Great Financial Crisis and Dollar Dominance

Enrico Cristoforoni* Boston College

Marco Errico Bank of Italy

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First Draft: March 2024

Abstract

This paper studies how large global shocks can undermine the dominance of the US dollar in the international monetary system. We show that following the Great Financial Crisis and the temporary increase in the cost of US dollar financing, the share of total Chilean imports denominated in US dollars steadily decreased by almost 10%, while the share denominated in Chilean pesos increased by 7% by the end of 2019. Using the Chilean universe of international transactions from 2004 to 2019, we study the firm-level determinants of these aggregate patterns. We show that: i) the bulk of changes in aggregate invoicing shares is due to firms switching from US dollar to Chilean Peso, rather than reallocation between firms or firm entry; ii) the first importers to switch to Chilean Peso invoicing are large firms with wider US Dollar currency mismatches, suggesting that both natural hedging and strategic complementarities are relevant in shaping invoicing choices. We rationalize these findings with a currency choice model of an economy populated by importing firms that choose the currency of denomination for their trade credit for imported inputs, considering natural hedging and strategic complementarities motives. We show that the introduction of sunk cost of currency management generates hysteresis in invoicing choices, leading to permanent changes in the aggregate invoicing share following a temporary shock in the cost of trade credit as in the data. Lastly, we test the key theoretical mechanisms and study the implications of large changes in invoicing patterns for the whole macroeconomy.

JEL Codes: F14, F31, F33, F41.

Keywords: Exchange rate, invoicing currency, vehicle currency, dollar dominance, dominant currency, trade finance, working capital, firm-level trade.

*Enrico Cristoforoni: cristofe@bc.edu; Marco Errico: marco.errico@esterni.bancaditalia.it. We thank Rosen Valchev, Jaromir Nosal, Stefania Garetto, Gustavo Joaquim, Susanto Basu, Luigi Pollio, Stefano Federico, Daniele Siena, Massimo Ferrari Minesso, Riccardo Masolo, and the audience at the Boston College Workshop, the Bank of Italy, the 1st PhD Workshop Imperial College, the 2024 NASM Econometric Society, Cattolica University, ECB, and the JIE Summer School for their comments and suggestions. The views expressed here do not necessarily reflect those of the Bank of Italy or the Euro-System.

1 Introduction

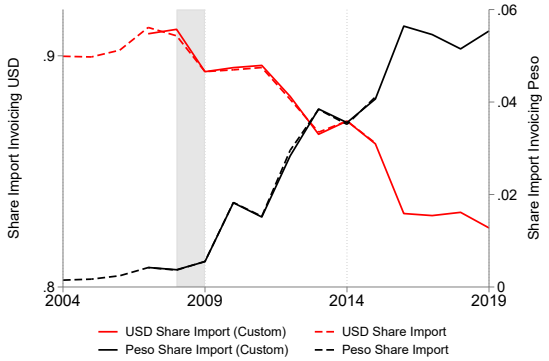
The global economy is characterized by the presence of a dominant currency, the US dollar, that is used to invoice the majority of international trade transactions, safe assets and international debt, and central banks' international reserves (Gopinath, 2015; Gopinath and Stein, 2021). Prior literature has expressed great interest to the implications of such dominance for several macroeconomics facts, including aggregate exchange rate pass-through, shocks transmissions and spillovers across countries, and the dynamics of external adjustment (Gourinchas et al., 2019; Adler et al., 2020). However, comparatively little attention has been devoted to understanding the forces and shocks that can undermine the widespread use of the US dollar and push the global economy out of dollar dominance.

This paper studies how large temporary aggregate shocks to dollar financing have long-lasting effects on invoicing decisions of international trade transactions. The majority of international trade transactions require external financing, usually heavily dollarized and locally sourced via domestic banks (Bruno and Shin, 2019; Niepmann and Schmidt-Eisenlohr, 2017). Using granular transaction-level data, our study provides a unique setting to examine how the temporary scarcity of dollar financing in periods of distress such as the Great Financial Crisis (henceforth GFC) permanently impact firms' invoicing decisions, and not only trade flows (Amiti and Weinstein, 2011; Ahn et al., 2011).

This paper is motivated by the unique episode of aggregate shift in import invoicing patterns in Chile after the GFC. Using Chilean import transactions from 2004 to 2019, we show that the share of imports denominated in US dollar has declined by 10 p.p. starting after the Great Financial Crisis, without recovering afterwards. Figure 1 shows that, at the onset of the GFC, the share of Chilean imports invoiced in US dollar was around 90%. By the end of 2019, the share declined to approximately 80%. Simultaneously, the use of Chilean peso, virtually nonexistent before 2008, accounts for almost 7% of total imports by the end of 2019. Importantly, we do not find similar patterns on the export side, with the US dollar being steadily used to invoice around 95% of exported value. These patterns together suggest that, during an episode of severe scarcity of dollar financing such as the GFC, firms have substituted away the dominant currency, the US dollar, with an alternative currency (namely the Chilean Peso) to meet their international trade financing needs, i.e. imported goods.

We dissect the dynamics of the aggregate invoicing shares, and show that the bulk of the aggregate dynamics is driving by within-firm invoicing choices. We leverage the granular

Figure 1: Aggregate Invoicing Shares for Imports - Chile



Note: Figure 3 shows the time series of the aggregate share of imports denominated in US Dollar and Chilean Peso for Chile between 2004-2019. The left vertical axis of Figure 3 reports the share of Chilean imports denominated in US dollar. The right axis shows the share of Chilean imports denominated in Chilean Peso. Data from 2007 for imports are from Chilean Customs Agency. Data before 2007 are from Garcia-Marin et al. (2019). The grey shaded area represents the NBER recession period.

nature of our data, and perform a dynamic Olley-Pakes decomposition with entry and exit (Melitz and Polanec, 2015) to understand which firms drive the change we observe at the aggregate level. We find that more than 80% of the aggregate change in the share of imports invoiced in US dollar is driven by incumbents firms, leaving only a residual role to potentially different invoicing decisions of entrant and exiting firms. Additionally, within incumbent firms, most of the aggregate dynamics is driven by within-firm forces rather than between-firms. In other words, the relevant force is that firms are now invoicing the same product from the same origin country in a different currency, rather than the market share of firms invoicing in US dollar decreased. This suggests that, during the GFC, firms actively switched away from dominant currency invoicing to an alternative currency, almost exclusively the Chilean peso.

We investigate further to understand whether there exists selection in the decision to first switch away from dollar invoicing and the forces that fueled the switching in invoicing over the decade after the GFC. We correlate firm characteristics with the firm's decision to be among the first importers to abandon the US dollar to invoice import transactions. We present evidence of selection along two main margins: firms that substitute away from dollar invoicing first are i) more operationally unhedged in US dollar and ii) bigger. The former suggests that the higher cost of financing firms face during a period of dollar financing scarcity, such as the GFC, is particularly relevant for those firms with relatively more negative cash flow denominated in US dollar. This is especially important for large firms that are

exclusively importers or that do not export as much as they import in US dollar, as they might have larger financial needs. Moreover, the fact more firms switch away from dollar invoicing over time and that the size of these new switchers decreases over time points to the presence of strategic complementarities among firms in invoicing decisions. Smaller firms' invoicing decisions gradually adjust following their competitors' currency choices, even after the end of GFC and the scarcity of dollar financing (Amiti et al., 2022,0).

Next, we develop a theoretical framework to rationalize the empirical findings on the invoicing choice dynamics focusing on the invoicing of firms' liabilities. A small open economy is populated by importing firms that choose the currency of denomination of their trade credit for imported inputs, in the presence of natural hedging and strategic complementarities motives. We treat imported inputs as working capital that requires financing in advance (Bahaj and Reis, 2020). The trade credit and import invoicing decision depend on the relative interest rate on trade credit denominated in domestic and vehicle currency. Asymmetric shocks to the financing costs in different currencies, such as the Great Financial Crisis, make trade credit in a particular currency more attractive, ultimately influencing invoicing patterns.

A key and novel element of the model is the introduction of a sunk cost associated with the use of new currency for import invoicing. The presence of a sunk cost generates the same type of hysteresis in invoicing choices that we observe in the data. Firms pay a sunk cost upon invoicing in a new currency, permanently lowering the fixed cost associated with the management of invoicing currency. This permanently alters the relative convenience of invoicing imports and trade credit in different currency, even in presence of temporary shocks. The mechanism allows to rationalize how a temporary shock to the financing costs in different currencies, such as the Great Financial Crisis, produces long-lasting effects in invoicing choices.

The theory further predicts that the threshold to use domestic or vehicle currency financing to finance imported inputs depends on strategic complementarities among importers and the firm's natural hedging. Strategic complementarity captures the idea that individual usage increases in the overall utilization. We introduce this mechanism by assuming that the firm-level fixed cost associated with the management of invoicing currencies decreases in the number of users of that currency. Natural hedging refers to the costly mismatch between costs and revenues due to exchange rate fluctuations that arises when imported inputs are invoiced in a currency different from the domestic. Trade credit denominated in vehicle currency is less appealing than trade credit denominated in domestic currency when firms

rely more on imported inputs as they become more exposed to exchange rate fluctuations.

We test the key mechanisms and assumptions of our theoretical framework and provide strong empirical support for its predictions. Using both an event study design and cross-sectional analysis, we show that those firms that are more exposed to US Dollar financing are more likely to substitute away from US Dollar invoicing and switch to the Chilean Peso. We also show that the differential between dollar-invoiced and peso-invoiced financing is a determinant of firms' dollar invoicing, and its effect is amplified by firms' exposed to US Dollar and by complementarities. We then provide evidence in support of the presence of sunk cost in invoicing choices, a key assumption of our model to generate the kind of hysteresis we observe in the data.

Lastly, we study the macroeconomic implications of the decline in the aggregate share of dollar invoiced imports in terms of transmission of exchange rate fluctuations to domestic prices, dynamics of the terms of trade and the trade balance, and, ultimately, macroeconomic policy. In line with previous literature, invoicing is a key determinant of the degree of exchange rate pass-through rates, with the pass-through being higher (lower) when transactions are invoiced in dominant (local) currency (Gopinath et al., 2010; Barbiero, 2021; Amiti et al., 2022). As a consequence, in 2019, the sensitivity of import inflation to exchange rate fluctuations decreased by 5% compared to 2007, while the sensitivity of trade balance and terms of trade has decreased by approximately 30%.

Although we know from history that abrupt shifts in the international monetary system can occur following permanent shifts in economic conditions, our analysis showcases how temporary large shocks to dollar financing availability, such as the Great Financial Crisis, weakens dollar dominance by influencing the individual and aggregate invoicing decisions, with key implications for macroeconomic policy.

Related Literature This paper is closely related to several strands of literature on dominant international currencies. Most models of currency dominance have in common the fact that they either define under which conditions a currency becomes dominant or they define under which conditions a currency remains dominant. Examples in this line of work are Eichengreen et al. (2018), Chahrour and Valchev (2022), Farhi and Maggiori (2018), and Gopinath and Stein (2021).[1] Fewer papers instead focus on forces and shocks that can perturb the current dollar dominant equilibrium. Chahrour and Valchev (2023) and

[1]Other recent contributions such as Gopinath et al. (2020) and Mukhin (2022) focus on understanding the consequences that the US dollar dominance has on international trade dynamics, and the global economy in general. Refer to Gourinchas et al. (2019) for a survey.

Corsetti et al. (2022) share the same perspective in analyzing how geo-political fragmentation and Brexit, respectively, affect the current dominant currency equilibrium. Bahaj and Reis (2020) and Bahaj and Reis (2022) focus on currency competition in the central banks' swap line market as a channel through which the People's Bank of China jump-started the international use of the RMB, challenging the dominant role of the dollar. Our paper complements this literature concerned with discontinuities in the international monetary system as we shed light on how large macroeconomic events such as the Great Financial Crisis might impair the dominance of a single currency and the mechanism that could lead to the rise of another competitive currency.[2]

Our theoretical framework emphasizes the role of trade finance. International trade transactions require external financing, usually heavily dollarized and locally sourced via domestic banks (Niepmann and Schmidt-Eisenlohr, 2017). The forces giving rise to currency dominance in trade and finance are closely related. The availability of supply of safe and liquid short-term government-backed liabilities generates invoicing dominance as in Coppola et al. (2023) and Eren and Malamud (2022). Similarly, Chahrour and Valchev (2023) dominance arises from the need for both parties in an international trade transaction to collateralize. We complement this theoretical contributions and provide evidence that the scarcity of dollar denominated trade finance during the Great Financial Crisis not only impacted trade volumes (Bruno and Shin, 2019; Amiti and Weinstein, 2011), but also invoicing decisions, with potential long-run effects on dollar dominance.

The key theoretical mechanism we use to rationalize our empirical findings relies on the complementarity between the currency of denomination of their trade credit and imported working capital. Bruno and Shin (2019) and Drenik and Perez (2020) stress the importance of the choice in which firms decide to invoice their credit for financing working capital because it influences the degree of exchange rate pass-through to the firm's production costs.[3] The closest to our theoretical framework is Bahaj and Reis (2020), which we extend by introducing sunk cost in the use of currencies for international transactions. This novel element is key to generate hysteresis in invoicing patterns as documented in the data.

We also contribute to the empirically oriented line of research on the firm-level deter-

[2]Only few other papers share the same approach and focus on a large aggregate transition in invoicing patterns like in our setting: Garofalo et al. (2024), which focuses on the UK after Brexit, and Mehl and Mlikota (2023) on the EU enlargement.

[3]Gopinath and Stein (2021) focus on the complementarity between trade and finance but from the point of view of domestic banks, which extend dollar credit to domestic firms in order to match domestic households' dollar deposits.

minants of invoicing choices and heterogeneous pass-through rate using micro-level data. Several papers have focused on the importance of variable markups and strategic complementarities in price-setting (Amiti et al., 2019,0), international input intensity and operational hedging (Amiti et al., 2014), firm characteristics such as size and productivity (Berman et al., 2012). See Burstein and Gopinath (2014), Itskhoki (2021), and Gopinath and Itskhoki (2022) for the most recent survey articles on this vast literature. We add to the literature showing that firm-level margins are relevant not only to understand cross-sectional differences in invoicing patterns, but also the gradual adoption of different currencies as firms change their invoicing choices after large aggregate shocks such as the GFC.

2 Data

The main data source we use covers the universe of Chilean trade transaction from the Chilean Customs Agency (*Aduanas*). The Chilean Customs Agency publishes information at the transaction level for each firm, product, destination/origin, currency and day, for both export and import. The following information is included: the origin or the destination country; the quantity exchanged in the transaction expressed in kilograms (KG) and in the unit of measure of the good; the classification of the goods exchanged at the 8-HS digit code; the value (both FOB and CIF) of the transaction expressed in US Dollar. Importantly, every transaction reports the currency in which the transaction was invoiced. All the major currencies are reported (US Dollar, Euro, Chilean Peso, UK Pound, and Chinese Yuan), together with minor regional currencies such as Latin-American currencies. The datasets have a time-invariant, anonymous, firm identifier which enables to create a panel of importers and exporters for Chile.

The data are available from 2007 to 2023 for export transactions, while import transactions are available from 2009 to 2023. Given our main interest is about the impact of the Great Financial Crisis on the usage of the US Dollar in international trade, we complement the main dataset from the Chilean Customs Agency with a similar dataset from Garcia-Marin et al. (2019).[4] This additional dataset contains the same information as official customs records starting from 2004, and thus it allows us to cover the time period right before the GFC, and exclude potential pre-trends. The only difference between the two different data sources is that the latter covers the customs transactions from the main trade partners of Chile. Nevertheless, the dataset covers 98% of the total Chilean transactions in

[4]We kindly thank Santiago Justel to share the dataset with us.

terms of value and quantity when compared with the official data from the Chilean Customs Agency. This gives us confidence on the quality and validity of the data.

In addition, we use additional firm level information from the Chilean Tax Registry (SII, *Servicio de Impuestos Internos*). The Chilean Tax Registry covers the universe of firms active in Chile and regularly registered at it. The Registry provides information on firm size (such as the number of employee and total turnover), together with the sector in which the firm operates and its equity. In conjunction with customs data, we are able to create measures of import and export intensity at the firm level.

We also use data from the Chilean public authority responsible for regulating the financial and banking markets (CMF, *Comision para el Mercado Financiero*). They agency collects and provides data on the banking industry both at the aggregate and bank level, such as deposit and lending rates distinguishing domestic and foreign invoiced loans, different maturity and loan size, commercial and non-commercial clients. We leverage information on the commercial lending rates that Chilean banks charge on short-term (less than one year) loans denominated in domestic currency and US Dollar. Rates are aggregated at the monthly level. We consider short-term loan rates given that trade financing for international transactions relies heavily on this type of financing (Amiti and Weinstein, 2011; Ahn et al., 2011; Schmidt-Eisenlohr, 2013). The data span the period around the Great Financial Crisis until a change in regulation and data collection in 2013 does not allow a consistent comparison between domestic currency and US Dollar invoiced loans. Due to the fact that our coverage is limited to 2013, we are only able to document the dynamics of financing costs in the period 2007-2009 and adjacent periods. Because of this, our analysis excludes the COVID-19 episode and the global financing shock that occurred in 2020.

Lastly, we use a collection of standard macro-level variables from a variety of sources. For instance, we use daily bilateral exchange rates between Chilean Peso and the currency of Chilean trade partners for the time period under analysis, obtained from Bloomberg and Datastream; the domestic inflation rate for Chile and its trade partners from the Central Bank of Chile and the IMF, respectively.

3 Macro and Micro-level Invoicing Dynamics

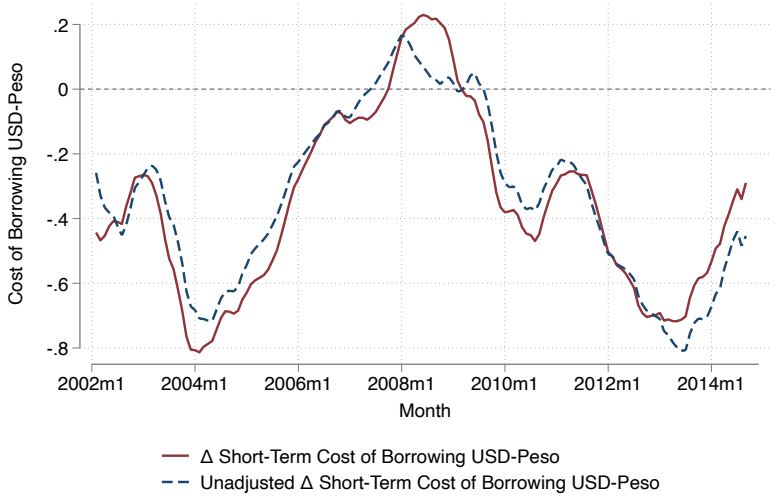
In this section, we use firm-level transactions data and financing cost from Chile to document a set of macro and micro-level stylized facts about invoicing and the dynamics of invoicing choices. At the aggregate level, we show that: i) the share of total Chilean

imports denominated in US Dollar (Chilean Peso) decreased (increased), while no changes in the invoicing patterns took place on the exports side; ii) during the Great Financial Crisis, the cost of US Dollar financing in Chile temporarily increased relatively more than the cost of financing in Chilean Peso. We further explore the micro-origin of the dynamics in the aggregate invoicing shares, and show that the bulk of changes in aggregate invoicing shares is due to firms switching from US dollar to Chilean Peso, as opposed to reallocation between firms or firm entry. Lastly, we explore the micro-level characteristics of the first importers to switch to Chilean Peso invoicing. We find that there is selection in the first switchers, as they are large firms with wider US Dollar currency mismatches, suggesting that both natural hedging and strategic complementarities are relevant in shaping invoicing choices. These facts together point to the role that the financing costs of import purchases might play in import invoicing choices, in addition to standard forces such as natural hedging and strategic complementarities.

Aggregate. Figure 2 shows that, during the GFC, the cost of financing in US Dollar become relatively more expensive than in domestic currency. The figure plots the difference between the short-term (< 1 year) cost of borrowing for firms in Chile in US Dollar and in domestic currency. The red line represents the delta in the short-term cost of borrowing between US Dollar and Chilean Peso adjusted for the realized 3-month ahead depreciation (or appreciation) in the bilateral nominal exchange rate between the two currencies. The blue dotted time series reports the same figure but unadjusted for realized variation in the bilateral nominal exchange rate. As the plot shows, the short-term cost of borrowing for Chilean firms becomes relatively cheaper in Chilean Peso compared to borrowing in US Dollar just at the start of the GFC and it reverts back to its previous pattern just after the end of the GFC. We interpret it as a transitory shock to the relative convenience of US Dollar financing.

Following the Great Financial Crisis, we show that the share of imports invoiced in US Dollar declined by 10 p.p. while no change in invoicing patterns happened on the export side. In addition, the share of imports invoiced in Chilean Peso increased by a virtually 0% in 2004 to approximately 6% in 2019. Figure 3 shows that, as the GFC starts, the share of imports denominated in US dollar is approximately 90%. Over a time span of 10 years, it declines until it amounts to just above 80% leading to a decline of almost 10 p.p. Differently, the share of imports invoiced in Chilean Peso was virtually 0% in 2004 and it increased to approximately 6% in 2019. Notably, we do not observe such changes in the

Figure 2: Relative Cost of Borrowing in US with respect to Chilean Peso



Note: Figure 2 shows the relative short-term (1-year) cost of borrowing in US Dollar with respect to the Chilean Peso. A value above zero implies that borrowing in Chilean Peso is relatively cheaper than in US Dollar.

share of exports invoiced in different currencies. Indeed, the share of exports denominated in the main currencies (US Dollar, Euro, Chilean Peso, and other currencies) remain stable over time.[5]

Firm Level Decomposition. To understand where the dynamics of the aggregate invoicing shares reported in Figure 3 originates from, we perform the following dynamics Olley-Pakes decomposition in the spirit of Melitz and Polanec (2015) to assess the role i) played by firms' entry and exit, ii) imports reallocation between and within firms, and iii) firms' sourcing strategies (origin and product level).

We show that the change in the aggregate share of total imports invoiced in US Dollar at time t, $\Delta\Lambda_{\$t}$, can be written as the sum of the :

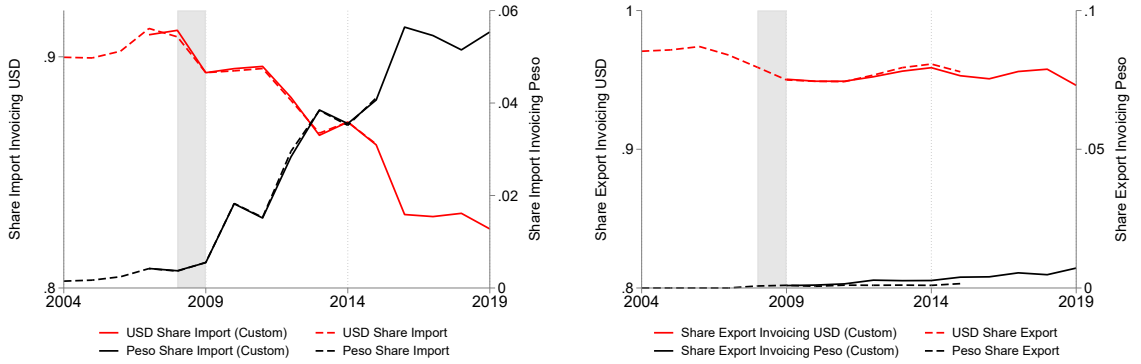
$$\Delta\Lambda_{\$t} = \Delta\text{Incumbents} + \text{Net Entry}, \tag{1}$$

$$\Delta\text{Incumbents} = \text{Within Margin} + \text{Between Margin}, \tag{2}$$

$$\begin{aligned}\text{Within Margin} = {} & \text{Within Origin-Product} + \text{Between Origin-Product} \\ & + \text{Net Entry Origin-Product},\end{aligned} \tag{3}$$

[5]See Table 5 in Appendix B.

Figure 3: Aggregate Invoicing Shares for Imports and Exports



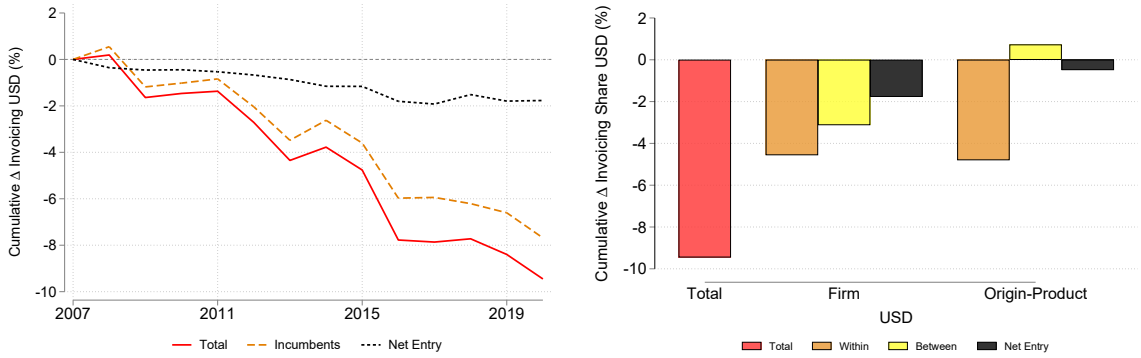
Note: Figure 3 shows the time series of the aggregate share of imports denominated in US Dollar and Chilean Peso for Chile between 2004-2019. The left vertical axis of Figure 3 reports the share of Chilean imports denominated in US dollar. The right axis shows the share of Chilean imports denominated in Chilean Peso. Data from 2007 (2009) for imports (exports) are from Chilean Customs Agency. Data before 2007 (2009) are from Garcia-Marin et al. (2019). The grey shaded area represents the NBER recession period.

where the change in the share of incumbents can be further decomposed into a within-firm, capturing the firms switching away from US Dollar invoicing, and a between-firm margins, capturing reallocation in the share of imports towards firms with less US Dollar invoicing. Lastly, the third equation shows that the within margin of each incumbent can be decomposed to account for the product and origin dimensions, given that it is possible that certain products or countries prefer US Dollar invoicing in case invoicing depends on the sourcing country. Appendix A provides additional details on the derivation of key equations of the decomposition.

We apply the decomposition specifications outlined above to the universe of Chilean import transaction from 2007, and show that the bulk of changes in aggregate invoicing shares is due to firms switching from US dollar to Chilean Peso within each origin×product. Firstly, the left panel of Figure 4 plots the results of the decomposition displayed in Equations (21) for the total variation in the share of imports denominated in US Dollar. Figure 4 shows that incumbent firms reduce the aggregate share of imports denominated in US Dollar by almost 8% by the end of 2019. Thus, the decline in the share of imports denominated in US Dollar is mainly driven by incumbents importers who started to reduce the use of the US Dollar to invoice transactions after the GFC. Moreover, the reduction in the aggregate share of imports invoiced in US Dollar due to net entry suggests the entrants use relatively less US Dollar than exiting firms.

Secondly, the right panel of Figure 4 reports the results of the decomposition exercise

Figure 4: Decomposition Invoicing Share for US Dollar



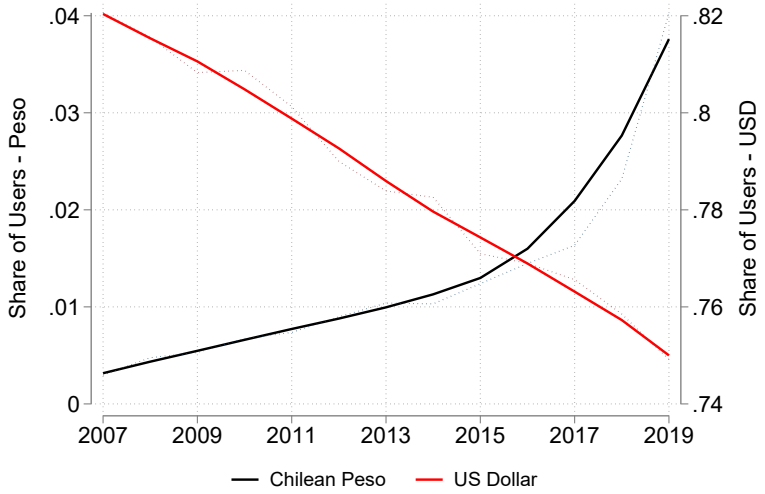
Note: The right panel of Figure 4 plots the results of the first decomposition exercise reported in Equation (21) for the US Dollar. The left panel of Figure 4 plot the results of the decomposition specifications of Equation (22) and (23) for the US Dollar. Tables 3 in Appendix B reports the corresponding numbers of the decomposition.

displayed in Equations (22) and (23). The first histogram in Figure 4 reports the total cumulative variation observed in the data for the share of imports invoiced in US Dollar. The three columns in the middle of Figure 4 report the results of Equation (22) while the three columns on the right display the results of the last decomposition exercise, that is Equation (23). The decomposition of the incumbent firms variation shows that the bulk of it is driven by the within component. In addition, the third decomposition results implies that the within component of surviving firms is fully explained by the within origin×product term. In other words, the three layers decompositions implies the following. Before the GFC, surviving firms were importing a specific product from a given origin and in a given amount in US Dollar. After the GFC, the same surviving firms were importing the same product from the same origin and in the same amount but they started to invoice the transactions in a different currency.

Firm-level Adoption and Dynamics: Selection in Switching We provide evidence that i) firms gradually substitute away from US Dollar invoicing for Chilean Peso invoicing, and ii) bigger and more exposed to US Dollar fluctuations firms are the first to switch away from the US Dollar invoicing.

Consistent with the previous findings, Figure 5 shows that the share of users of US Dollar invoicing within origin gradually decreases over a time span of 12 years starting with the onset of the GFC. By contrast, the share of users of Chilean Peso within origin gradually grows by the same amount over the same time horizon, suggesting that firms switch away

Figure 5: Share of Users by Currency within Origin



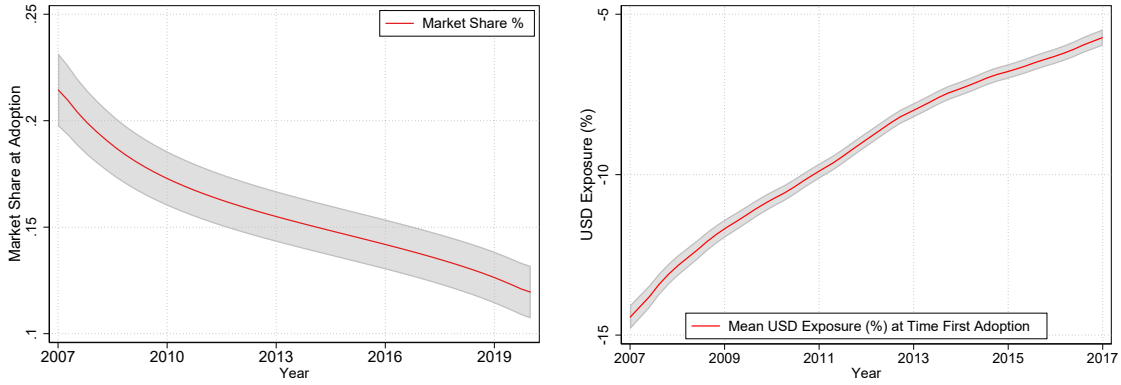
Note: The Figure plots the share of firms using the USD (right axis) and the CLP (left axis) at each point in time.

from US Dollar to Chilean Peso invoicing gradually over time, even though the GFC is a relatively short-lived temporary shock.

Next, we study whether there exist firm's observables that correlate with the decision to be among the first firms to switch away from the US Dollar in invoicing. We define an adopter (or a first switcher) a firm which, at time t, starts to use an alternative new currency and is already importing by invoicing in US Dollar. The left panel of Figure 6 reports the average market share within origin of adopters over time. As it is clear from the plot, those firms that started to substitute away first from US Dollar invoicing to an alternative currency are firms that have, on average, the highest market share within origin at the time of the GFC. Similarly, the right panel of Figure 6 shows that most exposed firms to US Dollar unbalances are the first to use an alternative currency followed by less exposed importers. We measure the US Dollar exposure as the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade. A negative number implies that a firm is importing relatively more in US Dollar with respect to the amount it is exporting. Hence, the firm faces a currency mismatch and it is not naturally hedged. The average switcher when the GFC hit has an exposure of approximately 15%, which decreased to 5% by 2017.

Figure 6 provides not only evidence that there exists selection in being a first switcher, but also the existence of strategic complementarities in currency switching (Amiti et al.,

Figure 6: Size and Hedging at Time of First Adoption



Note: The left panel plots the average market share of firms adopting a new currency at each point in time. Market share is defined at the origin level. The right panel plots the average US Dollar exposure of firms adopting a new currency at each point in time. US Dollar exposure is the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade. In both panels, an adopter is a firm which, at time t, starts to use an alternative new currency and is already importing by invoicing in US Dollar.

2022; Corsetti et al., 2022; Crowley et al., 2020). Figure 6 shows that, as bigger firms start to adopt alternative currencies to invoice transactions, smaller firms' invoicing decisions gradually adjust following their competitors' currency choices, even after the end of GFC and the scarcity of dollar financing.

Robustness We perform a series of robustness checks of our empirical analysis. Table 4 in Appendix B displays the results from a dynamic Olley-Pakes decomposition with entry and exit for imports at the origin level, abstracting away from the product dimension, and provides the same qualitative patterns as our benchmark decomposition.[6] We report the decomposition for all major currencies used to invoiced import transactions. Table 5 in Appendix B displays the results from our benchmark decomposition applied to exports, showing no particular movement as at the aggregate level. Figure 13 in Appendix B shows that aggregate invoicing dynamics are not driven by some specific product types (BEC classification) or trading partners, as the within-group invoicing share in Chilean peso (US Dollar) increases (decreases) across all major trading partners or types of product. Lastly, Figure 14 in Appendix B shows that first switchers are firms that use trade credit more

[6]We also performed alternative decomposition such as: Griliches and Regev decomposition, Baily, Hulten, and Campbell decomposition, and Foster, Haltiwanger, and Krizan decomposition. As expected, all these alternatives provide different contributions of the role of net entry, leaving the relative importance of the other margins unchanged.

often, in line with our evidence of being relatively in need of less financing.

4 A Model of Currency Choice

In this section, we propose a new theory to rationalize the empirical evidence observed among Chilean importers. The model in this section does so by combining in a simple setup the key elements from two growing literatures. The literature on invoicing currency choice in international trade and the one on invoicing currency choice in the denomination of borrowing cost for firms' working capital. The model includes standard forces such as natural hedging and strategic complementarities (Amiti et al. (2022) among others), while the environment for modelling the borrowing costs across currencies follows Bahaj and Reis (2020) (henceforth BR2020). Our novel contribution is the introduction of a sunk cost associated with the use of any new currency for invoicing into a model of currency choice and borrowing costs across currencies. The presence of a sunk cost generates hysteresis in invoicing choices after temporary shocks, helping us understand the empirical evidence in Section 3.

4.1 Environment

A small open economy has a continuum of importers indexed by $i \in [0,1]$. The firm sells a differentiated output domestically, pricing it in domestic currency. The demand faced by firm i in the domestic market d is $y_i^d = \left(\frac{p_i^d}{q^d}\right)^{-\theta}$, where q^d is a market specific demand shifter, and θ the constant demand elasticity ($\theta > 1$).

Each importer combines domestic labor, l, and imported inputs, x, using a CRS Cobb-Douglas production function:

$$y_i = A_i \left(l_i\right)^{1-\alpha_i} \left(x_i\right)^{\alpha_i}, \tag{4}$$

where y_i denotes the output of firm i, α_i the share of imported inputs used in production by firm i, and $A_i \equiv \left(\frac{1}{\alpha_i}\right)^{\alpha_i} \left(\frac{1}{1-\alpha_i}\right)^{1-\alpha_i}$ is a normalizing constant . Importantly, we assume that the imported inputs, x, are working capital and must be paid ahead of production, while labor can be paid later when revenues are generated.

We assume that in each period there are two sub-periods, a morning and an evening. In the morning, the firm must finance the imported inputs that are used as working capital and chooses the corresponding financing currency. The firm can borrow in either local d or vehicle currency v. Prices are nominally sticky and determined in the morning. In the evening, the

firm buys its inputs, satisfies its demand given the sticky price, collects revenues and pays off its loans. The choice of working capital made in the morning affects the production function in the evening because the exchange rate and the cost of credit in foreign currency are not known at the moment in which the firm chooses its input mix. Therefore, different realizations of the exchange rate have an impact on the future costs of production.

We assume that the firm faces the following production technology for imported inputs:

$$x_i = \min\left(\frac{x_i^d}{\eta_i}, \frac{x_i^v}{1-\eta_i}\right). \tag{5}$$

By choosing η_i, the firm chooses the relative shares of two imported inputs, x_i^d denominated in domestic currency d, and x_i^v denominated in vehicle currency v.

The firm must borrow to finance imported inputs and can choose between borrowing in domestic or foreign currency. We follow BR2022 and restrict our attention to the case in which the currency of financing coincides with the currency of invoicing of the imported inputs. This behaviour arises optimally because firms want to reduce the exchange rate risk originating from the mismatch between financing and input invoicing. The firm has two options: i) borrowing b_d units in domestic currency leads to a repayment of one unit the following period; ii) borrowing b_v units in vehicle currency requires a payment of ϵ units. Therefore the interest rate on a d (v) loan is $\frac{1}{b_d}$ ($\frac{\epsilon}{b_v}$). We assume that b_d, b_v, and ϵ are known when the borrowing decision is taken, while the exchange rate between the domestic currency and the vehicle currency s^v is not. This implies that the ex-post marginal cost of production for firm i expressed in domestic currency is:

$$C_i(s^v, \eta_i) = \frac{1}{A_i}\left[\frac{\eta_i \frac{1}{b_d}\rho_d + (1-\eta_i)\rho_v s^v \frac{\epsilon}{b_v}}{\alpha_i}\right]^{\alpha_i}\left[\frac{w}{1-\alpha_i}\right]^{1-\alpha_i}, \tag{6}$$

where w is the domestic wage rate; ρ_d and ρ_v are the price of the domestic and the imported intermediate inputs expressed in domestic and vehicle currency, respectively. We assume all prices and borrowing costs are exogenous. Importantly, it follows from standard theory that firms optimally invoice imported inputs entirely in domestic or vehicle currency, i.e. $\eta_i^\star = \{0, 1\}$.

We assume that the firms using currency j for international transactions incur into currency-specific fixed cost, F_i^j. In the spirit of Crowley et al. (2020), we assume that the fixed cost of currency j depends inversely on the number of firms using currency j for international transactions. We enrich their specification including a sunk cost in the use of

new currencies, implying that each firm's fixed cost of using currency j depends on the last period's invoicing choice. We specify the following reduced-form representation for firm i's fixed cost of invoicing in currency j at time t, F_{it}^j:

$$F_{it}^j = f_{it}^j - \gamma^j \widetilde{\omega_{t-1}^j}, \tag{7}$$

where $\widetilde{\omega_{t-1}^j}$ is the share of firms using currency j in period $t-1$, and $f_{it}^j = \kappa_0^j$ the first time firm i uses currency j, and $f_{it}^j = \kappa_1^j < \kappa_0^j$ for all subsequent periods. The first term in Equation (7) captures the firm-specific component of the fixed cost, and exhibits the presence of sunk costs.[7] The difference $\kappa_0^j - \kappa_1^j$ is the sunk entry cost of invoicing in a new currency, and captures the existence of one-time costs to managerial costs such as setting up foreign currency bank accounts. The second term in Equation (7) creates externalities in adoption and allows to capture the cost reduction due to complementarities in currency j usage, as the usage benefits increase in the number of users (Amiti et al, Crowley et al 2023, Alvarez et al 2023.).[8] The magnitude of these complementarities is governed by the parameter γ^j, with $0 < \gamma^j < f_{it}^j < 1$.

Lastly, to make progress in understanding the mechanism at play, we make the simplifying assumption that the exchange rate s_v is distributed log normal with mean μ and variance Σ.[9]

4.2 Working Capital Invoicing Choice

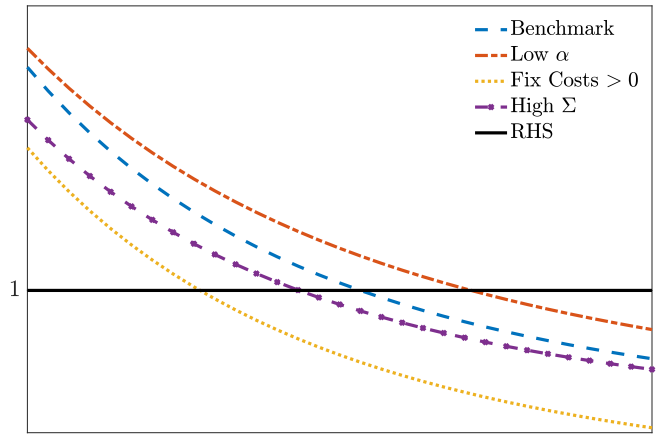
With these ingredients, we solve for the optimal invoicing choice and pricing decision, and discuss the key forces shaping them. Firms are risk neutral and maximize the expected profits after forming expectations on the exchange rate and on the cost of credit in different currencies. Different exchange rate realizations imply ex-post changes in the cost of credit in vehicle currency, generating deviations from the optimal markup over the marginal cost and reducing profits.

[7] The firm-specific component depends only on last period's usage of currency j. We can relax this assumption and expand to richer specifications in which longer invoicing history is relevant, allowing a slower accumulation. See Alessandria et al 2023 for a review of sunk costs in the trade literature.

[8] In our framework, we capture complementarities in invoicing choices across firm. The decomposition in Section 3 shows that invoicing switching is not driven by specific destination-product pairs within each firm. Nevertheless, our framework can be easily extended to include multi-market firms, capturing both within-firm and across-firm externalities.

[9] While log-normality provides analytical solutions, the same intuition holds using a second-order approximation with a general distribution.

Figure 7: Invoicing Choice - Comparative Statics



Given the isoelastic demand function and the imported inputs technology in Equation (5), firm i maximizes the ex-ante profits:[10]

$$\max_{\eta_i, p_i^d} \mathbb{E}\left[\pi_i^j\right] = p_i^d \left(p_i^d\right)^{-\theta} - \mathbb{E}\left[C_i(s^v, \eta_i)\right] \left(p_i^d\right)^{-\theta} - \eta_i F_i^d - (1-\eta_i) F_i^v. \tag{8}$$

Thus, for a given η_i, the optimal domestic price is: $p_i^{d\star} = \frac{\theta}{\theta-1} E[C_i]$. Given $p_i^{d\star}$, firm i chooses to invoice imported inputs in vehicle currency ($\eta_i^\star = 0$) if the following condition is satisfied:

$$\eta_i^\star = 0 \qquad \text{iff} \qquad \mathbb{E}\left[\left(\frac{\rho_v}{b_v} s^v \epsilon\right)^{\alpha_i}\right]^{1-\theta} - \left(\frac{\rho_d}{b_d}\right)^{\alpha_i(1-\theta)} > \tau \left(F_i^v - F_i^d\right), \tag{9}$$

where τ is a collection of parameters, $\tau = \frac{1}{w^{1-\alpha_i}}$. Abstracting away from the presence of fixed costs ($F^v = F^d = 0$) and leveraging the log-normality of the exchange rate distribution, we can grasp more intuition on the forces at play by rewriting the cut-off condition as follow:

$$\eta_i^\star = 0 \qquad \text{iff} \qquad \log \epsilon < \log\left(\frac{\rho_d}{\rho_v}\frac{b_v}{b_d}\right) - \left[\mu + \alpha_i \Sigma\right], \tag{10}$$

where μ and Σ are the mean and variance of the exchange rate s_v, respectively.

Equation (10) shows that invoicing imported inputs in the vehicle currency v is optimal when the cost of financing in vehicle currency is sufficiently low to offset the uncertainty arising from the exchange rate realization (captured by Σ), after accounting for the cost of

[10] Without loss of generality, we assume that the demand shifter q_d is normalized to one.

inputs (ρ_d, ρ_v) and the cost of credit (b_v, b_d). The firms' profits are maximized by keeping a constant mark up over marginal cost. Invoicing in vehicle currency means that the ex-post marginal cost of production depends on the realization of the exchange rate, potentially creating costly departure from the optimal markup. Firms choose to invoice in vehicle currency only when the financing cost is cheaper than the cost of departing from the optimal constant markup.

Figure 7 graphically represents the optimal decision rule in Equation (9) by plotting the expected profits given domestic and vehicle currency financing for different levels of financing cost in vehicle currency, ϵ. Expected profits with domestic currency financing are independent of ϵ and normalized to one (horizontal line). Expected profits when working capital is invoiced in vehicle currency are decreasing in the cost of financing in vehicle currency as higher ϵ increases the marginal cost (downward-sloped line). The intersection between the two pins down the cut-off level in ϵ above which it is optimal to invoice in domestic currency, $\eta^\star = 1$.

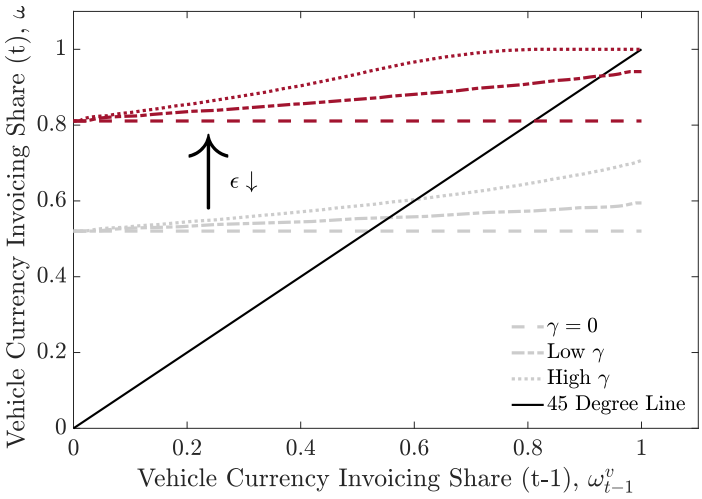
On Natural Hedging Equation (10) shows that the trade-off between cheaper financing option and costly departure from the optimal markup depends on the exposure of the marginal cost to exchange rates, α_i, capturing firm's operational hedging motive (Amiti et al., 2022). *Ceteris paribus*, firms prefer to match their input currency with that of their revenues (e.g. domestic currency), and the incentive is stronger the larger the share of imported inputs (high α_i). Thus, the repayment in foreign currency that makes a firm indifferent between domestic and foreign financing is lower the larger the firm's share of imported inputs.[11] Figure 7 shows that a lower α_i shifts the line representing the expected profits when working capital is invoiced in vehicle currency to the right, making invoicing in vehicle currency more likely.

The term on the right hand side of Equation (9) captures how fixed costs in currency use influence the invoicing choice.[12] Assuming the fixed cost of using the vehicle currency is larger than the fixed cost for domestic currency ($F^v > F^d$), the firm optimally invoices in vehicle currency when the financing cost denominated in vehicle currency is sufficiently low to offset not only the costly departure from the optimal constant markup, but also the higher fixed cost. In line with this reasoning, Figure 7 shows that the presence of fixed costs

[11] Formally, let $\epsilon^\star : \log \epsilon^\star = \log\left(\frac{\rho_d}{\rho_v}\frac{b_v}{b_d}\right) - [\mu + \alpha_i \Sigma]$ be the repayment in foreign currency that makes a firm indifferent between domestic and foreign financing. It is immediate to show that $\epsilon^\star$ is decreasing in α_i.

[12] In deriving the optimal invoicing choice, we assume that firms do not internalize the effect that their invoicing choice has on the aggregate invoicing share and, thus, on fixed costs (Equation (7)).

Figure 8: Invoicing Choice - Transition



shifts the line representing the expected profits when working capital is invoiced in vehicle currency to the right, making invoicing in vehicle currency less likely.

On Strategic Complementarities The last mechanism influencing invoicing choices is strategic complementarities, related to the reduction in fixed costs in invoicing due to higher usage of a given currency. The idea behind complementarities is that usage increases in the overall utilization. The fixed cost of invoicing in currency j decreases in the number of firms using currency j to invoice their working capital, increasing the probability and the usage of currency j. The strength of the strategic complementarity in invoicing is governed by γ in Equation (7). Figure 8 illustrates how the share of imported inputs in vehicle currency evolves given different degrees of strategic complementarities. When $\gamma^v = 0$ (dash line), fixed costs do not depend on the overall utilization of vehicle currency, thus the share of imported inputs in vehicle currency does not change. In the presence of strategic complementarities, i.e. $\gamma^v > 0$ (dotted line), the overall level of utilization reduces the fixed costs of invoicing. Thus, the share of vehicle currency invoicing stabilizes to levels that are higher. When γ^v is high enough (or ϵ low enough, or both), the share of vehicle currency invoicing converges to an equilibrium in which all firms choose to invoice in vehicle currency only.[13]

[13]The invoicing decision in the presence of dynamic fixed costs cannot be solved analytically, and requires the problem to be solve computationally.

4.3 Temporary Shocks, Invoicing Dynamics and Hysterisis

Our main focus in this paper is on how temporary changes in access to trade credit invoiced in different currencies alter imports invoicing choices at both firm and aggregate level, and their dynamics over time. We show that our theory can rationalize the main empirical findings of Section 3: i) a temporary increase in the cost of trade credit invoiced in vehicle currency generates long lasting effects on the individual and aggregate import invoicing patterns; ii) firms that are larger and more exposed to exchange rate are the first to switch to domestic currency invoicing, iii) invoicing dynamics are influenced by the presence of strategic complementarities. Figure 9 displays these results graphically.

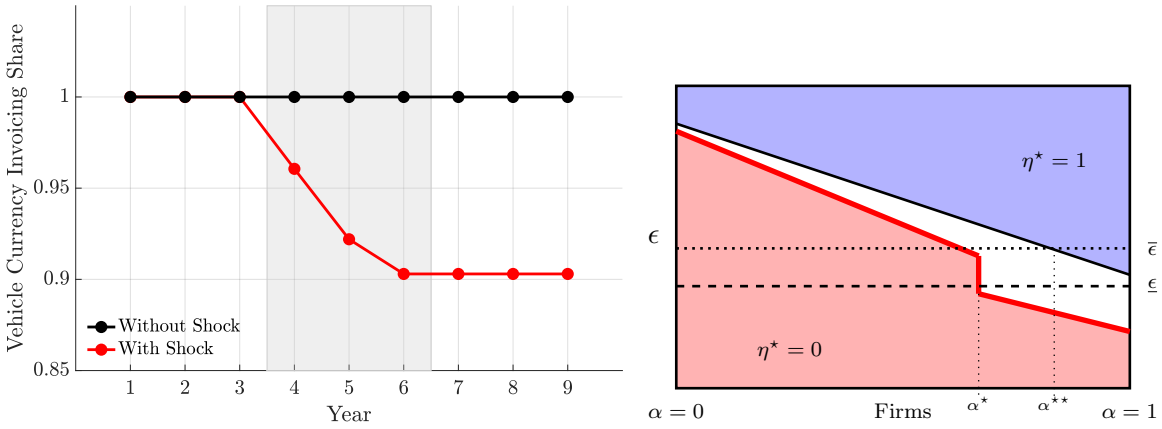
We consider a rise in ϵ that permanently reverts after three periods to its previous level, as the short-term financing costs in USD in Chile around the GFC. We keep our model as tractable as possible assuming that all firms initially invoice in vehicle currency and start with no invoicing experience in domestic currency, so that firms have to pay the sunk cost to switch to domestic currency invoicing. Moreover, we assume that the share of imported goods in the production of output, α_i, is uniformly distributed: $\alpha_i \sim U[0,1]$.[14]

Short-run response The right panel of Figure 9 graphically represents the invoicing choice of each firm i. On the horizontal axis firms are ranked so that the higher is i the higher is the share of imported inputs the firm uses, α_i. On the vertical axis is represented the cost of financing in vehicle currency, ϵ. For any level of ϵ, there is a threshold $\tilde{\alpha}$ such that firms with $\alpha_i < \tilde{\alpha}$ invoice in domestic currency ($\eta^\star = 1$), and firms with $\alpha_i > \tilde{\alpha}$ invoice in vehicle currency ($\eta^\star = 0$). The downward-sloped lines dividing the box in two areas, domestic (blue area) and vehicle (non-blue area) currency financing, represents the locus of $\tilde{\alpha}$ as a function of ϵ.

Following the rise in the cost of financing in vehicle currency, large and more exposed companies are the first to switch to domestic invoicing, consistent with the empirical presented in Section 3. The initial cost of financing in vehicle currency, $\underline{\epsilon}$, is such that it is optimal for all firms to invoice in vehicle currency. This is represented by $\underline{\epsilon}$ (dash horizontal line) lying below the initial locus of $\tilde{\alpha}$ (solid black line). When epsilon increases from the initial level $\underline{\epsilon}$ to a higher level $\overline{\epsilon}$, i.e. foreign invoicing becomes less convenient, a mass of firms with $\alpha_i > \alpha^{\star\star}$ start borrowing and invoicing in domestic currency. Importantly, the first switchers are firms with high α_i, which represents a sufficient statistics for both their

[14] The firm-level invoicing patterns presented in Section 3 support the assumption of absence of invoicing experience in domestic currency. The main insights are unchanged to the distributional assumption on α_i.

Figure 9: Shock to Vehicle Currency Financing



unhedged vehicle currency exposure and their market share in the imported inputs market.[15]

The presence of strategic complementarities generates a positive feedback of prior domestic currency invoicing which further extends the utilization of domestic currency in imports. The left panel of Figure 9 shows that the aggregate share of imports invoiced in vehicle currency keeps decreasing also after the shock in ϵ in period 4. The use of the domestic currency by a group of firms after the shock reduces the fixed cost of invoicing in the domestic currency for all the others, increasing the probability that other firms start using it. As in the data, firms with α_i lower relative to the initial switchers start using the domestic currency to invoice imported inputs as domestic invoicing becomes more convenient for them. Graphically firms with $\alpha^\star < \alpha_i < \alpha^{\star\star}$ gradually switch to domestic currency invoicing as fixed costs decrease.

Hysteresis in invoicing The sunk-cost model generates invoicing hysteresis: when ϵ permanently reverts to the original level $\underline{\epsilon}$, firms do not switch back to vehicle currency invoicing. The presence of sunk cost in invoicing implies that the relative convenience of domestic and vehicle currency invoicing permanently changes when a firm switches to domestic currency invoicing. Specifically, the difference between the fixed costs of invoicing in vehicle and domestic currency, $F^v - F^d$ in Equation (9), decreases, making domestic currency invoicing more permanently appealing than vehicle currency invoicing.

Graphically, this is represented by a downward shift in the threshold between domestic

[15]The former follows immediately from the fact that firms are importers only, with revenues denominated in domestic currency. The latter follows from the fact that firms are assumed to have identical size. Thus, higher α_i implies more imported inputs and, thus, a larger market share in the input market.

and vehicle currency invoicing for all those firms that start invoicing in domestic currency (i.e. with $\alpha_i > \alpha^\star$). The area in which domestic invoicing is optimal ($\eta^\star = 1$) extends to the area above the solid red line (i.e. the white area in addition to the original blue area). Thus, the new relevant cut-off rule implies that for firms with $\alpha_i > \alpha^\star$ is now optimal to invoice in domestic currency also when ϵ reverts to the original level $\underline{\epsilon}$.[16]

At the aggregate level, this implies that the share of imports invoiced in domestic currency in Figure 9 does not increase back to one after ϵ reverts to the original level (in period 6), consistent with what we see in the data.[17] The fact that we do not observe in the data any partial reversion in the aggregate share of imports invoiced in domestic currency suggests that the sunk cost of domestic currency invoicing is large enough to make the switch permanent. If the sunk cost was smaller, it could be optimal for some firms to switch back to vehicle currency invoicing because the decrease in the fixed costs of domestic invoicing, F^d, is not enough to make domestic currency invoicing optimal at the original level of ϵ, $\underline{\epsilon}$.

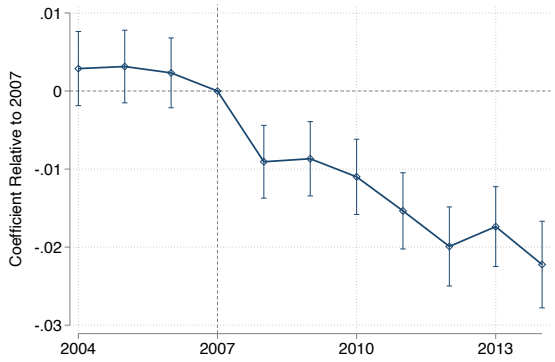
5 Model Validation

In this section, we test the key mechanisms of model. First, the model predicts that, as the cost of borrowing becomes relatively more expensive in US Dollar than in Chilean Peso, those firms that are more exposed to US Dollar fluctuations (higher α) are more likely to substitute away from US Dollar invoicing and switch to the Chilean Peso. We employ a dynamic, event study approach and show that firms more exposed before the shock in 2007 are the one that reduced US Dollar invoicing relatively more by the end of 2019. We also use a static, cross-sectional regression analysis to confirm this analysis and show that strategic complementarities also impact invoicing dynamics. Lastly, we also provide evidence in support of the presence of sunk cost in invoicing choices, a key assumption of our model to generate the kind of hysteresis we observe in the data.

[16] Notice that domestic currency invoicing is more appealing also for firms that have not paid the sunk cost, i.e. $\alpha_i < \alpha^\star$. The reason is that the fixed cost of invoicing in domestic currency decreases also for them because of the strategic complementarities force. Relative to the initial steady state, in which the share of invoicing in vehicle currency is one, the fixed cost of invoicing in vehicle currency is now higher because a subset of firms permanently switch to domestic invoicing. The higher fixed cost of invoicing in vehicle currency F^v makes domestic invoicing more competitive for all firms.

[17] Differently from the empirical evidence in Section 3, the model does not generate a slow-paced decline in the aggregate share after the shock is reversed. In the model, strategic complementarities depends only on last period aggregate share, while in real world it could time a longer amount of time for these forces to phase in. The model can be enriched to make the transition more sluggish.

Figure 10: Testing the Model - Event Study



Note: The Figure plots the coefficients β_τ from the event study specification in Equation (11), capturing the differential reduction in US Dollar invoicing by more exposed firms. Coefficient in 2007 is normalized to zero. Exposure is measured by: share of US Dollar imports over the total imports of the firm. Data are from Garcia-Marin et al. (2019). Standard errors are clustered at firm level.

Event Study design We estimate the dynamic effects of the GFC to financing costs on invoicing decisions relying on the following specification at the firm-product-origin (fio) level and at yearly (t) frequency:

$$s^{\$}_{foit} = \sum_{\tau=2003}^{2015} \left[\beta_\tau \alpha_{f,2006} \times \Delta(i^{\$}_{2007} - i^{CLP}_{2007}) \times_{\tau=t}\right] + FE + \nu_{foit}, \tag{11}$$

where $s^{\$}_{foit}$ is the share of US Dollar invoicing of a given firm in a product-origin pair at time t, $\Delta(i^{\$}_{2007} - i^{CLP}_{2007})$ is the change in the difference in currency-specific cost of financing in 2007, $\alpha_{f,2006}$ is the exposure of firm f to US Dollar financing in 2006, $\mathbf{1}_{\tau=t}$ is an equal to 1 in year τ and 0 otherwise, and FE is a set of fio fixed effects. We follow our theory, and define $\alpha_{f,2006}$ as the share of US Dollar imports over the total imports of the firm. Alternatively, we measure firms' exposure as the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade, or as the market share of a firm in a given product-origin pair.[18] For this exercise, we use data from Garcia-Marin et al. (2019) as they cover the window around the GFC.

Figure 10 shows that, consistently with our theory, the share of US Dollar invoicing decreases relatively more for those firms that are more exposed before the shock. The effect is strong at impact and also gradually builds over time, even after the end of temporary

[18] $\Delta(i^{\$}_{2007} - i^{CLP}_{2007})$ is defined as the two-year average around 2007 of the change in the difference between the short-term (< 1 year) cost of borrowing for firms in Chile in US Dollar and in domestic currency, adjusted for the exchange rate depreciation rate.

dollar financing shock. Importantly, we do not observe any pre-trend or anticipation effect that could potentially undermine our empirical approach. In Appendix B, we show that the key qualitatively results hold when we use alternative measures of firms' exposure to US Dollar financing (Figure 15).

Cross-sectional analysis We leverage the panel nature of our data to further investigate the implications of the model in Section 4. Specifically, we show that i) the differential in US Dollar - domestic financing costs is a determinant of invoicing choices, and ii) its effect is stronger for more dollar exposed firms or in the presence of stronger complementarities.

We run the following specification:

$$\begin{aligned} s^{\$}_{foit} = \beta_0 \Delta(i^{\$}_t - i^{CLP}_t) + \beta_1 \alpha_{ft} + \beta_2 SC^{\$}_{(-f)sot} + \\ + \beta_3 \alpha_{ft} \times \Delta(i^{\$}_t - i^{CLP}_t) + \beta_4 SC^{\$}_{(-f)sot} \times \Delta(i^{\$}_t - i^{CLP}_t) + \\ + FE + \nu_{foit}, \end{aligned} \tag{12}$$

where $s^{\$}_{foit}$ is the share of US Dollar invoicing of a given firm in a product-origin pair at time t, $\Delta(i^{\$}_t - i^{CLP}_t)$ is the change in the difference in currency-specific cost of financing, α_{ft} is the exposure of firm f to US Dollar financing at time t, $SC^{\$}_{(-f)sot}$ is the strategic complementarity index, and FE is a set of fio and year fixed effects. We follow our theory, and define α_{ft} as the share of US Dollar imports over the total imports of the firm or as the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade. We construct the strategic complementarities measure as the average share of imports invoiced in US Dollar among all competitors in a given sector(HS6)-origin pair Amiti et al. (2022). Given the endogeneity of the latter, we instrument it following Crowley et al. (2020): we use the import-weighted average US Dollar exposure of all competitors in a given sector(HS6)-origin pair, where the exposure is defined as the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade. For this exercise, we use data from Garcia-Marin et al. (2019) as they cover the window around the GFC.

Our theory predicts that the rise in the cost of dollar financing reduces US Dollar invoicing (β_0¡0), and this effect is stronger for firms with higher α_{ft} (β_3¡0) while it is attenuated by the presence of complementarities (β_4¿0). Table 1 broadly confirms the qualitative predictions of our model. Column (1) reports the average effect of changes in the cost of financing on

Table 1: Testing the Model - Cross-section Analysis

	Average Effect	Heterogeneous Effect	
	(1)	(2)	(3)
$\Delta(i^{\$} - i^{CLP})$	-0.004		
	(0.000)		
$\Delta(i^{\$} - i^{CLP}) \times \mathbf{1}_{Post2009}$	0.003		
	(0.001)		
$\Delta(i^{\$} - i^{CLP}) \times \log SC^{\$}_{(-f)sot}$		0.087	0.058
		(0.031)	(0.030)
$\Delta(i^{\$} - i^{CLP}) \times \alpha_{ft}$		-0.012	0.005
		(0.003)	(0.001)
Controls	Yes	Yes	Yes
Firm × Product × Origin	Yes	Yes	Yes
Year	No	Yes	Yes
N	1275379	1147087	1147087

Note: The Table reports the coefficients from specification in Equation (12). The specification in Column (1) estimates Equation (12) excluding the interaction terms and year fixed effects. The specifications in Column (2) and (3) estimates Equation (12). Given the presence of year fixed effect, the coefficient β_0 cannot be identified. We introduce the level of all interacted variables in all specification, which are not reported for convenience. In Column (2), α_{ft} is the share of US Dollar imports over the total imports of the firm. In Column (3) α_{ft} is the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade. The strategic complementarities variable is the average share of imports invoiced in US Dollar among all competitors in a given sector(HS6)-origin pair. In all specification the strategic complementarity measure is instrumented with the import-weighted average US Dollar exposure of all competitors in a given sector(HS6)-origin pair. Standard errors are robust. We use data from Garcia-Marin et al. (2019) from 2005-2014.

invoicing decision. We estimate it separating the window around the GFC (2006-2009) to the rest of the sample. The coefficient is negative and, on average, stronger during the GFC. Column (2) and (3) report the heterogeneous effects of exposure and complementarities. As predicted the effect of complementarities is positive, dampening the overall effect of changes in the cost of financing when many competitors keep invoicing in US Dollar. Firm's exposure to US Dollar financing cost amplifies the effect of changes in the cost of financing. We use the share of US Dollar imports over the total imports of the firm in Column (2), while we use the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade in Column (3). In the former (latter) case, an increase in α_{ft} translates in a higher (lower) exposure, explaining the opposite sign.

Table 2: Testing the Model - Sunk Cost

	Dummy USD				Share USD		
	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) First Difference - IV	(7) First Diffrence - GMM
Lagged Dollar Share	0.216	0.126	0.040	0.040	0.157		
	(0.009)	(0.006)	(0.005)	(0.005)	(0.046)		
Lagged ΔDollar Share						0.036	-0.056
						(0.017)	(0.011)
Controls	No	No	Yes	Yes	Yes	Yes	Yes
Origin × Year & Product × Year	No	Yes	Yes	Yes	No	No	No
Firm × Product × Origin & Year	No	No	No	No	Yes	Yes	No
Observations	2187942	2181688	774868	774868	623768	356394	260203

Note: The Table reports the coefficients from specification in Equation (13). The dependent variable in specifications (1) to (5) is a dummy variable equal to 1 when US Dollar invoicing is used and 0 otherwise; The dependent variable in specifications (5) to (7) is the (log) share of US Dollar invoicing. Column (6) is estimated in first difference via OLS. Column (7) is estimated using an Arellano-Bond GMM estimator using lagged levels of the right-side variables as instruments. "Lagged Dollar Share" refers to the lagged (log) share of US Dollar invoicing at the firm level. Controls include: a natural hedging measure defined as the share of export invoiced in US Dollar; a strategic complementarities measure as the average share of imports invoiced in US Dollar among all competitors in a given sector(HS6)-origin pair. IV columns refers to the case in which the strategic complementarity measure is instrumented with the import-weighted average US Dollar exposure of all competitors in a given sector(HS6)-origin pair. Standard errors are clustered at firm level. We use data from official customs 2007-2019.

On the presence of sunk costs A key element of the theoretical framework in Section 4 to explain the hysteresis in invoicing choices is the presence of sunk cost in invoicing. We follow the international trade literature estimating the presence of sunk cost in exporting and provide evidence consistent with the presence of sunk costs in invoicing.

The key implication of sunk costs is that the decision of invoicing in a specific currency increases when the same currency has been used previously. Therefore, conditional on the other forces determining invoicing choices, the past invoicing share should be a predictor of current invoicing choices. This idea translates in the following econometric specification:

$$y^{\$}_{foit} = \beta y^{\$}_{f,t-1} + Controls_{foit} + FE + \nu_{foit}, \tag{13}$$

where $y^{\$}_{foit}$ is the (log) share of US Dollar invoicing or a dummy variable equal to 1 when US Dollar invoicing is used and 0 otherwise, $y^{\$}_{f,t-1}$ is the lagged (log) share of US Dollar invoicing at the firm level, and β is the coefficient of interest.

The presence of the lagged endogenous variable on the right side poses potential endogeneity concerns due to highly serially correlated unobserved characteristics that induce persistence in invoicing choices, potentially bias upward the coefficient of interest β. We follow the literature and, in addition to standard controls such natural hedging and strategic complementarities (Amiti et al., 2022), we saturate the specification with fixed effects

(Bernard and Jensen, 2004; Timoshenko, 2015; Das et al., 2007).[19] We alternatively estimate Equation (13) in first difference via OLS and via an Arellano-Bond GMM estimator using lagged levels of the right-side variables as instruments.

Table 2 provides strong support for the presence of sunk costs in invoicing. The benchmark specifications in Column (4) and (5) show that a 1% increase in the past share of US Dollar invoicing increases the probability of invoicing by 4% and the current share of US Dollar invoicing by 0.16%, respectively. Alternative specifications using first difference also show the relevance of past US Dollar invoicing share in the contemporaneous invoicing decision. In Appendix B, Table 6 shows that the results are robust to the use of lagged (log) share of US Dollar invoicing at the firm-origin-product level, rather than firm level, suggesting that these costs exhibit some product-origin specific component as well.

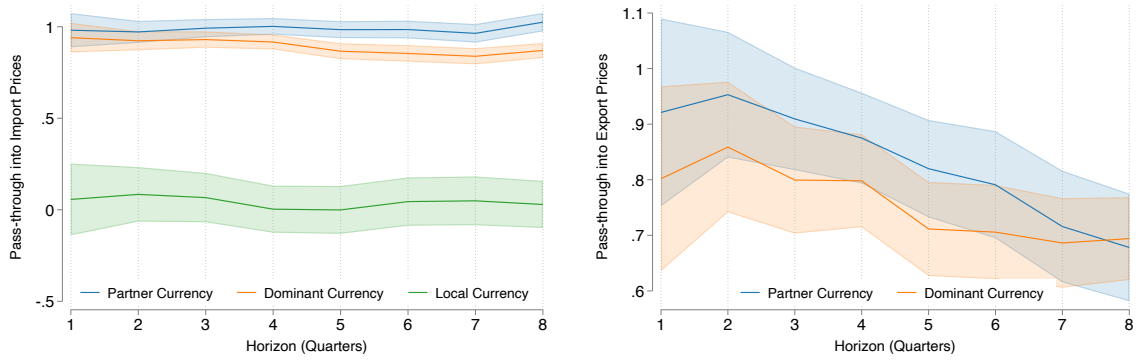
6 Aggregate Implications

In this section we quantitatively assess the macroeconomic implications of the large changes in invoicing shares after the GFC. We focus on the implications of invoicing choices on the dynamics of terms of trade and trade balance. We proceed as follow. We first estimate short-run and long-run price and quantities elasticities to exchange rate fluctuations accounting for the different invoicing currencies, building on existing empirical frameworks (Adler et al., 2020; Barbiero, 2021; Chen et al., 2022). We then leverage the estimated elasticities and consider actual and counterfactual invoicing shares in accounting counterfactual exercises (Auer et al., 2021). We find that the change in the invoicing shares after the GFC implies a trade balance elasticity to exchange rate which is 30% higher.

Price and Quantity Elasticities to Exchange Rate We first estimate the exchange rate pass-through to border prices and quantities, both in the short-run and in the long-run, conditioning on the currency of invoicing. Following existing econometric frameworks such

[19] We introduce a natural hedging measure defined as the share of export invoiced in US Dollar (Crowley et al., 2020), and a strategic complementarities measure as the average share of imports invoiced in US Dollar among all competitors in a given sector(HS6)-origin pair Amiti et al. (2022). We also construct an instrument for the latter following Crowley et al. (2020): we use the import-weighted average US Dollar exposure of all competitors in a given sector(HS6)-origin pair, where the exposure is defined as the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade.

Figure 11: Price Sensitivities to Exchange Rates



The left (right) panel show the estimated coefficients from the specification in Equation (14) using import (export) prices as dependent variable. We use data from official customs running from 2007 to 2019 for imports and 2009 to 2019 for exports. We exclude the LCP case for export prices because of the absence of sufficient observations in the estimation.

as Adler et al. (2020), the benchmark specification is:

$$\Delta y_{jt} = \sum_l \Bigg[\underbrace{\beta_l^{y,CLP} D_j^{CLP}}_{\text{Chilean Peso}} + \underbrace{\beta_l^{y,p} D_j^{p}}_{\text{Partner}} \Bigg] \Delta e_{t-l}^{CLP/p} + \sum_l \underbrace{\beta_l^{y,D} D_j^{D} \Delta e_{t-l}^{CLP/\$}}_{\text{Dominant}} + \sum_l \underbrace{\beta_l^{y,D} D_j^{D} \Delta e_{t-l}^{\$/p}}_{\text{Dominant}} + \\ + \alpha_j + \phi x_{jt} + \delta_{t \times \Delta} + \varepsilon_{jt}, \tag{14}$$

where Δy_{jt} is the log difference between either the unit values (expressed in Chilean peso), quantity (expressed in kilograms), or values (expressed in Chilean peso) of good j between quarter t and the quarter of the last transactions. A good j is a unique combination of firm, 8-digit HS code, partner country, and invoice currency. The exchange rate $e_t^{CLP/p}$ is the log average Chilean Peso value per unit of currency p in quarter t. An increase in $\Delta e_t^{CLP/p}$ implies a depreciation of the Chilean peso with respect to currency p during the corresponding period t. $D_j^{CLP}, D_j^{p}, D_j^{D}$ are dummy variables to capture whether the transaction is invoiced in local, producer or dominant currency, respectively. For dominant-priced products, we split the bilateral peso-partner exchange rate, $\Delta e^{CLP/p}$, into the two sub-components, the sensitivity to peso-dollar fluctuations and to partner-dollar fluctuations (Barbiero, 2021).

Figure 11 plots the estimates of the cumulative exchange rate pass-through into import (left panel) and export (right panel) prices obtained from the main specification in Equation (14). We show that exchange rate pass-through varies substantially across invoicing choices, both in the short-run and in the long-run. Pass-through into import prices is zero when transactions are invoiced in local currency (Chilean peso), while it is complete when trans-

actions are invoiced in dominant and partner currencies. Pass-through rates into import prices remain at essentially the same level after two years. On the export side, pass-through rates are almost complete in the short-run when transactions are invoiced in dominant and partner currencies (80% and 90%, respectively).[20] In the long-run, the pass-through rate decreases to approximately 70% in both cases. These patterns are in line with previous findings and with the idea that prices are sticky in the currency in which they are invoiced (Chen et al., 2022; Gopinath et al., 2010).

Figure 16 in Appendix B reports the pass-through rates into import and export quantities. We show that different pass-through rates into prices translates into different response of quantities, providing evidence of allocative effects of invoicing choices (Amiti et al., 2022). Import quantities do not react in the short-run, independently of the invoicing currency. They decrease by 20% in the long-run when invoiced in dominant or partner currencies.[21] The long-run response of quantities remains essentially the same level when invoiced in local currency, in line with the fact that after a depreciation, Chilean-invoiced prices do not change. The sluggish response of quantities is in line with expenditure switching forces toward domestic goods.

Thus, abstracting away invoicing choices can improperly inform on the effects of exchange rate fluctuations on the macroeconomy (Gopinath and Itskhoki, 2022; Barbiero, 2021). We now explore the quantitative relevance focusing on the dynamics of the terms of trade.

On the Effects on Trade Balance In traditional models of international economics (e.g. Mundell-Fleming), in which international prices are invoiced in the exporter's currency, exchange rates play a key role in external adjustment. Exchange rate changes induce changes in imported and exported quantities by influencing the relative price of domestic and foreign goods. However, the widespread use of dollar invoicing, together with the large differences in price and quantity elasticities documented above, impacts how the trade balance respond to exchange rate fluctuations. We focus on the dynamics of a country's external imbalance following a movement of its exchange rate vis-a-vis all other currencies, and how invoicing patterns at the aggregate level influence its response to exchange fluctuations.

Let define the trade balance of Chile as the same of net export from the rest of the world,

[20] We do not report the pass-through rate into export prices conditional on being invoiced in Chilean peso because of very noisy estimates due to a very restricted sample of only approximately 500 observations.

[21] The magnitude of the is smaller compared to estimates from the macro (Boehm et al., 2023) or trade literature (Broda and Weinstein, 2006). Nevertheless, the quantity response may be muted by the fact that we are working with customs prices, without considering additional rounds of incomplete pass-through into final consumer prices (Auer et al., 2021).

as follow: $TB_t = \sum_{i \in I} \left(P_{it}^X Q_{it}^X - P_{it}^M Q_{it}^M \right)$, where P_{it}^X and Q_{it}^X (P_{it}^M and Q_{it}^M) are the price and quantity of exports to (import from) country i, respectively. It follows that the effect of exchange rates on the trade balance (relative to GDP, Y_t) at horizon l is given by:

$$\frac{\Delta TB_t^l}{Y_t} = \Delta e \times \frac{X_t}{Y_t} \left[\sum_{\tau=0}^{l} \left(\beta_\tau^{PX,CLP} + \beta_\tau^{QX,CLP} \right) S^{X,CLP} + \left(\beta_\tau^{PX,D} + \beta_\tau^{QX,D} \right) S^{X,D} + \left(\beta_\tau^{PX,p} + \beta_\tau^{QX,p} \right) S^{X,p} \right] \tag{15}$$

$$- \Delta e \frac{M_t}{Y_t} \left[\sum_{\tau=0}^{l} \left(\beta_\tau^{PM,CLP} + \beta_\tau^{QM,CLP} \right) S^{M,CLP} + \left(\beta_\tau^{PM,D} + \beta_\tau^{QM,D} \right) S^{M,D} + \left(\beta_\tau^{PM,p} + \beta_\tau^{QM,p} \right) S^{M,p} \right], \tag{16}$$

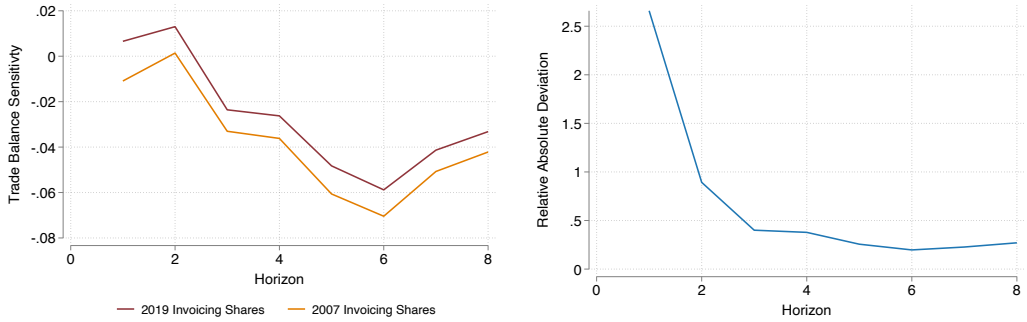
where $S^{X,z}$ ($S^{M,z}$) the share of exports (imports) invoiced in currency z, and $\beta_\tau^{j,z}$ is the elasticity of j to exchange rates when invoiced in currency z at horizon τ, with j being import and export prices and quantities ($\{PX, PM, QX, QM\}$) and $z \in \{CLP, p, D\}$. In other words, the aggregate response of trade balance to a movement of the exchange rate vis-a-vis all other currencies is a weighted sum of the response of import and export prices and quantities, weighted by their respective invoicing shares.

Figure 12 shows that the large increase in the share of Peso invoicing after the GFC lowers the sensitivity of the Chilean trade balance at all horizons. In 2019, trade balance is approximately 30% less sensitive in the long-run, while the sensitivity flips sign and become positive in the short-run. The key driver is the fact that imports denominated in Peso have lower sensitivity at all horizons, especially in the short run. The lower sensitivity of trade balance raises questions about the benefits of exchange rate flexibility.[22]

On the Effects on Terms of Trade and Import Inflation We follow the same rationale to assess how the sensitivity of import inflation and the terms of trade evolved after the GFC. Figure 18 in Appendix B shows that the import price index of Chile becomes less sensitive to exchange rate fluctuations by approximately 5% at all horizon, as a larger share of imports is non-sensitive to exchange rate fluctuations. Similarly, Figure 17 in Appendix B shows how lower import price sensitivity translates into a lower sensitivity for the terms of trade. In this case, following a depreciation, terms of trade decrease by less in 2019 compared to 2007, with a larger discrepancy in the short-run.

[22]Notice that the trade balance is not following the standard J-curve dynamic after a depreciation of the exchange rate. This is a consequence of the Dominant Currency Paradigm, which departs from the producer-pricing assumption of the traditional models of international economics.

Figure 12: Trade Balance Sensitivity to Exchange Rates



Notes: The left panel plots the 2-periods moving average of the response of the trade balance to a depreciation of the Chilean peso computed from the formulas in Equation (16). We use the estimated coefficients from Equation (14). Invoicing shares are computed from official import (export) customs data from 2007 (2009) for the initial period (orange line) and from 2019 for the last period (red line). The share of export and import on GDP is computed from IMF data. The right panel plots the difference between the response of the trade balance in 2007 and in 2019 relative to the 2019 case.

7 Conclusion

Although we know from history that abrupt shifts in the international monetary system can occur following permanent shifts in economic conditions, our analysis showcases how temporary large shocks to dollar financing availability weakens dollar dominance. We document a gradual 10 percentage point decline in the share of Chilean imports denominated in US Dollars over a decade, coupled with a corresponding increase in Chilean Peso denominations. We conduct different decomposition exercises, and show that surviving firms emerge as the primary contributors to the observed change, accounting for approximately 80% of the aggregate variation. Larger and more exposed firms to fluctuations in US Dollar exchange rate and financing take the lead in substituting the dominant currency with the Chilean Peso. Moreover, complementarities within and across firms fuel the adoption of the Chilean Peso over time.

We develop a model in which firms decide on the currency of trade credit for imported inputs. A key aspect is treating imported inputs as working capital, requiring advance financing. The decision relies on the relative interest rates on trade credit denominated in domestic and vehicle currency. In the model, temporary shock, like those from the GFC, influences the invoicing patterns. Lastly, a sunk cost associated with using a new currency for import invoicing introduces hysteresis in invoicing choices, permanently altering the convenience of invoicing in different currencies. The theory predicts that the threshold to use

domestic or vehicle currency financing depends on two forces, namely strategic complementarities and natural hedging. We extensively test the key mechanisms in the data and find evidence consistent with our theory.

We lastly explore the macroeconomic implications of large changes in invoicing patterns. We show that the sensitivity of trade balance, terms of trade, and import inflation is substantially lower in 2019 compared to 2007. Thus, our analysis demonstrates how significant shocks, such as the Great Financial Crisis, can have enduring effects on invoicing decisions at both micro and macro levels.

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A Decomposing Invoicing Share

A.1 General Intuition

Let i be a firm and k a currency. Let S_i be the share of firm i in total import (or export). Also, let Λ_{ik} be the share of import (export) denominated in currency k by firm i. Define for any variable X:

$$\Delta X_t \equiv X_t - X_{t-1},$$
$$\overline{X_t} \equiv \frac{1}{2}(X_t + X_{t-1}),$$
$$\Delta X_T \equiv X_t - X_0,$$

We can now decompose:

$$\Delta\Lambda_{kt} = \underbrace{\sum_i \overline{S_{it}}\Delta\Lambda_{kit}}_{\text{Within}} + \underbrace{\sum_i \Delta S_{it}\overline{\Lambda_{kit}}}_{\text{Cross}}. \tag{17}$$

It follows that:

$$\Delta_T\Lambda_k = \sum_t\sum_i \overline{S_{it}}\Delta\Lambda_{kit} + \sum_t\sum_i \Delta S_{it}\overline{\Lambda_{kit}}. \tag{18}$$

We account for firms' entry and exit. Let Ω_{kt} be the set of firms denominating in currency k at time t, $\overline{\Omega_{kt}}$ be the set of common firms between time t and $t-1$, Ω^+_{kt} the set of new firms at time t, and Ω^-_{kt} the set of firms exiting between time t and $t+1$. We can then write:

$$\Delta\Lambda_{kt} = \underbrace{\sum_{i\in\overline{\Omega_{kt}}} \overline{S_{it}}\Delta\Lambda_{kit}}_{\text{Within}} + \underbrace{\sum_{i\in\overline{\Omega_{kt}}} \Delta S_{it}\overline{\Lambda_{kit}}}_{\text{Cross}} + \underbrace{\sum_{i\in\Omega^+_{kt}} S_{it}\Lambda_{kit} - \sum_{i\in\Omega^-_{kt-1}} S_{it-1}\Lambda_{kit-1}}_{\text{Net Entry}}. \tag{19}$$

A.2 Derivations

Let λ_{ikt} and s_{it} be the share of firm i's imports invoiced in currency k at time t and the import share of firm i at time t on the total imports of Chile, respectively.[23] Thus, the change in the aggregate share of total imports invoiced in currency k at time t, $\Delta\Lambda_{kt}$, can

[23] Thus, $\lambda_{ikt} = \frac{\text{Imports of } i \text{ denominated in } k}{\text{Imports of } i}$ and $s_{it} = \frac{\text{Imports of } i}{\text{Total imports Chile}}$.

be written as follow:

$$\Delta\Lambda_{kt} = \underbrace{\sum_{i\in inc} \lambda_{ikt} s_{it} - \sum_{i\in inc} \lambda_{ikt-1} s_{it-1}}_{\Delta\text{Incumbents}} + \underbrace{\sum_{i\in ent} \lambda_{ikt} s_{it} - \sum_{i\in ex} \lambda_{ikt-1} s_{it-1}}_{\text{Net Entry}} \tag{20}$$

$$= \underbrace{\lambda^{inc}_{kt} - \lambda^{inc}_{kt-1}}_{\Delta\text{Incumbents}} + \underbrace{\alpha^{en}_{kt}(\lambda^{en}_{kt} - \lambda^{inc}_{kt})}_{\text{Entry}} - \underbrace{\alpha^{ex}_{kt-1}(\lambda^{ex}_{kt-1} - \lambda^{inc}_{kt-1})}_{\text{Exit}}, \tag{21}$$

where a firm i is considered an incumbent (inc) when $s_{it} > 0$ and $s_{it-1} > 0$, entrant (en) when $s_{it} > 0$ and $s_{it-1} = 0$, and exiting (ex) when $s_{it} = 0$ and $s_{it-1} > 0$. In other words a firm is considered: an incumbent if it imports goods for two consecutive periods, an entrant firm it starts importing in the current period and, an exiting firm if it stops importing in the current period. In addition, let λ^{en}_{kt}, λ^{inc}_{kt} and λ^{ex}_{kt} denote the aggregate share of imports invoiced in currency k of all the firms entering in period t, of all the firms that survived between period t and $t-1$, and of all the firms that exit at period t, respectively. Lastly, α^{en}_{kt} and α^{ex}_{kt-1} represent the aggregate share of imports of entrant and exiting firms, respectively.

Equation (21) allows us to determine whether the aggregate variation observed in Figure 3 is mainly driven by incumbents firms or by the entry or exit of firms. Intuitively, if the aggregate change is due to incumbents firms, Equation (21) implies that the group of incumbent firms have been importing less in US Dollar over time and thus contributing to the decline in the aggregate share we observe in the data ($\lambda^{inc}_{kt} < \lambda^{inc}_{kt-1}$). Similarly, Equation (21) captures the case in which entrant firms have been importing less in US Dollar over time with respect to a reference level given by the aggregate share of the surviving firms ($\lambda^{en}_{kt} < \lambda^{inc}_{kt}$). In addition, their contribution is properly weighted by their import market share α^{en}_{kt}. The same logic applies to the last terms in Equation (21) referring to the group of the exiting firms.

We further decompose Equation (21) to quantify the change in the aggregate share of incumbents that it is played by within firms dynamics and between firms reallocation:

$$\lambda^{inc}_{kt} - \lambda^{inc}_{kt-1} = \underbrace{\sum_{i\in inc} \Delta\tilde{s}_{it}\overline{\lambda_{ikt}}}_{\text{Incumbent - Between}} + \underbrace{\sum_{i\in inc} \Delta\lambda_{ikt}\overline{\tilde{s}_{it}}}_{\text{Incumbent - Within}}, \tag{22}$$

where $\overline{x_t} \equiv \frac{1}{2}(x_t + x_{t-1})$, $\Delta x_t \equiv x_t - x_{t-1}$, and $\tilde{s}_{it}$ denotes the import share of firm i at time t relative to the total import of incumbents firms.[24] The first term is the between-

[24] Hence, $\tilde{s}_{it} = \frac{\text{Imports of } i}{\text{Total imports of } inc}$.

firm contribution and it assesses the role played by across firms reallocation in the share of imports denominated in US Dollar. By contrast, the second term quantifies the role played by within-firm substitution in the denomination of the same quantity of imports across different currency.

Lastly, we further decompose the within-firm component to understand whether the observed change in the US Dollar invoicing share of incumbent firms is driven by a shift in their sourcing strategies across origin×product, $o \times g$, or whether it is due to a simple reduction in the quantity of imports within origin×product. Specifically, the change in the share of i's imports invoiced in currency k, $\Delta\lambda_{ikt}$, can be decomposed as follows:

$$\begin{aligned}\Delta\lambda_{ikt} = &\underbrace{\sum_{o\times g\in I_{it}} \Delta\lambda_{ikto\times g}\overline{\hat{s}_{ito\times g}}}_{\text{Within origin-product}} + \underbrace{\sum_{o\times g\in I_{it}} \overline{\lambda_{ikto\times g}}\Delta\hat{s}_{ito\times g}}_{\text{Between origin-product}} + \\ &+ \underbrace{\sum_{o\times g\in I^{+}_{it}} \lambda_{ikto\times g}\hat{s}_{ito\times g}}_{\text{Origin-Product entry}} - \underbrace{\sum_{o\times g\in I^{-}_{it}} \lambda_{ikt-1o\times g}\hat{s}_{it-1o\times g}}_{\text{Origin-Product exit}},\end{aligned} \tag{23}$$

where I_{it}, I^{-}_{it} and I^{+}_{it} refer to the set of origin-product from which firm i imports both in t and $t-1$ (continuing origin-product), only in $t-1$ (exiting origin-product) and only in t (entrant origin-product), respectively. $\hat{s}_{ikto\times g}$ denotes the share of imports of firm i from origin-product $o \times g$ over the total import imports of firm i.[25]

[25] Formally, $\hat{s}_{ikto\times g} = \frac{\text{Imports of } i \text{ from } o \times g}{\text{Total imports of } i}$.

B Additional Results

B.1 Additional Results: Decomposition

Table 3: Dynamic Olley-Pakes Decomposition with Entry and Exit: Imports at the Origin-Product Level

	USD	Peso	Euro	Others
-				
Aggregate Invoicing Share	-9.452	6.093	3.611	-0.251
Contribution Net Entry				
Total	-1.769	0.778	0.813	0.178
Firm Entry	-2.618	0.856	1.872	-0.110
Firm Exit	0.850	-0.078	-1.059	0.288
Contribution Incumbents				
Total	-7.683	5.315	2.798	-0.430
Within Firm	-4.560	6.367	-1.337	-0.470
Between Firm	-3.123	-1.052	4.134	0.041
Within Firm				
Total	-4.560	6.367	-1.337	-0.470
Net Entry Origin	-0.489	0.875	-0.188	-0.198
Within Origin	-4.801	5.192	-0.213	-0.177
Between Origin	0.729	0.301	-0.935	-0.095

Notes: The Table reports the results from the dynamic Olley-Pakes decomposition with entry and exit for imports at the origin-product level. It shows the corresponding numbers of Equations (21), (22), and (23).

Table 4: Dynamic Olley-Pakes Decomposition with Entry and Exit: Imports at the Origin Level

	USD	Peso	Euro	Others
-				
Aggregate Invoicing Share	-9.452	6.093	3.611	-0.251
Contribution Net Entry				
Total	-1.769	0.778	0.813	0.178
Firm Entry	-2.618	0.856	1.872	-0.110
Firm Exit	0.850	-0.078	-1.059	0.288
Contribution Incumbents				
Total	-7.683	5.315	2.798	-0.430
Within Firm	-4.560	6.367	-1.337	-0.470
Between Firm	-3.123	-1.052	4.134	0.041
Within Firm				
Total	-4.560	6.367	-1.337	-0.470
Net Entry Origin	0.634	0.080	-0.222	-0.491
Within Origin	-6.118	5.589	0.435	0.095
Between Origin	0.924	0.699	-1.549	-0.074

Notes: The Table reports the results from a dynamic Olley-Pakes decomposition with entry and exit for imports at the origin level. It shows the corresponding numbers of Equations (21), (22), and (23).

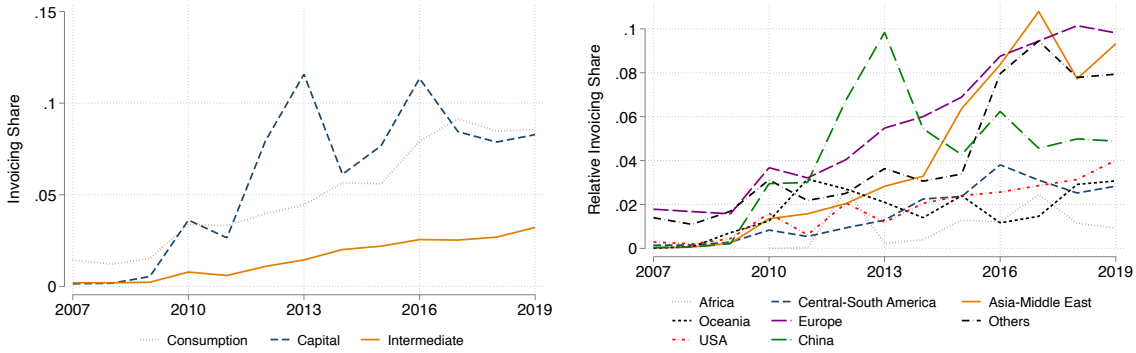
Table 5: Dynamic Olley-Pakes Decomposition with Entry and Exit: Exports at the Firm Level

	USD	Peso	Euro	Others
-				
Aggregate Invoicing Share	0.488	0.009	-0.949	0.452
Contribution Net Entry				
Total	0.015	-0.000	-0.230	0.215
Firm Entry	-0.305	0.012	0.087	0.205
Firm Exit	0.319	-0.013	-0.317	0.010
Contribution Incumbents				
Total	0.473	0.009	-0.719	0.237
Within Firm	0.717	-0.326	-0.472	0.081
Between Firm	-0.244	0.335	-0.247	0.156
Within Firm				
Total	0.717	-0.326	-0.472	0.081
Net Entry Destination	-1.551	2.107	-0.528	-0.028
Within Destination	0.932	-2.445	1.272	0.242
Between Destination	1.336	0.013	-1.215	-0.133

Notes: The table reports the results from the benchmark dynamic Olley-Pakes decomposition with entry and exit for export at the firm level. It shows the corresponding numbers of Equations (21), (22), and (23).

B.2 Additional Results: Product vs Origin

Figure 13: Subgroup by Origin or Product Type - Chilean Peso Invoicing



Notes: The left panel shows the evolution of the invoicing share in Chilean Peso in imported goods within three broad product categories: Consumption, capital, and investment goods as defined according to the BEC classification. The right panel shows the evolution of the invoicing share in Chilean Peso in imported goods within major trade partners: USA, Europe, China, Central-South America, Asia-Middle East, Africa and Others.

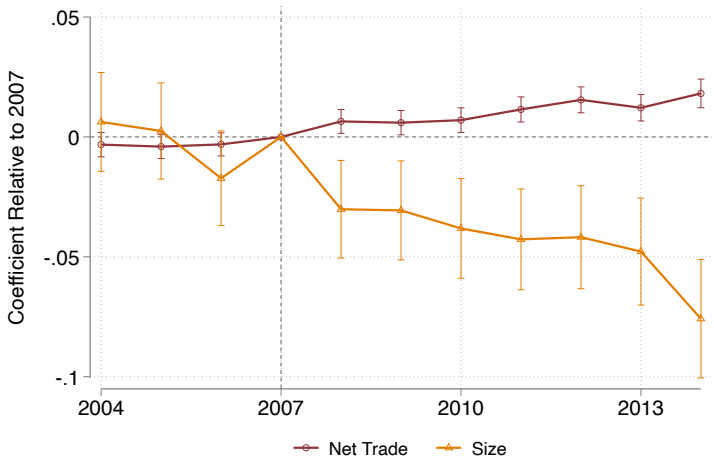
B.3 Additional Results: Role of trade credit

Figure 14: Trade Credit and Invoicing

Notes:

B.4 Additional Results: Model Validation

Figure 15: Testing the Model - Event Study



Note: The Figure plots the coefficients β_τ from the event study specification in Equation (11), capturing the differential reduction in US Dollar invoicing by more exposed firms. Coefficient in 2007 is normalized to zero. Exposure is measured by: i) the difference between the total exports denominated in US Dollar and the total imports denominated in US Dollars normalized by the firm's total trade ("Net Trade"); ii) the market share of a firm in a given product-origin pair ("Size"). Data are from Garcia-Marin et al. (2019).

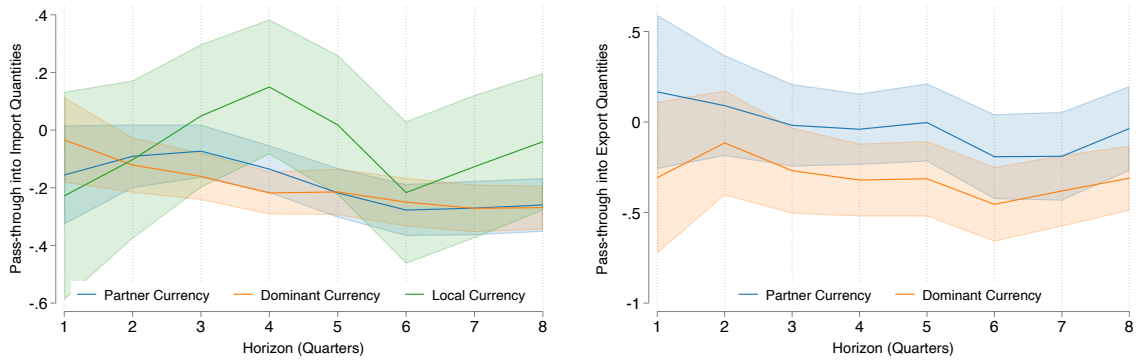
Table 6: Testing the Model - Sunk Cost

	Dummy USD			Share USD		
	(1) OLS	(2) OLS	(3) IV	(4) IV	(5) First Difference - IV	(6) First Diffrence - GMM
Lagged Dollar Share	0.160	0.062	0.061	0.158		
	(0.000)	(0.005)	(0.005)	(0.044)		
Lagged ΔDollar Share					-0.382	-0.224
					(0.017)	(0.013)
Controls	No	Yes	Yes	Yes	Yes	Yes
Origin × Year & Product × Year	Yes	Yes	Yes	No	No	No
Firm × Product × Origin & Year	No	No	No	Yes	Yes	No
Observations	1776386	768375	768375	623768	356394	260203

Note: The Table reports the coefficients from specification in Equation (13). The dependent variable in specifications (1) to (5) is a dummy variable equal to 1 when US Dollar invoicing is used and 0 otherwise; The dependent variable in specifications (5) to (7) is the (log) share of US Dollar invoicing. Column (6) is estimated in first difference via OLS. Column (7) is estimated using an Arellano-Bond GMM estimator using lagged levels of the right-side variables as instruments. "Lagged Dollar Share" refers to the lagged (log) share of US Dollar invoicing at the firm-origin-product level. Controls include: a natural hedging measure defined as the share of export invoiced in US Dollar; a strategic complementarities measure as the average share of imports invoiced in US Dollar among all competitors in a given sector(HS6)-origin pair. IV columns refers to the case in which the strategic complementarity measure is instrumented with the import-weighted average US Dollar exposure of all competitors in a given sector(HS6)-origin pair. Standard errors are clustered at firm level. We use data from official customs 2007-2019.

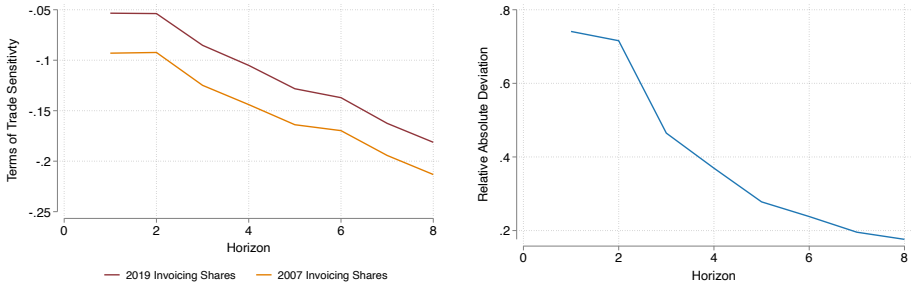
B.5 Additional Results: Counterfactual Exercises

Figure 16: Quantity Sensitivities to Exchange Rates



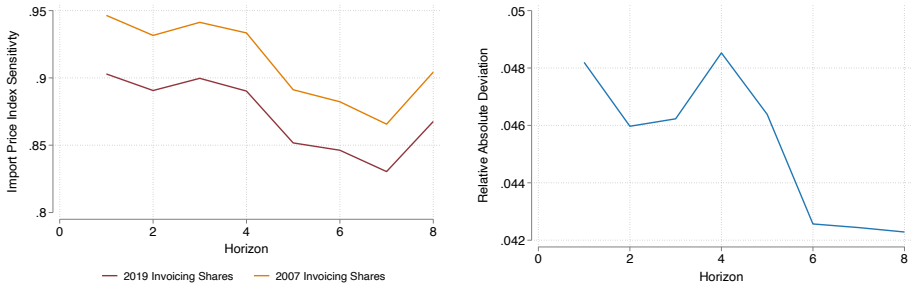
Notes: The left (right) panel show the estimated coefficients from the specification in Equation (14) using import (export) quantities as dependent variable. We use data from official customs running from 2007 to 2019 for imports and 2009 to 2019 for exports. We exclude the LCP case for export quantities because of the absence of sufficient observations in the estimation.

Figure 17: Terms of Trade Sensitivity to Exchange Rates



Notes: The left panel plots the 2-periods moving average of the response of the terms of trade (TOT) to a depreciation of the Chilean peso. For each horizon l, we use the following formula: $\Delta TOT_t^l = \Delta e \left[\sum_{\tau=0}^{l} \beta_\tau^{PX,CLP} \times S^{X,CLP} + \beta_\tau^{PX,D} \times S^{X,D} + \beta_\tau^{PX,p} \times S^{X,p}\right] - \Delta e \left[\sum_{\tau=0}^{l} \beta_\tau^{PM,CLP} \times S^{M,CLP} + \beta_\tau^{PM,D} \times S^{M,D} + \beta_\tau^{PM,p} \times S^{M,p}\right]$. We use the estimated coefficients from Equation (14). Invoicing shares are computed from official import (export) customs data from 2007 (2009) for the initial period (orange line) and from 2019 for the last period (red line). The right panel plots the difference between the response of the trade balance in 2007 and in 2019 relative to the 2019 case.

Figure 18: Terms of Import Inflation to Exchange Rates



Notes: The left panel plots the response of the import price index (IPI) to a depreciation of the Chilean peso. For each horizon l, we use the following formula: $\Delta IPI_t^l = \Delta e \left[\sum_{\tau=0}^{l} \beta_\tau^{PM,CLP} \times S^{M,CLP} + \beta_\tau^{PM,D} \times S^{M,D} + \beta_\tau^{PM,p} \times S^{M,p}\right]$. We use the estimated coefficients from Equation (14). Invoicing shares are computed from official import customs data from 2007 for the initial period (orange line) and from 2019 for the last period (red line). The right panel plots the difference between the response of the trade balance in 2007 and in 2019 relative to the 2019 case.