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Import Prices and Invoice Currency: Evidence from Chile *

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Abstract

We use transaction-level customs data to document that a large majority of Chilean imports are invoiced in dollars regardless of country of origin and sector. We study the implications of this fact for the determination of exchange rate pass-through (ERPT) to border prices. We find that the special role of the dollar in international trade has real effects, but bilateral exchange rates with respect to exporter currencies also matter in the medium-term. In particular, exchange rate fluctuations against the dollar account for most of the ERPT in the short run and are still relevant after two years. However, the cumulative ERPT with respect to the exporter country's currency increases with time and after two years accounts for most of the ERPT to border prices.

JEL: F3, F4.

Keywords: Invoice currency, Exchange rate pass-through.

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1 Introduction

The sensitivity of domestic prices to nominal exchange rate fluctuations has long been a core topic in international macroeconomics. The level and determinants of exchange-rate pass-through (ERPT) have important implications for the international transmission of monetary shocks, inflation, and optimal monetary policy. The extent to which nominal exchange rate shocks affect relative prices and the reaction in quantities is a core area of study and a continuous source of public debate. The issue is particularly relevant in emerging market economies with commodity currencies, as is the case of Chile, given that they are usually subject to large nominal exchange rate swings.

A recent surge in studies on ERPT with the help of the increasing availability of microdata has uncovered important patterns not explored in earlier literature. Three such findings are of particular interest to this study. First, ERPT differs whether prices are measured at the border (i.e. at point of entry to the country) or at the retail (i.e. consumer) level. In particular, prices at the border are more sensitive to exchange rate fluctuations than prices at the retail level (see for example Burstein et al., 2003, or Berger et al., 2012). Second, most of international trade is conducted in US dollars (USD), a vehicle currency, regardless of origin or destination (see for example Goldberg and Tille, 2008). Third, the currency of invoice of imports matters for the level of ERPT. Specifically, countries where most of their imports are invoiced in USD have systematically higher ERPT than countries that do not (see Gopinath, 2015).

We focus on the role of the currency of invoice of imports in the determination of ERPT at the border. This exercise was originally motivated by a recurrent concern in Central Banks in emerging economies, namely: what exchange rate parity is relevant to identify inflation pressures going forward, the USD or the nominal effective exchange rate? We explore this issue empirically using transaction-level microdata from the Chilean Customs for the 2004-

2015 period. We analyze the invoicing pattern of Chilean imports to then disentangle the role of the currency of invoice *vis a vis* the exporter currency in the determination of ERPT at different time horizons. We first document that over 90 percent of Chilean imports (in value) are invoiced in USD, despite the fact that imports from the US account for roughly 12 percent of Chilean trade. This mismatch in trade originating in the US and trade invoiced in USD is in line with previous findings for other emerging economies (see for example Campa and Goldberg, 2005, or Gopinath et al., 2010, among others).

Given the distinct role of the USD in Chilean imports, we quantify the contribution of the invoicing currency and the exporter currency to the ERPT to border prices at different time horizons. That is, we make a distinction between ERPT due to fluctuations in the bilateral CLP-USD nominal exchange rate (invoice currency), and due to fluctuations in the bilateral CLP-X exchange rate (exporter countrys currency), and we analyze its dynamics. The distinction of ERPT according to currencies and time horizons is of interest to both practitioners and theorists. On the practitioner side, it addresses the question of which exchange rate parity matters to identify inflation pressures from international nominal shocks in the short and medium-term, among other relevant issues. On the theoretical side, it helps distinguish across different pricing assumptions and their implications for relative prices: producer currency pricing (PCP), where exporters price in their own currency, local currency pricing (LCP), where exporters price in their destination's currency, or the more recent dominant currency pricing (DCP), where exporters price in one of a few dominant currencies (notably the USD).[1]

Our main empirical result is that both the CLP-USD and the CLP-X parities matter for ERPT at the border for different time horizons. The CLP-USD nominal exchange rate dominates ERPT dynamics in the short run, but the exporter currency gains prominence with time and reverts this result in the medium-term. Specifically, the ERPT to border

[1]See Casas et al., 2017 for an exposition on DCP.

prices is higher after one quarter for a bilateral CLP-USD depreciation than for a bilateral CLP-X depreciation (73 vs. 10 percent), but lower after 2 years (27 vs. 39 percent).[2] A multilateral depreciation of the Chilean peso (a depreciation with respect to both the USD and the exporter currency) results in a high but incomplete ERPT in the medium-run. We also find that the ERPT at the border is higher for imports invoiced in the exporters currency (the majority of them are from USD origin) than for imports invoiced in USD from non-USD exporting countries.

Our findings are consistent with DCP, but they also give a relevant role to the exporter currency in the medium-term, regardless of invoicing, closer to the flexible price benchmark.[3] The high short-run USD ERPT into import prices can be rationalized as the consequence of two features: Short-run nominal rigidities in the currency of invoice (see Fitzgerald and Haller, 2012, for an account on the role of nominal rigidities in international trade) and the USD as the major currency of invoice. In the medium-run, the incomplete ERPT to border prices is in accordance with previous findings (see Burstein and Gopinath, 2014, for a survey). This result can be replicated with models where strategic complementarities give rise to real rigidities such as variable markups in response to shocks (see Gopinath and Itskhoki, 2010, for a survey on real rigidities). Our finding on the composition of the ERPT confirms the relevance of the USD in determining relative prices even in the medium-run, but to a lesser extent than a strict DCP hypothesis. We instead find an important role for the CLP-X parity in the medium-term, hinting at a stronger sensitivity of marginal costs and/or desired markups in the exporting country to fluctuations in the value of its own currency.

Our paper contributes to the growing body of literature that tries to understand the real effects of nominal exchange rate shocks with the use of microdata. On the empirical side,

[2]Although for most specifications the ERPT difference after two years is not statistically significant, the point estimates are consistently higher for CLP-X than for CLP-USD.

[3]In the flexible price benchmark the ERPT with respect to the exporter countrys currency depends on the degree of strategic complementarities and on local competitor's marginal costs. See Casas et al. (2017) for a theoretical discussion on pricing assumptions.

this literature could be roughly divided into two strands. One strand uses case studies to analyze the ERPT associated with particular depreciation/appreciation episodes. Burstein et al. (2007) is a seminal study of this kind, focusing on Argentina's large devaluation in early 2002. The appreciation of the Swiss Franc in January 2015 represented a recent, relatively clean, nominal natural experiment, exploited by Auer et al. (2018) or Bonadio et al. (2018). As in our work, these papers find that the ERPT to domestic prices is incomplete and that the currency of invoice does have a differential effect.

This study is inscribed in the second strand, which uses distributed lag regressions to evaluate the ERPT at different horizons, without focusing on particular episodes of exchange rate volatility, as surveyed in Burstein and Gopinath (2014). We find this approach to be better suited for our purposes because it can disentangle between bilateral and multilateral fluctuations of the domestic currency. This strand of literature also finds that the ERPT at the border is incomplete (see for example Campa and Goldberg, 2005), as is the case in our own estimates for Chile. Within this framework, we dig into the special role of the USD as a vehicle currency in international trade. Unlike papers like Goldberg and Tille (2008), Engel (2006) or Gopinath et al. (2010), who evaluate the reasons behind the special role of the USD, we focus on its empirical implications for relative prices. Casas et al. (2017) argue that the exchange rate parity against the USD explains all the ERPT to border prices at a 1-year horizon, a finding consistent with a strong version of DCP. We also find support for DCP, since exchange rate fluctuations against the USD have permanent real effects in our data, but we additionally find a significant role for the exporter currency at 2-year horizons. This could be interpreted through the lens of the permanent-transitory confusion. As was first presented in Muth's (1961) influential paper, rational agents that observe a shock with permanent and transitory components, overtime infer a higher weight of the permanent component. [4] In this framework, our results hint that the higher the weight attached to the permanent component

[4] See Cukierman et al. (2018) for a recent exposition of the problem applied in macroeconomic and financial frameworks.

of a shock, the higher the PCP component in import pricing. However, as is the case in the rest of the studies in this strand of literature, our empirical approach does not explicitly explore the role of shock persistence in the determination of ERPT.

The rest of the paper is structured as follows. Section 2 describes the empirical strategy and methodological aspects of our work. Section 3 explains the features of the dataset and our handling of the data. Section 4 documents the invoice of Chilean imports and presents the main results of the paper, together with a series of robustness checks for different disaggregation of the data. Section 5 concludes.

2 Methodology

To quantify the degree of exchange rate pass-through to import prices, we start by considering dynamic-lag regressions of the type surveyed by Burstein and Gopinath (2014). Pass-through regressions estimate the sensitivity of prices to exchange rates in a given location, controlling for other relevant variables. We first regress quarterly changes in import prices in domestic currency (Chilean pesos) on changes in contemporaneous and lagged bilateral exchange rates. That is,

$$\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i \Delta ber_{xt-i} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt} \,, \tag{1}$$

where p_{gcxt} is import prices of good g, invoiced in currency c, imported from country x at time t, ber is the exchange rate between Chilean pesos and the exporter country's currency, $\mathbf{z}$ is a set of controls including exporter country's inflation and domestic activity and inflation,

α is a set of fixed effects, and Δ is the first difference quarterly operator.[5] All variables are expressed in logarithms. The Q-periods cumulative ERPT of an exchange rate movement at time 0 is captured by $\sum_{i=0}^{Q} \beta_i$. The inclusion of fixed effects in the regression implies that identification of the Q-periods cumulative exchange rate pass-through is achieved through variation of prices at the good, invoice, and country level.

We then gauge the degree of ERPT according to invoice currency. With nominal price stickiness, the currency of invoice in international trade transactions is a key determinant of the degree of ERPT and the transmission of monetary policy, at least in the short-run. Taking the currency in which the price of goods are set as given, we measure the degree of ERPT of transactions invoiced in the exporter country's currency as well as transactions invoiced in USD. To do so, we pool together all the goods that are invoiced in the exporter currency, and otherwise we consider all goods that are invoiced in USD.[6] Interacting the invoice currency with the associated exchange rate, we measure the ERPT for each currency of invoice

$$\begin{aligned} \Delta p_{gcxt} &= \sum_{i=0}^{8} \beta_i^{ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd} \Delta usd_{t-i} \times D_{invoice=usd} \\ &\quad + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt} , \end{aligned} \tag{2}$$

with $D_{invoice=x}$ indexing transactions invoiced in the exporter country's currency, $D_{invoice=usd}$ indexing transactions invoiced in USD, and usd is the CLP-USD parity. Cumulative ERPT of transactions invoiced in the currency of country x is $\sum_{i=0}^{Q} \beta_i^{ber}$ and $\sum_{i=0}^{Q} \beta_i^{usd}$ for transactions invoiced in USD.

[5] In our definition a Chilean currency depreciation is an increase in the nominal exchange rate.

[6] Goods imported from United States invoiced in USD are pooled with the first group of goods, i.e those that invoice in the exporter's currency.

We further quantify the role of the exporter currency's exchange rate from non-dollar origins for those transactions invoiced in USD, which make up the bulk of Chilean imports. Equation 2 abstracts from the effects of bilateral exchange rates with respect to the exporting currency on import prices. To answer this question, we add an interaction term in the previous specification, between transactions invoiced in USD and the CLP-X exchange rate.

$$\begin{aligned}\Delta p_{gcxt} \;=\; & \sum_{i=0}^{8} \beta_i^{ber;\,ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd;\,usd} \Delta usd_{t-i} \times D_{invoice=usd} + \\ & + \sum_{i=0}^{8} \beta_i^{ber;\,usd} \Delta ber_{xt-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}\,, \end{aligned} \tag{3}$$

where $\sum_{i=0}^{Q} \beta_i^{ber;usd}$ is the cumulative ERPT with respect to the exporter currency for transactions invoiced in USD.

With this specification we want to test the following hypothesis: in the short-run, and given nominal rigidities in the currency of invoice, the ERPT to import prices for goods shipped from non-USD origins invoiced in USD should be high with respect to the USD, but low with respect to the exporter currency. Casas et al. (2017) find this result for Colombia, consistent with a strict DCP with strategic complementarities. However, for longer time horizons, the ERPT with respect to the USD should moderate as nominal rigidities ease, and import prices should tend to those under flexible prices. The ERPT with respect to the exporter-currency should thus become more relevant. Our specification lets us test this hypothesis. For the cumulative USD ERPT, $\sum_{i=0}^{Q} \beta_i^{usd;\,usd}$, the hypothesis anticipates a decreasing pattern in Q; while for the cumulative bilateral ERPT, $\sum_{i=0}^{Q} \beta_i^{ber;\,usd}$, this hypothesis anticipates an increasing pattern in Q.

3 Data

Our data is drawn from Customs Import Declaration collected by Chile's National Customs Service. The data covers the universe of Chilean imports, about 300,000 transactions per month.[7] From the Customs Import Declaration we use information of each transaction shipments value, invoice currency, and country of origin and shipment. Our study focuses on the 2004-2015 period. The database classifies goods according to an 8-digit classification system, equivalent to the US' 10-digit Harmonized System (HS10). The level of dissagregation within each category varies. For example, one category corresponds to *wine from fresh grapes, in recipients smaller than 2 liters, with designation of origin, elaborated with organic grapes, Sauvignon Blanc*, while another one corresponds to *Synthetic fiber suit for man or child.*

A typical shortcoming of customs declarations is they do not contain information on prices. Our dataset is not an exception. As is usual in the related literature (see for example Berman et al., 2012, Casas et al., 2017, and Amiti et al., forthcoming) we proxy them through unit values. In particular, the price of good g, invoiced in currency c, shipped from country x, in month m with shipment number s is

$$P_{gcxms} = \frac{\text{Import value}_{gcxms}}{\text{Import quantity}_{gcxms}}$$

For each triplet (g, c, x) we have a set of prices (proxied by unit values).[8] However, our empirical analysis requires collapsing all the price variation within a quarter to a single number. We define the price of the triplet (g, c, x) at time t as the median across all items shipped over this period.[9] That is,

[7] Official aggregate statistics on Chilean trade are built upon the same dataset.

[8] Our sample of exporting countries includes Argentina, Australia, Austria, Belgium, Brazil, China, Colombia, Finland, France, Germany, India, Indonesia, Italy, Japan, Malaysia, Netherlands, Paraguay, Peru, Republic of Korea, Sweden, Switzerland, Thailand, Turkey, United Kingdom, and the United States.

[9] We consider as well collapsing the data by taking the mean and weighted (by the shipment value) mean across prices. All our results carry through under these alternatives, but with less precision. Hence, we stick

$$P_{gcxt} = \text{Median}\left(P_{gcxms} | g,\, c,\, x,\, t\right)$$

Even though Chile's 8-digit classification system is very detailed for international standards, we still encounter heterogeneity within codes that may generate spurious price variations.[10] To deal with this issue we follow the Central Bank of Chile's procedure to build aggregate unit value import indexes (see Méndez, 2007). Following this procedure, we constrain our attention to transactions with the same classification codes as those considered by the Central Bank of Chile, which leaves out very heterogeneous varieties whose price is not well represented by unit values.[11] We also exclude items with price variation anomalies that likely originate in errors in the reported unit scale (for example, they are reported in thousands of units when they should be reported in units).[12] In particular, we keep transactions that are not too far apart from the imported quantity mode for a given country, 8-digit code, and year.[13] As in Casas et al. (2017) we only consider transactions where the imported good is produced and shipped from the same country. We also drop those transactions that contain obvious errors such as missing values in quantities or value, or where the classification code does not belong to the classification system. Finally, our regressions do not consider the top 5% price variations (in absolute value) of a given country, year, and quarter or a given 8-digit classification code, year, and quarter.[14]

The source of data for the aggregate controls are twofold. Quarterly average bilateral exchange rate data between CLP and the exporter country's currency is from the Central Bank

to the median as our price measure.

[10]The main drawback of using unit values instead of prices is that they reflect price changes as well as changes in product mix. For a discussion about this issue see Alterman (1991) and Silver (2007).

[11]A large majority of categories that remain in the database are still heterogeneous goods according to the Rauch classification.

[12]The unit of analysis for the Central Bank of Chile is the code-country pair. To follow as close as possible their cleaning procedure, and just for this purpose, we treat two observations with the same 8-digit code and shipped from the same country as corresponding to the same item.

[13]We define the amount of digits of the modal value, and consider the shipments with quantities in which digits are between the modal value plus minus two.

[14]Our results hold if we take into account these observations, but our estimates are less precise.

of Chile. Inflation is measured through the Gross Domestic Product Deflator.[15] Exporter countries' inflation is from the International Financial Statistics (International Monetary Fund). Chilean inflation and Gross Domestic Product are from the Central Bank of Chile.[16]

4 Results

4.1 The Currency of Invoice of Chile's Imports

In this section, we briefly describe the currency of invoice of Chilean imports since, to our knowledge, this has not been previously documented. Our results can be summarized in the following statements: (i) The large majority of Chilean imports are invoiced in USD; and (ii) no imports are invoiced in Chilean Pesos.

Most of Chile's imports are denominated in USD. Table 1 documents the share of imports invoiced in USD, Euros (EUR), Japanese Yen (JPY), British Pound (GBP), and other currencies over time. On average, 90 percent of Chilean imports, by value, are denominated in USD.[17] This is consistent with evidence presented by Gopinath (2015) for other emerging economies.

Chilean imports are mostly invoiced in USD regardless of country of origin, with the exception of countries in the Eurozone. Figure 1 shows the invoice currency by region of origin. For example, European countries not in the European Union also heavily invoice in USD. 98 percent of imports from Mercosur, 97 percent of imports from the rest of Latin America, and 99 percent of imports from Asia (excluding Japan) are denominated in USD. An exception is Germany, where two-thirds of its exports to Chile are invoiced in EUR. But

[15] Whenever countries do not report the Deflator we use the Consumer Price Index.

[16] Some series were incomplete. In these cases, we fill the missing values with data from the Federal Reserve Economic Database.

[17] Results are similar if measured as a share of total inbound transactions.

even in Germany, about a third of exports to Chile are invoiced in USD.

The second most used currency is the EUR, in a far second place, which in 2014 accounted for 14 percent of transactions and 8 percent of the value of imports. The EUR is used mostly in imports originating in the Eurozone, but it also has minor share in imports originating from Mercosur (1.2 percent), European countries not in the European Union (5.1 percent), Africa (7.4 percent), and the Middle East (2.7 percent). Japan, Great Britain, and Switzerland also invoice a non-negligible share of their exports to Chile in their own currencies. Their overall impact on Chilean invoice stats is, however, small: the British Pound (GBP) has a 0.8 percent share in shipping and 0.3 percent in value and the Japanese Yen (JPY) a 0.6 percent and 1.7 percent share, respectively. The invoicing currency pattern documented here is consistent with the theoretical predictions of Goldberg and Tille (2008). More concretely, the dominant role of the USD, and to a lesser extent the EUR, are predicted by exporters from small countries to be less likely to invoice in their own currencies.

The preeminence of the USD holds across sectors. Figure 2 shows the invoice currency by 2-digit sectors. The share of transactions in USD represents more than 60 percent of transactions in all sectors and exceeds 80 percent for most sectors. If we define a sector according to a 4-digit HS classification, there were over 1100 sectors represented in Chilean imports in 2014. About 10 percent of those sectors traded exclusively in USD, and in 93 percent of them the USD accounts for over half of imports. From a theoretical perspective however, the overwhelming role of the USD across sectors is tougher to rationalize. The emergence of a common invoicing pattern might be explained by the USD being the currency with lowest transactions costs among currencies.

Finally, no imports in Chile are invoiced in domestic currency units. This is an extreme version of a feature also found in most emerging economies: Most of international trade in such countries is invoiced in foreign currency. This is true for most of the years in our sample. In a few years (between 2004 and 2005) there are some recorded transactions in CLP, but they amount to less than 0.1 percent of total imports.

4.2 ERPT to Border Prices

Given that the USD has a dominant role in Chilean imports, what is the induced change in the relative price of imports from a depreciation of the CLP against the USD and other currencies? We try to understand the role of the currency of invoice and country of origin in the ERPT to border prices empirically through a series of steps. In the first step, we run a dynamic panel regression of Chilean border import prices with respect to the bilateral exchange rate of the exporting country, regardless of their currency of invoice (see Equation 1). We control for exporting country's aggregate prices and for Chilean aggregate prices and economic activity. The results are displayed in Table 2 and Figure 3. The ERPT from a depreciation in the bilateral exchange rate CLP-X, where X is the exporting country, is 60 percent in the first quarter and remains relatively stable through eight quarters. This result is in line with previous findings using aggregate data in Campa and Golberg (2005). This first approximation has at least two shortcomings for our purposes. First, the coefficient on the exporter currency exchange rate could also be capturing movements in the CLP-USD parity. That is, it could be capturing both a bilateral depreciation against the exporter currency and a depreciation against the USD.[18] Second, the coefficient on the bilateral exchange rate is an average of potentially heterogeneous ERPT to border prices: on one hand is the coefficient from exporting countries that invoice in local currency units; on the other hand is the coefficient from non-USD exporting countries that invoice in USD.

In the second step, we account for the currency of invoice by running a dummy panel regression for exporters that invoice in their country's currency *vis a vis* those that invoice in USD (see Equation 2).[19] Results are shown in Table 3 (Figure 4). For both types of

[18]We use the word *depreciation* without loss of generality, since we do not focus on potential asymmetric responses between depreciations and appreciations.

[19]Countries whose home currency is the USD are included in the first group. The first group also includes

exporters, the ERPT is high on impact and decreases with time for up to eight quarters (panels A and B). The ERPT from exporters that invoice their products in their countrys currency is however higher on impact (95 percent vs. 78 percent) and after eight quarters (76 percent vs. 41 percent). The differences are statistically significant throughout, and increase with time (Panel C). This regression tells us that the bilateral exchange rate with respect to the exporter country does matter for ERPT at the border. It also tells us that the CLP-USD exchange rate matters even in the medium run for exporters that invoice in currencies other than their own. Our result is consistent with the evidence presented for Colombia by Casas et al. (2017).[20] What we do not know from this regression is the role of bilateral exchange rates for this latter group of firms: those in non-USD countries that invoice their exports in USD. They represent the bulk of Chilean imports originating outside the US.

4.3 The Bilateral Exchange Rate and The Currency of Invoice

In the third step, our benchmark regression and the main result of the paper, we dig deeper into the role of bilateral exchange rates in those transactions in USD from non-USD origins (see Equation 3). Panel B of Table 4 decomposes the ERPT for imports invoiced in USD (from non-USD origins) into CLP-USD and CLP-X. Results are plotted in Figure 5. The ERPT with respect to a CLP-USD depreciation only (that is, a depreciation against the USD holding constant the CLP-X parity) is high in the first quarter (73 percent) and then decreases monotonically, but is still significantly greater than zero after two years (27 percent). The cumulative ERPT with respect to the exporter currency displays the opposite behavior. It is close to zero in the first quarter, but increases monotonically to reach 38 percent in two years. Figure 5 Panel C shows the difference and statistical significance between them. Though the

countries in the Euro Zone that invoice in EUR. A minor amount of transactions from Japan, Sweden, Switzerland, and United Kingdom also show up in this group. Finally, tables labeled "Invoice USD" refer to exporters that invoice in USD from non-USD origins.

[20]They show that the ERPT to import prices from USD origins is around 1 in the short run, but declines to 0.81. From non-dollar origin the estimated pass-through starts at around 0.8 and decreases to close to 0.5.

CLP-USD ERPT remains higher than the CLP-X for the first four quarters, the difference is statistically significant for the first two. From the fifth quarter on, the CLP-X ERPT point estimate is higher, but not statistically different than the CLP-USD. These results suggest that the exchange rate that matters for ERPT to border prices in the short run is the USD, whereas in the medium run both the dollar and the exporter currency are equally important.

The result of a joint depreciation of the CLP with respect to the USD and the exporter currency, akin to a multilateral depreciation, is shown in Figure 6. The sum of the two coefficients above displays the known pattern of high ERPT in the first quarter (82 percent) and a monotone fall for a cumulative ERPT of 66 percent after two years. 66 percent is the standard high but incomplete pass-through to border prices found in the literature.

Although the results above support the hypothesis of a special role for the USD, we find the exporter currency to be more relevant than in early studies on DCP. In the short-run, and in line with previous studies, the prominence of the USD for ERPT at the border is clear, since even the result that imports invoiced in the exporter currency have high ERPT (Panel A in tables 3 and 4) is mainly driven by imports from the US, invoiced in USD. Our findings, however, do not support a strong version of DCP in the medium-run. Such a hypothesis would be consistent with a negligible role for exporting currencies (other than the USD) once the CLP-USD parity has been taken into account, something we do not find for Chile. We instead find evidence that marginal costs and/or desired markups in source countries are more sensitive to exchange rate fluctuations of the exporter countrys currency in the medium-term. Our results are thus consistent with a more nuanced version of DCP, where it holds in the short-run but where in the medium-run the exporter currency matters as well.

4.4 Robustness Exercises

In this section, we argue that the result that both the USD and the exporter currency matter in the case of Chilean imports is robust to different specifications and disaggregations of the data.

First, we run our benchmark regression except that we focus in the top fifteen countries exporting to Chile excluding China and the United States to make sure results are not driven by neither marginal exporters nor the largest exporters to Chile.[21] It is also of interest since the United States and China are the largest exponents of the two broad groups of exporters: those that invoice in their own currency, and those non-USD countries that invoice in USD. Results are statistically identical in every case, as displayed in Table 5 and Figure 7.

Next, we discriminate by type of good according to the Rauch classification (i.e. competitive goods, partially differentiated goods, differentiated goods).[22] They all display roughly the same patterns as described above: a high initial ERPT to the USD that gradually decreases, and a low initial ERPT to the exporter currency that gradually increases, though the estimates for competitive goods and partially differentiated goods are very imprecise and confidence bands are large (Table 6). The pattern of a high and incomplete ERPT from a multilateral depreciation also holds for the three types of goods, subject to the same caveats as above (Table 7).

In addition, we run regressions by region. Specifically, we group countries in the following regions: (i) the Americas, (ii)Euro Zone, (iii) Non-Euro Zone Europe, (iv) Asia.[23] Our

[21]The top fifteen Chilean exporters are Argentina, Brazil, Canada, China, Colombia, Ecuador (excluded because of lack of data), France, Germany, Italy, Japan, Mexico, Peru, Republic of Korea, Spain, and the United States. The results were virtually the same when we plainly consider the top fifteen exporters.

[22]We have 2,934 observations for competitive goods, 37,186 for partially differentiated goods, and 293,768 for differentiated goods.

[23]The Americas includes Argentina, Brazil, Colombia, Paraguay, Peru, and the United States. Euro Zone includes Austria, Belgium, Finland, France, Germany, Italy, and Netherlands. Non-Euro Zone Europe includes Sweden, Switzerland, Turkey, and United Kingdom. In our regressions Asia includes Australia, China, India, Indonesia, Japan, Malaysia, Republic of Korea, and Thailand.

findings are statistically significant for all regions except for the Non-Euro Zone European countries, whose point estimates are the most imprecise (Table 8 and Table 9).

Finally, we also run cumulative medium term ERPT regressions for up to a year of the type found in the literature.[24] We do this for ease of comparison with existing work and reach the same conclusion: exporter currency is as relevant as the USD in the medium term for those imports invoiced in USD (Table 10).[25]

5 Closing Remarks

Our results, if confirmed for other countries, have potentially important policy implications. For example, to relate directly to our original motivation, what exchange rate provides more useful information to forecast inflation at different horizons? Our findings point in the direction of the USD over short horizons and the nominal effective exchange rate over longer ones. Although a more complete response to this question would need a better understanding of the transmission mechanisms from border to retail prices, we think studies such as this one are a necessary first step along this agenda.

More generally, our findings can help shed light on important aspects of the international transmission of nominal shocks. For example, under an extreme version of DCP, a global appreciation of the USD would significantly increase the relative price of imports in all countries and thus depress international trade. Our results temper this conclusion in favor of a less dominant role for the USD in the medium-term. A quantification of this effect in a general equilibrium framework is called for. Another interesting research question could evaluate the

[24] We estimate the relation $\Delta_4 p_{gcxt} = \beta^{ber;\,ber} \Delta_4 ber_{x;\,t} \times D_{invoice=x} + \beta^{usd;\,usd} \Delta_4 usd_t \times D_{invoice=usd} + \beta^{ber;\,usd} \Delta_4 ber_{x;\,t} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where $\Delta_4 y_t = y_t - y_{t-4}$. To maximize the sample size, from the last period in which a price is observed, we consider all prices that led us to obtain non-overlap annual differences.

[25] Detailed results by country for medium-term regressions also confirm our results and are available upon request.

ERPT implications from the interaction between market concentration in different industries, as in Devereux et al (2007), with our findings on the currency of invoice/origin of international trade.

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Table 1: Invoice Curency of Chilean Imports

Year	USD	EUR	JPY	GBP	Other
2004	90.4	6.9	1.3	0.2	1.1
2005	89.7	8.0	1.2	0.2	0.8
2006	91.0	7.0	1.1	0.2	0.8
2007	91.4	6.4	1.4	0.2	0.7
2008	91.5	6.5	1.3	0.1	0.5
2009	89.8	8.6	0.8	0.1	0.6
2010	91.2	6.7	1.5	0.1	0.4
2011	91.0	7.2	1.2	0.1	0.5
2012	90.8	7.4	0.9	0.2	0.6
2013	90.1	8.1	1.1	0.2	0.5
2014	90.4	7.8	1.0	0.2	0.5
2015	90.1	7.9	1.3	0.2	0.6
Average	90.4	7.4	1.2	0.2	0.7

Source: Authors' own calculations are based on Chile's National Customs Service data.

Table 2: Exchange Rate Pass-through.

Quarters	0	1	2	3	8
Pass-trough	0.6063	0.7124	0.6436	0.617	0.5679
	(0.0277)	(0.0336)	(0.0438)	(0.0545)	(0.0862)
Observations			373408		

Notes: Cumulative exchange rate pass-through. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i \Delta ber_{xt-i} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, ber is the exchange rate between Chilean pesos and the exporter country's currency, $\mathbf{z}$ is a set of controls including exporter country's inflation and domestic activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable plus 8 lags. All variables are in logarithm and Δ is the first difference quarterly operator. The estimation period is the first quarter of 2004 until the third quarter of 2015.
Each column shows the cumulative exchange rate pass-through up to quarter Q of an exchange rate depreciation at time 0, $\sum_{i=0}^{Q} \beta i$. Homoscedastic standard errors are in parentheses.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 3: Exchange Rate Pass-through by Invoice Currency.

Quarters	0	1	2	3	8
Panel A: Invoice Exporter Country Currency					
CLP-X (A)	0.9505	0.8844	0.885	0.8337	0.7604
	(0.0362)	(0.0408)	(0.053)	(0.0634)	(0.0948)
Panel B: Invoice USD					
CLP-USD (B)	0.7804	0.6754	0.5765	0.5051	0.4127
	(0.0375)	(0.0445)	(0.0592)	(0.0714)	(0.1058)
Panel C: Difference between Exporter Country and USD ERPT					
(A)−(B)	0.1701	0.209	0.3086	0.3286	0.3477
	(0.0424)	(0.0476)	(0.057)	(0.0662)	(0.088)
Observations			373408		

Notes: Cumulative exchange rate pass-through by invoice currency. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i^{ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd} \Delta usd_{t-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, $D_{invoice=x}$ and $D_{invoice=usd}$ are dummy variables indexing trade invoice in the exporter country's currency and USD, respectively, ber is the exchange rate between Chilean pesos and the exporter country's currency, usd is the exchange rate between Chilean pesos and USD, $\mathbf{z}$ is a set of controls including exporter country's inflation and Chilean activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable and 8 lags. All variables are in logarithm and Δ is the first difference quarterly operator. The estimation period is the first quarter of 2004 until the third quarter of 2015.

Each column shows the cumulative exchange rate pass-through up to quarter Q of an exchange rate depreciation at time 0. Panel A shows exporter x exchange rate pass-through, $\sum_{i=0}^{Q} \beta_i^{ber}$, when exports are invoice in country x currency. Panel B shows USD exchange rate pass-through, $\sum_{i=0}^{Q} \beta_i^{usd}$, when exports are invoice in USD regardless country of origin. Panel C reports $\sum_{i=0}^{Q} \left(\beta_i^{ber} - \beta_i^{usd}\right)$. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 4: Invoice Currency and Bilateral Exchange Rate Pass-through.

Quarters	0	1	2	3	8
Panel A: Invoice Exporter Currency					
CLP-X	0.9541	0.8995	0.9274	0.8903	0.8459
	(0.0365)	(0.0414)	(0.0538)	(0.0649)	(0.0984)
Panel B: Invoice USD					
CLP-USD (A)	0.7261	0.5796	0.4112	0.3593	0.2703
	(0.0437)	(0.0528)	(0.0677)	(0.0792)	(0.1176)
CLP-X (B)	0.0966	0.1776	0.3138	0.3328	0.386
	(0.0424)	(0.0485)	(0.0599)	(0.0702)	(0.1008)
(A)−(B)	0.6295	0.402	0.0974	0.0265	-0.1157
	(0.0741)	(0.0871)	(0.1087)	(0.1254)	(0.1836)
Panel C: Multilateral Exchange Rate Depreciation					
(A)+(B)	0.8226	0.7572	0.7251	0.6921	0.6563
	(0.0437)	(0.0518)	(0.0673)	(0.0817)	(0.1196)
Observations			373408		

Notes: Cumulative invoice currency and bilateral exchange rate pass-through. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i^{ber;\,ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd;\,usd} \Delta usd_{t-i} \times D_{invoice=usd} + \sum_{i=0}^{8} \beta_i^{ber;\,usd} \Delta ber_{xt-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, $D_{invoice=x}$ and $D_{invoice=usd}$ are dummy variables indexing trade invoice in the exporter country's currency and USD, respectively, ber is the exchange rate between Chilean pesos and the exporter country's currency, usd is the exchange rate between Chilean pesos and USD, $\mathbf{z}$ is a set of controls including exporter country's inflation and Chilean activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable and 8 lags. All variables are in logarithm and Δ is the first difference quarterly operator. The estimation period is the first quarter of 2004 until the third quarter of 2015.

Each column of Panel A shows the cumulative exchange rate pass-through up to quarter Q of an exchange rate depreciation at time 0 when exports are invoice in country x currency, $\sum_{i=0}^{Q} \beta_i^{ber;\,ber}$. Panel B shows USD, $\sum_{i=0}^{Q} \beta_i^{usd;\,usd}$, and exporter x, $\sum_{i=0}^{Q} \beta_i^{ber;\,usd}$, cumulative exchange rate pass-through, and the difference between them, when exports are invoice in USD regardless country of origin. Panel C reports $\sum_{i=0}^{S} \left(\beta_i^{usd;\,usd} + \beta_i^{ber;\,usd}\right)$. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 5: Invoice Currency and Bilateral Exchange Rate Pass-through: Main Exporters Excluding China and US.

Quarters	0	1	2	3	8
Panel A: Invoice Exporter Currency					
CLP-X	0.88	0.8763	0.8888	0.8344	0.7156
	(0.0539)	(0.0637)	(0.0781)	(0.0969)	(0.1434)
Panel B: Invoice USD					
CLP-USD (A)	0.7299	0.5965	0.4352	0.3495	0.2494
	(0.0507)	(0.0618)	(0.0806)	(0.095)	(0.1426)
USD-X (B)	0.0761	0.1871	0.3334	0.3603	0.3752
	(0.0475)	(0.0548)	(0.0674)	(0.0795)	(0.1169)
(A)-(B)	0.6538	0.4094	0.1018	-0.0107	-0.1258
	(0.0807)	(0.0951)	(0.1194)	(0.1374)	(0.2059)
Panel C: Multilateral Exchange Rate Depreciation					
(A)+(B)	0.806	0.7836	0.7686	0.7098	0.6245
	(0.0559)	(0.0678)	(0.0886)	(0.1087)	(0.1599)
Observations			233213		

Notes: Cumulative invoice currency and bilateral exchange rate pass-through main exporters. See Table 4 notes. Transactions from the top fifteen exporters to Chile are included except those coming from either China or the United States.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 6: Exchange Rate Pass-through: Goods by Degree of Differentiation.

Quarters	0	1	2	3	8
Panel A: Invoice Exporter Currency					
CLP-X Competitive	1.0516	0.7663	1.0129	0.8488	1.5985
	(0.4438)	(0.5597)	(0.6815)	(0.8331)	(1.3851)
CLP-X Partially Differentiated	1.0645	0.8563	0.9594	0.7663	0.5363
	(0.1098)	(0.1413)	(0.1698)	(0.2053)	(0.3319)
CLP-X Differentiated	0.8679	0.9048	0.8843	0.8199	0.6113
	(0.0418)	(0.0532)	(0.0678)	(0.0835)	(0.1315)
Panel B: Invoice USD					
CLP-USD Competitive	0.8233	0.3439	0.1339	-0.0295	0.0481
	(0.3633)	(0.4551)	(0.5325)	(0.6099)	(0.9344)
CLP-X Competitive	0.2219	0.0475	0.0541	0.3378	0.3075
	(0.411)	(0.5065)	(0.6167)	(0.7206)	(1.0859)
CLP-USD Partially Differentiated	0.8018	0.5981	0.1899	0.204	0.0161
	(0.1085)	(0.1367)	(0.1656)	(0.1926)	(0.3093)
CLP-X Partially Differentiated	0.0978	0.0888	0.2505	0.2013	0.297
	(0.1206)	(0.147)	(0.1807)	(0.2092)	(0.3182)
CLP-USD Differentiated	0.6705	0.5784	0.3717	0.3584	0.1197
	(0.0496)	(0.0616)	(0.0783)	(0.0924)	(0.153)
CLP-X Differentiated	0.0808	0.2107	0.2823	0.3495	0.4627
	(0.0479)	(0.0577)	(0.0707)	(0.0822)	(0.1292)
Observations			333888		

Notes: Cumulative invoice currency and bilateral exchange rate pass-through, goods by degree of differentiation. Goods are defined according to Rauch (1999) classification. We estimate the relation $\Delta p_{gcxt} = \sum_{r\in\{\text{Goods}\}} \sum_{i=0}^{8} \beta_i^{ber;\,ber;\,r} \Delta ber_{xt-i} \times D_{invoice=x} \times D_r + \sum_{r\in\{\text{Goods}\}} \sum_{i=0}^{8} \beta_i^{usd;\,usd;\,r} \Delta usd_{t-i} \times D_{invoice=usd} \times D_r + \sum_{r\in\{\text{Goods}\}} \sum_{i=0}^{8} \beta_i^{ber;\,usd;\,r} \Delta ber_{xt-i} \times D_{invoice=usd} \times D_r + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where D_r indexes goods belonging to the r category and Goods is the set {Competitive, Partially Differentiated, Differentiated}. All the other variables are defined as in Table 4.

Each column of Panel A shows the cumulative exchange rate pass-through up to quarter Q of an exchange rate depreciation at time 0 when exports are invoice in country x currency by goods category, $\sum_{i=0}^{Q} \beta_i^{ber;\,ber;\,r}$. Panel B shows USD, $\sum_{i=0}^{Q} \beta_i^{usd;\,usd;\,r}$, and exporter x, $\sum_{i=0}^{Q} \beta_i^{ber;\,usd;\,r}$, cumulative exchange rate pass-through, when exports are invoice in USD regardless country of origin. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 7: Goods by Degree of Differentiation and Invoice USD: Exchange Rate Pass-through.

Quarters	0	1	2	3	8
Panel A: Difference between CLP-USD and USD-X					
Competitive	0.6014	0.2963	0.0799	-0.3673	-0.2594
	(0.6938)	(0.847)	(0.989)	(1.1116)	(1.5526)
Partially Differentiated	0.704	0.5093	-0.0606	0.0028	-0.2809
	(0.1989)	(0.2408)	(0.2901)	(0.3281)	(0.4912)
Differentiated	0.5897	0.3678	0.0894	0.0089	-0.343
	(0.0835)	(0.099)	(0.1225)	(0.1402)	(0.2244)
Panel B: Multilateral Exchange Rate Depreciation					
Competitive	1.0452	0.3914	0.188	0.3084	0.3557
	(0.3472)	(0.4582)	(0.5913)	(0.7396)	(1.3015)
Partially Differentiated	0.8995	0.6869	0.4403	0.4053	0.3131
	(0.1145)	(0.1504)	(0.1898)	(0.2325)	(0.3905)
Differentiated	0.7513	0.7891	0.654	0.7079	0.5824
	(0.0503)	(0.0667)	(0.0851)	(0.1044)	(0.1727)

Notes: Each column of Panel A shows the difference between USD and exporter x cumulative exchange rate pass-through up to quarter Q. For instance, the row Competitive is the difference between the first two rows of Panel B in Table 6. Panel B shows the sum of USD and exporter x currency cumulative exchange rate pass-through up to quarter Q, equivalent to a joint depreciation of the CLP with respect to the currency of country x and the USD. For instance, the row Competitive is the sum of the first two rows of Panel B in Table 6. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 8: Exchange Rate Pass-through to Import prices: Regions.

Quarters	0	1	2	3	8
Panel A: Invoice Exporter Currency					
CLP-X America	0.952	0.9222	0.8232	0.7546	0.5452
	(0.0518)	(0.0632)	(0.0829)	(0.0995)	(0.1639)
CLP-X Euro Zone	0.83	0.8296	0.9525	0.8864	0.6861
	(0.06)	(0.0736)	(0.083)	(0.1034)	(0.1484)
CLP-X Euorpe Non-Euro Zone	0.7652	0.795	0.3428	0.9715	0.9753
	(0.1587)	(0.1897)	(0.234)	(0.2725)	(0.4023)
CLP-X Asia	0.9633	0.8027	0.752	0.7946	0.8926
	(0.1205)	(0.1564)	(0.2013)	(0.2405)	(0.3638)
Panel B: Invoice USD					
CLP-USD America	0.6721	0.4984	0.2787	0.2237	0.1613
	(0.0544)	(0.0691)	(0.0861)	(0.1016)	(0.1567)
CLP-X America	0.0627	0.1601	0.291	0.3893	0.362
	(0.058)	(0.0717)	(0.0896)	(0.106)	(0.1672)
CLP-USD Euro Zone	0.7163	0.5938	0.4422	0.3315	-0.0388
	(0.115)	(0.1304)	(0.1708)	(0.1985)	(0.3108)
CLP-X Euro Zone	-0.0037	0.1162	0.3881	0.4269	0.6059
	(0.142)	(0.1421)	(0.1657)	(0.2044)	(0.3009)
CLP-USD Non-Euro Zone	0.7652	0.795	0.3428	0.9715	0.9753
	(0.1587)	(0.1897)	(0.234)	(0.2725)	(0.4023)
CLP-X Non-Euro Zone	0.0377	-0.2581	0.3365	-0.1735	-0.3471
	(0.1961)	(0.2092)	(0.2556)	(0.3067)	(0.4672)
CLP-USD Asia	0.5998	0.405	0.2333	-0.0932	-0.1932
	(0.1524)	(0.172)	(0.223)	(0.2508)	(0.3034)
CLP-X Asia	0.179	0.3391	0.2435	0.5844	0.5573
	(0.1529)	(0.1739)	(0.2219)	(0.2452)	(0.3063)
Observations			373408		

Notes: Cumulative invoice currency and bilateral exchange rate pass-through by regions. We estimate the relation $\Delta p_{gcxt} = \sum_{r\in\{\text{Regions}\}} \sum_{i=0}^{8} \beta_i^{ber;\,ber;\,r} \Delta ber_{xt-i} \times D_{invoice=x} \times D_r + \sum_{r\in\{\text{Regions}\}} \sum_{i=0}^{8} \beta_i^{usd;\,usd;\,r} \Delta usd_{t-i} \times D_{invoice=usd} \times D_r + \sum_{r\in\{\text{Regions}\}} \sum_{i=0}^{8} \beta_i^{ber;\,ber;\,r} \Delta ber_{xt-i} \times D_{invoice=usd} \times D_r + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where D_r indexes goods exported from region r and Regions is the set $\{\text{America, Euro Zone, Europe Non} - \text{Euro Zone, Asia}\}$. All the other variables are defined as in Table 4.

Each column of Panel A shows the cumulative exchange rate pass-through up to quarter Q of an exchange rate depreciation at time 0 when exports are invoice in country x currency by regions, $\sum_{i=0}^{Q} \beta_i^{ber;\,ber;\,r}$. Panel B shows USD, $\sum_{i=0}^{Q} \beta_i^{usd;\,usd;\,r}$, and exporter x, $\sum_{i=0}^{Q} \beta_i^{ber;\,usd;\,r}$, cumulative exchange rate pass-through, when exports are invoice in USD regardless country of origin. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Table 9: Regions and Invoice USD Exchange Rate Pass-through.

Quarters	0	1	2	3	8
Panel A: Difference between CLP-USD and USD-X					
America	0.6093	0.3383	-0.0123	-0.1656	-0.2007
	(0.0912)	(0.1106)	(0.1336)	(0.1517)	(0.2319)
Euro Zone	0.72	0.4776	0.0541	-0.0954	-0.6447
	(0.2379)	(0.2487)	(0.3132)	(0.3774)	(0.5825)
Non-Euro Zone	0.7275	1.0531	0.0063	1.145	1.3224
	(0.3181)	(0.3511)	(0.4383)	(0.5183)	(0.775)
Asia	0.4208	0.066	-0.0102	-0.6776	-0.7505
	(0.2968)	(0.3335)	(0.4293)	(0.4757)	(0.5691)
Panel B: Multilateral Exchange Rate Depreciation					
America	0.7348	0.6585	0.5697	0.613	0.5233
	(0.0658)	(0.0871)	(0.1143)	(0.1417)	(0.2264)
Euro Zone	0.7126	0.7099	0.8303	0.7585	0.5671
	(0.1008)	(0.1118)	(0.1232)	(0.1411)	(0.1871)
Non-Euro Zone	0.8028	0.537	0.6794	0.798	0.6282
	(0.1616)	(0.1904)	(0.2195)	(0.2606)	(0.3996)
Asia	0.7788	0.7441	0.4769	0.4912	0.3641
	(0.0714)	(0.0921)	(0.1165)	(0.1406)	(0.2187)

Notes: Each column of Panel A shows the difference between USD and exporter x cumulative exchange rate pass-through up to quarter Q. For instance, the row America is the difference between the first two rows of Panel B in Table 8. Panel B shows the sum of USD and exporter x cumulative exchange rate pass-through up to quarter Q, equivalent to a joint depreciation of the CLP with respect to the currency of country x and the USD. For instance, the row America is the sum of the first two rows of Panel B in Table 8. Homoscedastic standard errors are in parentheses.

Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

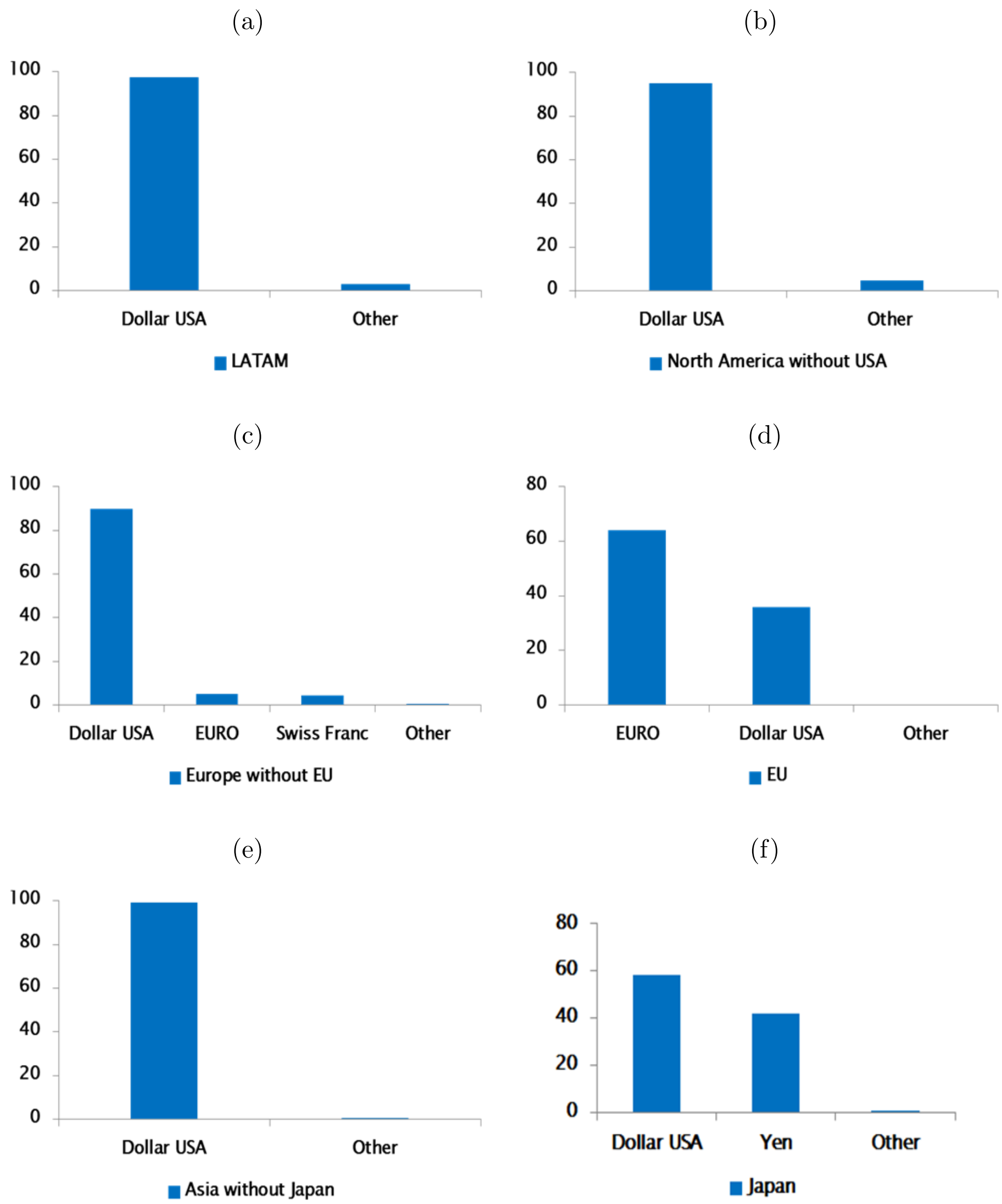
Table 10: Medium-term Exchange Rate Pass-through.

	Invoice Exporter Currency	Invoice USD			
	CLP-X	CLP-USD (A)	CLP-X (B)	(A)−(B)	(A)+(B)
Pass-trough	0.9145	0.3919	0.3493	0.0426	0.7412
	(0.0461)	(0.0493)	(0.0425)	(0.0728)	(0.0564)
Observations			113638		

Notes: Medium-term cumulative invoice currency and bilateral exchange rate pass-through. We estimate the relation $\Delta_4 p_{gcxt} = \beta^{ber;\, ber} \Delta_4 ber_{x;\, t} \times D_{invoice=x} + \beta^{usd;\, usd} \Delta_4 usd_t \times D_{invoice=usd} + \beta^{ber;\, usd} \Delta_4 ber_{x;\, t} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where $\Delta_4 y_t = y_t - y_{t-4}$. For the remaining variable definitions see Table 4 notes. To maximize the sample size, from the last period in which a price is observed, we consider all prices that let us to obtain non-overlap annual differences. The Column CLP-X reports the coefficient $\beta^{ber;\, ber}$, CLP-USD $\beta^{usd;\, usd}$, CLP-X $\beta^{ber;\, usd}$, (A)−(B) $\beta^{usd;\, usd} - \beta^{ber;\, usd}$, and (A)+(B) $\beta^{usd;\, usd} + \beta^{ber;\, usd}$. Homoscedastic standard errors are in parentheses.

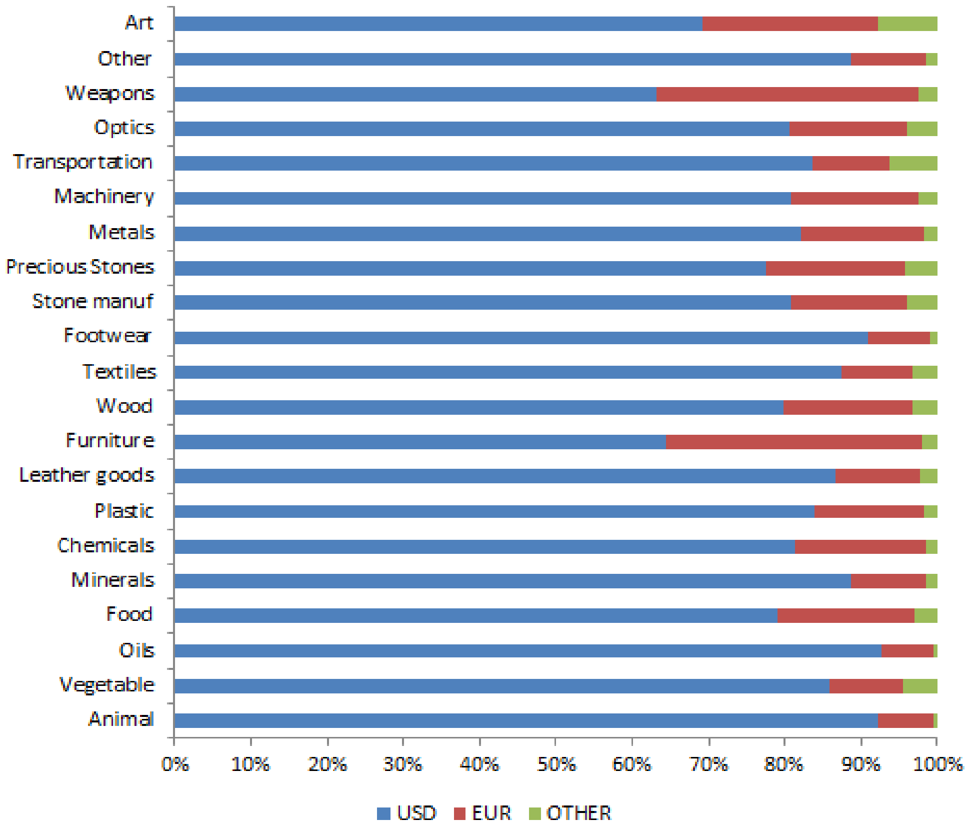
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Figure 1: Invoice Curency of Chilean Imports by Origin.



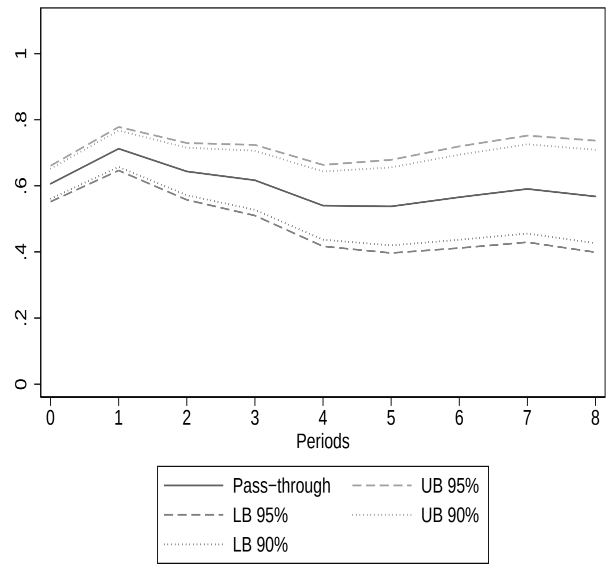
Source: Authors' own calculations are based on Chile's National Customs Service data.

Figure 2: Invoice Curency of Chilean Imports by Sector.



Source: Authors' own calculations are based on Chile's National Customs Service data.

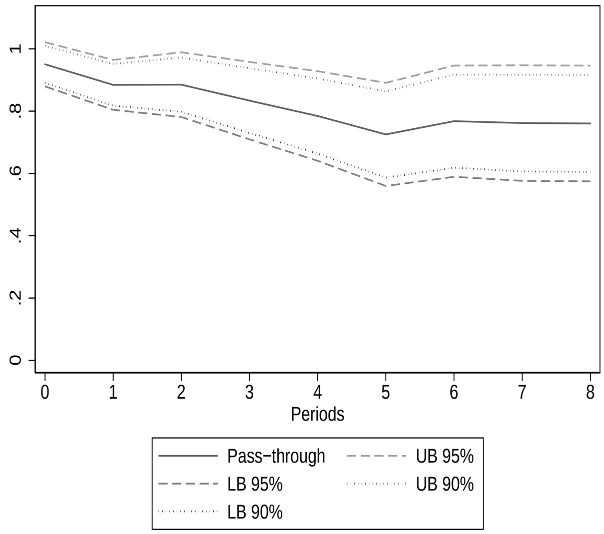
Figure 3: Exchange Rate Pass-through.



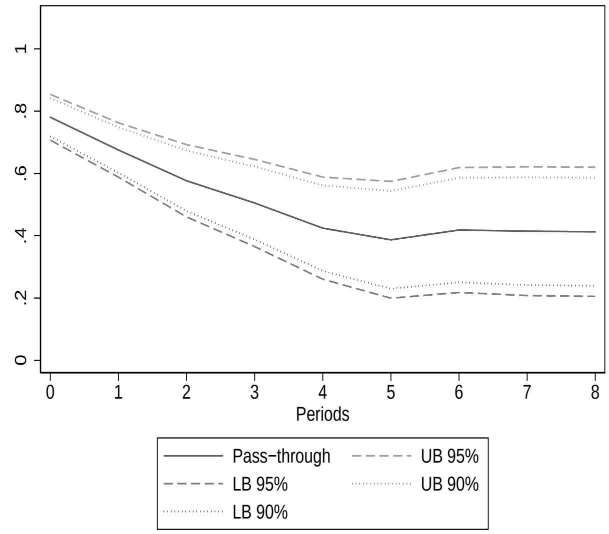
Notes: Cumulative exchange rate pass-through. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i \Delta ber_{xt-i} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, ber is the exchange rate between Chilean pesos and the exporter country's currency, $\mathbf{z}$ is a set of controls including exporter country's inflation and domestic activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable plus 8 lags. All variables are in logarithm and Δ is the first difference quarterly operator. $\sum_{i=0}^{Q} \beta_i^{ber}$, solid black line, is interpreted as the cumulative exchange rate pass-through up to period Q of an exchange rate depreciation at time 0. Dashed grey and dotted black lines indicate 95% and 90% confidence bands, respectively.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Figure 4: Exchange Rate Pass-through by Invoice Currency.

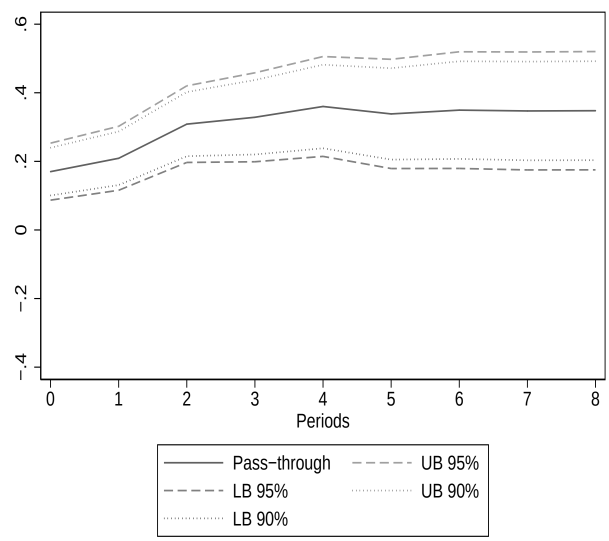
(a) Invoice Exporter Currency.



(b) Invoice USD.



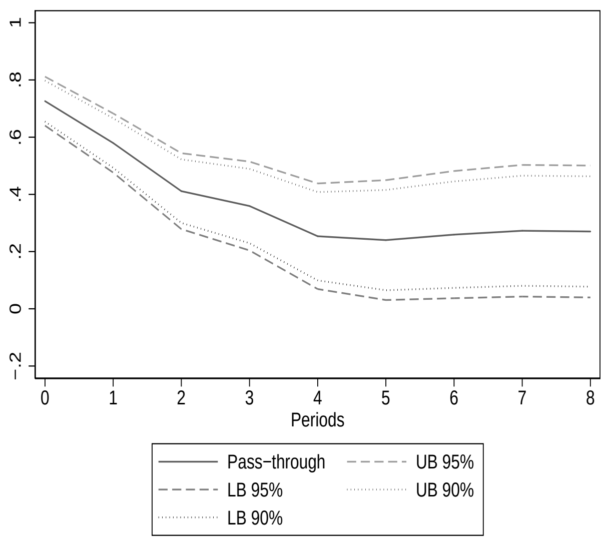
(c) Difference Invoice Exporter Currency and USD.



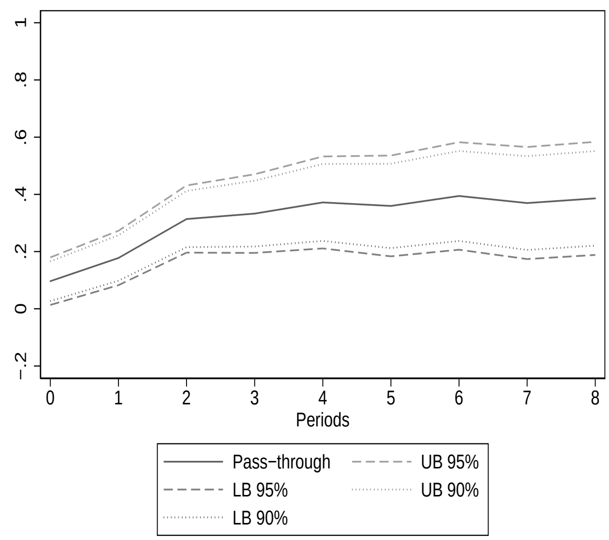
Notes: Cumulative exchange rate pass-through by invoice currency. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i^{ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd} \Delta usd_{t-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, $D_{invoice=x}$ and $D_{invoice=usd}$ are dummy variables indexing trade invoice in the exporter country's currency and USD, respectively, ber is the exchange rate between Chilean pesos and the exporter country's currency, usd is the exchange rate between Chilean pesos and USD, $\mathbf{z}$ is a set of controls including exporter country's inflation and Chilean activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable and 8 lags. . All variables are in logarithm and Δ is the first difference quarterly operator.
Panel (a) Invoice Exporter Currency: $\sum_{i=0}^{Q} \beta_i^{ber}$ is interpreted as the cumulative exchange rate pass-through up to period Q (x-axis) of an exchange rate depreciation at time 0 whenever country x exports to Chile are invoice in its own currency. Panel (b) Invoice USD: $\sum_{i=0}^{Q} \beta_i^{usd}$ is interpreted as the cumulative exchange rate pass-through up to period Q of an exchange rate depreciation at time 0 whenever country x exports to Chile are invoiced in USD. Panel (c) Difference Between Invoice Exporter Currency and USD Pass-through: It reports $\sum_{i=0}^{Q} \left(\beta_i^{ber} - \beta_i^{usd} \right)$. Solid black lines indicate pointwise estimates. Dashed grey and dotted black lines indicate 95% and 90% confidence bands, respectively.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Figure 5: Invoice USD: USD and Bilateral Exchange Rate Pass-through.

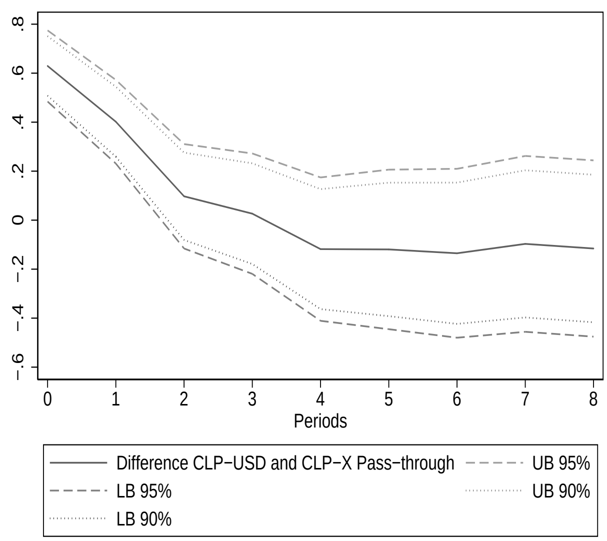
(a) CLP-USD.



(b) CLP-X.

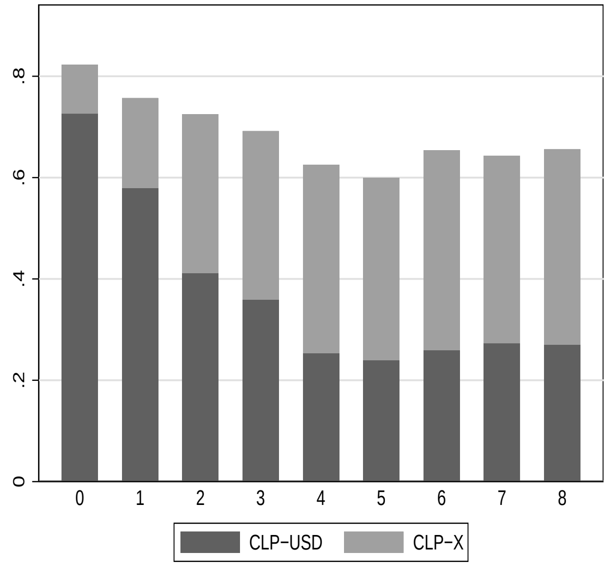


(c) CLP-USD − CLP-X.



Notes: Cumulative exchange rate pass-through of imports invoice in USD. We estimate the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i^{ber;\, ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd;\, usd} \Delta usd_{t-i} \times D_{invoice=usd} + \sum_{i=0}^{8} \beta_i^{ber;\, usd} \Delta ber_{xt-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$, where p_{gcxt} is import prices of good g, invoice in currency c, imported from country x at time t, $D_{invoice=x}$ and $D_{invoice=usd}$ are dummy variables indexing trade invoice in the exporter country's currency and USD, respectively, ber is the exchange rate between Chilean pesos and the exporter country's currency, usd is the exchange rate between Chilean pesos and USD, $\mathbf{z}$ is a set of controls including exporter country's inflation and Chilean activity and inflation, and α_{gcx} is a set of fixed effects at the good, invoice, and country level. All controls include the contemporaneous variable and 8 lags. All variables are in logarithm and Δ is the first difference quarterly operator.
Panel (a) CLP-USD: It reports the cumulative exchange rate pass-through up to period Q (x-axis) from a USD depreciation, $\sum_{i=0}^{Q} \beta_i^{usd;\, usd}$. Panel (b) CLP-X: It reports the cumulative exchange rate pass-through up to period Q from a CLP-X depreciation, $\sum_{i=0}^{Q} \beta_i^{ber;\, usd}$. Panel (c) CLP-USD − CLP-X: It reports $\sum_{i=0}^{Q} \left(\beta_i^{usd;\, usd} - \beta_i^{ber;\, usd} \right)$. Solid black lines indicate pointwise estimates. Dashed grey and dotted black lines indicate 95% and 90% confidence bands, respectively.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

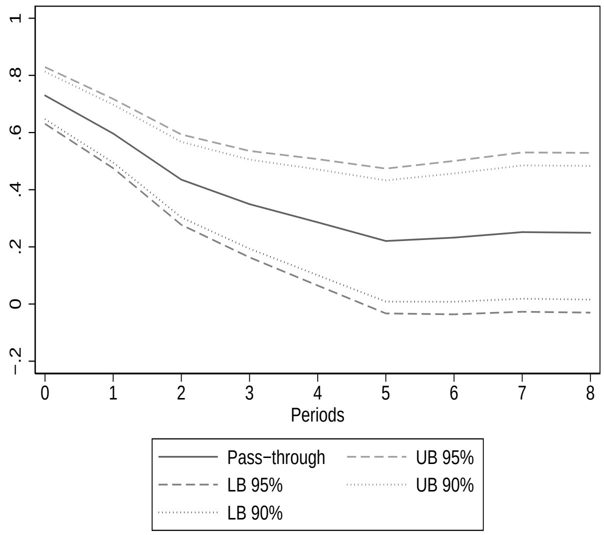
Figure 6: Invoice USD: Multilateral Exchange Rate Pass-through Decomposition.



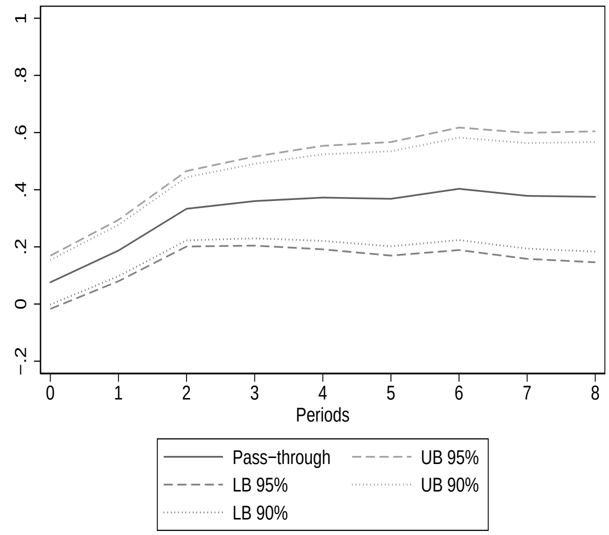
Notes: Cumulative multilateral exchange rate pass-through of imports invoice in USD. From estimating the relation $\Delta p_{gcxt} = \sum_{i=0}^{8} \beta_i^{ber;\, ber} \Delta ber_{xt-i} \times D_{invoice=x} + \sum_{i=0}^{8} \beta_i^{usd;\, usd} \Delta usd_{t-i} \times D_{invoice=usd} + \sum_{i=0}^{8} \beta_i^{ber;\, usd} \Delta ber_{xt-i} \times D_{invoice=usd} + \gamma' \mathbf{z}_{xt} + \alpha_{gcx} + \epsilon_{gcxt}$ (for variable definitions see Figure 5 notes), we decompose the cumulative exchange rate pass-through up to quarter Q (x-axis) of a joint depreciation of the CLP with respect to the USD and the currency of country x into a USD driver (dark grey), $\sum_{i=0}^{Q} \beta_i^{usd;\, usd}$, and a bilateral component (light grey), $\sum_{i=0}^{Q} \beta_i^{ber;\, usd}$.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Figure 7: Invoice USD: Invoice Currency and Bilateral Exchange Rate Pass-through: Main Exporters Excluding China and US.

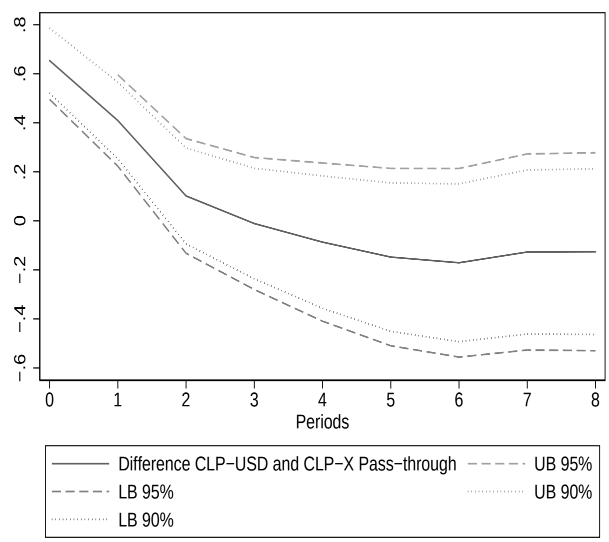
(a) CLP-USD.



(b) CLP-X.

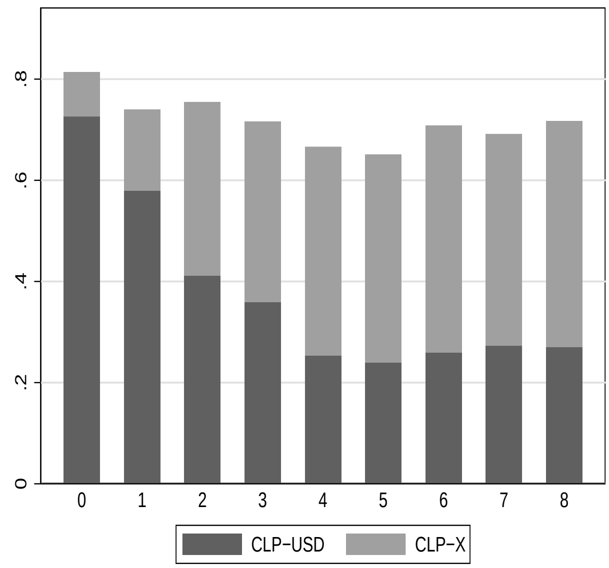


(c) CLP-USD − CLP-X.



Notes: Cumulative exchange rate pass-through of imports invoice in USD. See Figure 5 notes. Transactions from the top fifteen exporters to Chile are included except those coming from either China or the United States.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund, and Federal Reserve Economic Database data.

Figure 8: Invoice USD: Multilateral Exchange Rate Pass-through Decomposition: Main Exporters Excluding China and US.



Notes: Cumulative multilateral exchange rate pass-through of imports invoice in USD. See Figure 6 notes. Transactions from the top fifteen exporters to Chile are included except those coming from either China or the United States.
Source: Authors' own calculations are based on Chile's National Customs Service, International Monetary Fund and Federal Reserve Economic Database data.

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