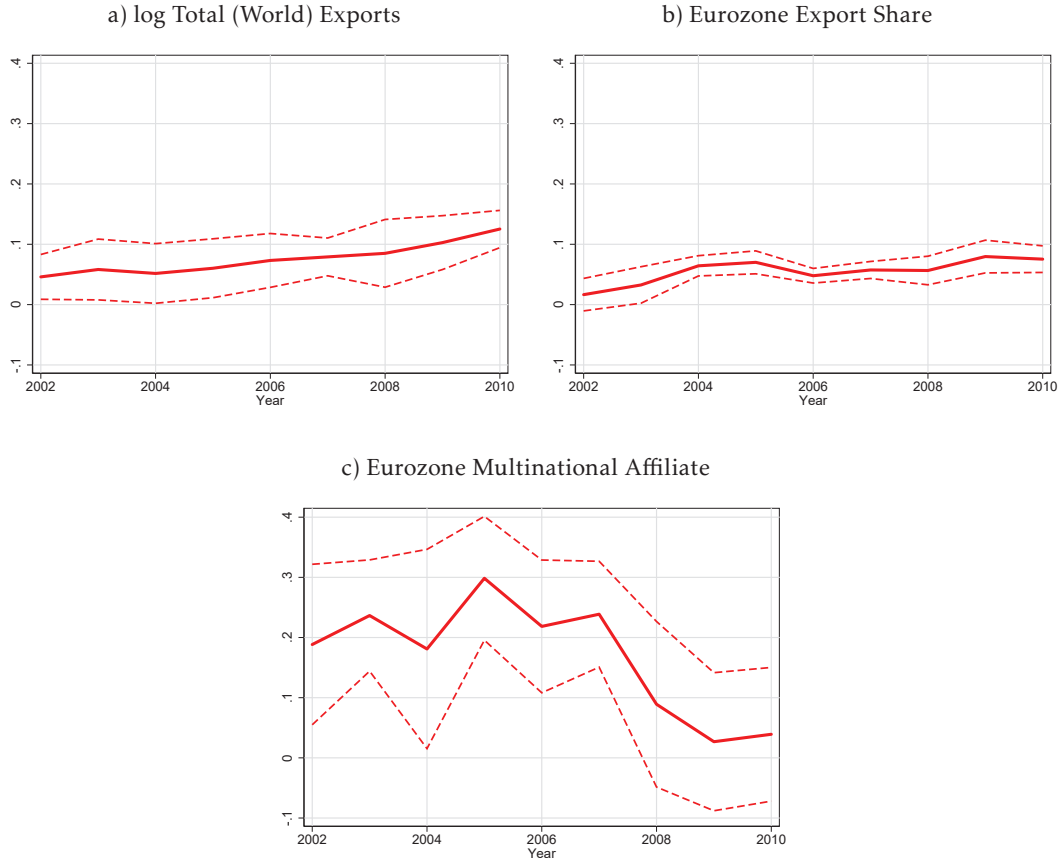
	(1) 2002-2006	(2) 2002-2010	(3) 2002-2006	(4) 2002-2010
log Revenue	0.113**	0.113**	0.086*	0.087**
	(0.023)	(0.015)	(0.036)	(0.024)
EZ Export Share	0.080**	0.068**	0.051**	0.045**
	(0.021)	(0.010)	(0.014)	(0.013)
Euro-Invoiced Imports / Cost			0.149**	0.110**
			(0.031)	(0.021)
Dollar-Invoiced Imports / Cost			-0.110	-0.068
			(0.083)	(0.054)
Entrant to EZ market (not first–time exporter)	-0.039	-0.061	0.006	-0.040
	(0.030)	(0.042)	(0.035)	(0.039)
Entrant to EZ market (first–time exporter)	0.129**	0.294**	0.090**	0.265**
	(0.028)	(0.082)	(0.024)	(0.080)
Prod. (HS8) × Dest. × Time F.E.	Yes	Yes	Yes	Yes
Observations	11321	20044	11321	20044

Notes: This table reports the estimation of equation (5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The sample is restricted to the Census of Manufactures subsample in all columns. All continuous variables are standardized to have mean zero and standard deviation one. Standard errors are clustered by firm, product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

A.2.7 Determinants of the adoption of the euro: Dynamics

As described under the heading "Adoption Dynamics" in Section 4.2, the following two figures report the results of estimating equation (5) modified to include the interaction of each firm–level determinant with a set of year dummies. Appendix Figure A.13 corresponds to the full sample and Appendix Figure A.14 corresponds to the Census of Manufactures subsample.

Figure A.13: Probability of invoicing in euros: Firm-level determinants. *Dynamics; Full sample.*



Note: This solid lines in each panel correspond to the estimated coefficients from an augmented version of equation (5), in which firm–level determinants are interacted with year dummy variables. As in equation (5), we include product (HS8) × destination × time (year–quarter) fixed effects and cluster standard errors by firm, product (HS6) destination and time using multiway clustering. The dotted lines correspond to 95% confidence intervals.

Figure A.14: Probability of invoicing in euros: Firm-level determinants. *Dynamics; Census of Manufactures subsample.*

Note: This solid lines in each panel correspond to the estimated coefficients from an augmented version of equation (5), in which firm–level determinants are interacted with year dummy variables. As in equation (5), we include product (HS8) × destination × time (year–quarter) fixed effects and cluster standard errors by firm, product (HS6) destination and time using multiway clustering. The dotted lines correspond to 95% confidence intervals.

A.2.8 Summary statistics for regressions in Tables 2, 3 and 4

Table A.22: Summary statistics for invoicing regressions.

	Mean	St. Dev.	10th pct.	50th pct.	90th pct.
Column 3 in Table 2:					
Dep. var: 1[Euro]	0.28	0.45	0.00	0.00	1.00
Destination EZ Import Share	0.35	0.22	0.07	0.31	0.71
Differentiated	0.19	0.39	0.00	0.00	1.00
Column 3 in Table 3:					
Dep. var: 1[Euro]	0.34	0.47	0.00	0.00	1.00
log Revenue	16.62	1.25	15.10	16.58	18.23
EZ Export Share	0.30	0.24	0.08	0.24	0.62
Euro-invoiced imports over Cost	0.02	0.04	0.00	0.00	0.11
Dollar-invoiced imports over Cost	0.02	0.05	0.00	0.00	0.06
Column 5 in Table 3:					
Dep. var: 1[Euro]	0.20	0.40	0.00	0.00	1.00
EZ Multinational Affiliate	0.02	0.14	0.00	0.00	0.00
EZ Export Share	0.40	0.30	0.08	0.30	1.00
log Total (World) Exports	14.03	2.03	11.39	14.19	16.56

Notes: This table reports summary statistics for the invoicing regressions in Section 4.

A.2.9 Product–level determinants: Invoicing in local currency in exports to the Eurozone versus the rest of the world

The results for regression (1) in Section 4.1 show that the probability of invoicing in local (i.e. destination) currency is higher in exports to the Eurozone relative to the rest of the world after the euro is introduced. In addition, the results for regression (4) in Section 4.2 show that the probability of invoicing in euros in exports to the Eurozone is higher in industries facing a higher Eurozone import share (i.e. more competition from within the Eurozone) and among differentiated industries. Here, we augment regression (4), showing that the growth in invoicing in local currency in exports to the Eurozone relative to the rest of the world after 2002 is higher among industries facing a higher Eurozone import share (i.e. more competition from within the Eurozone) and among differentiated industries.

To this end, we estimate equation (A.5), in which the first regressor of interest is the triple interaction between the dummy variable EZ_c, equal to one for exports to Eurozone destinations; the dummy variable Post2002_t, equal to one for periods during and after 2002; and the destination's Eurozone import share. While in the main text the Eurozone import share measure varied across industries and destinations, here we construct an alternative measure that varies only by industry, such that it can be assigned to exports to any destination and is constant across destinations.[78] The second regressor of interest is the triple interaction between EZ_c, Post2002_t, and a dummy variable for differentiated industries. The regression includes both country × time (year–quarter) and product × time fixed effects. In addition, standard errors are clustered by HS6 product, destination and time (year–quarter) using multiway clustering.

$$\begin{aligned}\Pr(\text{LC})_{fpct} = {} & \beta_1 \cdot \text{EZ}_c \cdot \text{Post2002}_t \cdot \text{EZ Import Share}_{py} + \beta_2 \cdot \text{EZ}_c \cdot \text{Post2002}_t \cdot \text{Differentiated}_p \\ & + \beta_3 \cdot \text{EZ}_c \cdot \text{EZ Import Share}_{py} + \beta_4 \cdot \text{EZ}_c \cdot \text{Differentiated}_p + \gamma_{ct} + \nu_{pt} + \epsilon_{fpct} \,. \end{aligned} \tag{A.5}$$

The results are shown in Appendix Table A.23, and indicate that there is an increase in invoicing in local currency in exports to the Eurozone that is stronger in industries facing stronger competition from within the Eurozone. To interpret the magnitude of these coefficients, recall first that in Table 1 we had found a 14.6 log point increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

In Appendix Table A.23, we find that comparing the 75th and 25th percentiles of the Eurozone

[78] Specifically,the Eurozone import share is now defined as follows. For each HS6 product p and year y, we compute the share of imports M_{psy} of the entire Eurozone sourced from within the Eurozone (i.e. from Eurozone countries $s \in EZ$) out of imports from all countries s:

$$\text{Destination EZ Import Share}_{py} = \frac{\sum_{s \in EZ} M_{psy}}{\sum_s M_{psy}} \,. \tag{A.4}$$

import share variable, the former has a 13.6 larger log point increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

In addition, comparing differentiated and nondifferentiated industries, the former have a 8.4 log point larger increase in invoicing in local currency in the Eurozone relative to the rest of the world between 1997–2001 and 2002–2010.

Furthermore, we can replace Post2002_t by a set of time (year–quarter) dummy variables. Focusing on the Eurozone import share, we estimate:[79]

$$\Pr(\text{LC})_{fpct} = \sum_{s=1997Q1}^{2010Q4} \beta_{1,s} \cdot \text{EZ}_c \cdot \text{EZ Import Share}_{py} \cdot 1[t = s] + \gamma_{ct} + \nu_{pt} + \epsilon_{fpct} \,. \tag{A.6}$$

The results are shown graphically in Appendix Figure A.15 and corroborate the previous findings.

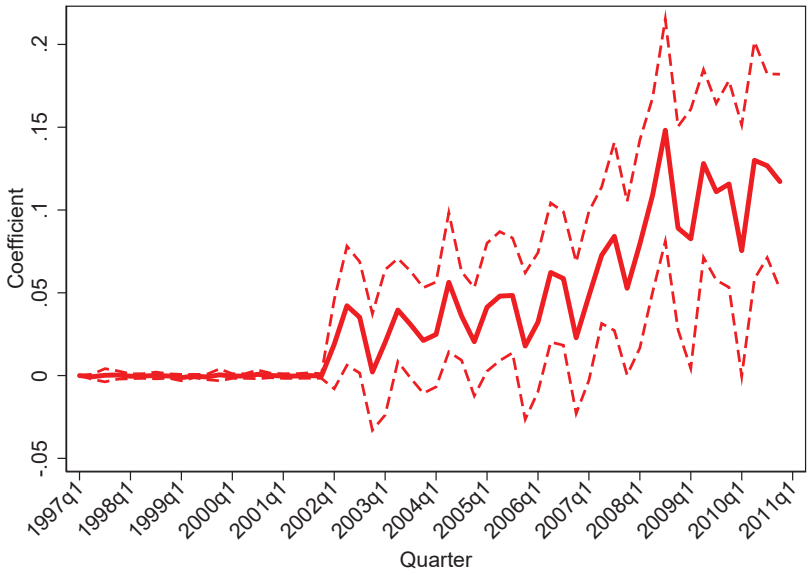
Table A.23: Probability of invoicing in euros: Product-level determinants. *Triple interaction.*

	(1)	(2)
EZ × Post2002 × Destination EZ Import Share	0.063**	0.076**
	(0.024)	(0.024)
EZ × Post2002 × Differentiated		0.085*
		(0.034)
Destination × Time F.E.	Yes	Yes
Product (HS8) × Time F.E.	Yes	Yes
Observations	1406534	1406534

Notes: This table reports the estimation of equation (A.5). Each observation is a firm–product (HS8)–destination–time (year–quarter) combination. The terms EZ × Destination EZ Import Share and EZ × Differentiated are included in the regression but the coefficients are not reported. Standard errors are clustered by product (HS6), destination and time (year–quarter) using multiway clustering. ** and * indicate statistical significance at the 1% and 5% level.

[79] Note that this regression also includes the double interaction between EZ_c and EZ import share_{py}, not shown for conciseness.

Figure A.15: Probability of invoicing in local currency: Eurozone versus non–European destinations. *Triple interaction.*



Note: This figure plots the estimated coefficients from equation (A.6) and 95% confidence intervals with standard errors clustered by destination and time (year–quarter) using multiway clustering.

A.3 Appendix to Section 5: The effect of the euro on exchange rate pass–through

Table A.24: Summary Statistics for exchange rate pass–through regressions.

	Mean	St. Dev.	10th pct.	50th pct.	90th pct.
Dep. var: Δp_{fpct}	0.00	0.27	-0.23	0.00	0.23
Δe^{USD}	-0.00	0.06	-0.06	-0.00	0.07
Δe^{EUR}	0.00	0.05	-0.06	0.00	0.05
1[USD]	0.73	0.45	0.00	1.00	1.00
1[EURO]	0.27	0.45	0.00	0.00	1.00
1[Post2002]	0.81	0.39	0.00	1.00	1.00

Notes: This table reports summary statistics for the exchange rate pass–through regressions in Section 5.

Table A.25: Exchange rate pass–through: Heterogeneity within the *post* period.

	(1)	(2)
Δe^{USD}	0.824***	1.027***
	(0.285)	(0.213)
1[2002-2006] $\times \Delta e^{USD}$	-0.122	-0.264
	(0.295)	(0.246)
1[2007-2010] $\times \Delta e^{USD}$	-0.292	-0.560**
	(0.290)	(0.224)
Δe^{EUR}	0.044	-0.019
	(0.071)	(0.076)
1[2002-2006] $\times \Delta e^{EUR}$	0.222**	0.308*
	(0.106)	(0.164)
1[2007-2010] $\times \Delta e^{EUR}$	0.458***	0.675***
	(0.114)	(0.128)
Firm × Prod. × Dest. F.E.	Yes	Yes
Year F.E.	No	Yes
Quarter F.E.	Yes	Yes
Observations	79323	79323

Notes: This table reports the results of the estimation of equation (10), replacing the Post2002$_t$ variable into two categorical variables marking the periods 2002–2006 and 2006–2010. All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.

Table A.26: Exchange rate pass–through: Permanent exporters.

	(1)	(2)
Δe^{USD}	0.764*	0.958**
	(0.348)	(0.349)
Post2002 × Δe^{USD}	-0.267	-0.435
	(0.350)	(0.355)
Δe^{EUR}	-0.115	-0.106
	(0.101)	(0.108)
Post2002 × Δe^{EUR}	0.728**	0.712**
	(0.168)	(0.174)
Firm × Prod. × Dest. F.E.	Yes	Yes
Year F.E.	Yes	Yes
Quarter F.E.	Yes	Yes
Observations	35052	38613

Notes: This table reports the results of the estimation of equation (10). The sample is restricted to firms that export in all years (column 1) or firms that export at least in the initial (1997) and final (2010) years (column 2). All columns control for changes in exporting and importing country price levels. Standard errors are clustered by time (year–quarter). ** and * indicate statistical significance at the 1% and 5% level.