Comfort in Floating: Taking Stock of Twenty Years of Freely Floating Exchange Rate in Chile

Elías Albagli
Central Bank of Chile

Mauricio Calani
Central Bank of Chile

Metodij Hadzi-Vaskov
International Monetary Fund

Mario Marcel
Central Bank of Chile

Luca Antonio Ricci
International Monetary Fund

Pages 413-470 | Chapter printout

Independence, Credibility, and Communication of Central Banking

Ernesto Pastén
Ricardo Reis
editors

28
Series on Central Banking, Analysis, and Economic Policies

Banco Central de Chile
Central Bank of Chile

The views and conclusions presented in the book are exclusively those of the authors and do not necessarily reflect the position of the Central Bank of Chile or its Board Members.

Copyright © Banco Central de Chile 2021
Agustinas 1180
Santiago, Chile
All rights reserved
Published in Santiago, Chile
by the Central Bank of Chile
Manufactured in Chile

This book series is protected under Chilean Law 17336 on intellectual property. Hence, its contents may not be copied or distributed by any means without the express permission of the Central Bank of Chile. However, fragments may be reproduced, provided that a mention is made of the source, title, and author(s).

ISBN (print) 978-956-7421-69-5
ISBN (digital) 978-956-7421-70-1
Intellectual Property Registration 2021-A-3095

ISSN 0717-6686 (Series on Central Banking, Analysis, and Economic Policies)

Comfort in Floating: Taking Stock of Twenty Years of Freely Floating Exchange Rate in Chile

Elías Albagli
Central Bank of Chile

Mauricio Calani
Central Bank of Chile

Metodij Hadzi-Vaskov
International Monetary Fund

Mario Marcel
Central Bank of Chile

Luca Antonio Ricci
International Monetary Fund

Chile offers an example of a country that has overcome the fear of floating by reducing balance-sheet mismatches; enhancing financial-market development; and improving monetary, fiscal, and political institutions; while strengthening policy credibility. Under

We benefitted from useful comments by Patricia Alonso-Gamo, Guillermo Calvo, Martin Cerisola, Mariana García, Andrés Sansone, Alejandro Werner and the participants at the XXIII Annual Conference of the Central Bank of Chile "*Independence, Credibility, and Communication of Central Banking*" and the WHD seminar at the International Monetary Fund. We thank Ivan Burgara, Isidora Lara, Emilio Guamán, and Sebastián Ramírez for excellent research assistance. We also thank Marcela Arriagada and Dagoberto Quevedo for their help in web-scrapping data, Alexander Hynes and Paulina Rodríguez for helping us access currency derivatives data, and *Comisión para el Mercado Financiero* for kindly giving us access to historic records on nonfinancial corporations under their supervision. The views expressed in this paper and those of the authors and do not necessarily represent the opinion of the Board of the Central Bank of Chile, or the views of the IMF, its Executive Board, or IMF Management. All errors are our own.

Independence, Credibility, and Communication of Central Banking edited by Ernesto Pastén and Ricardo Reis, Santiago, Chile. © 2021 Central Bank of Chile.

the floating regime, Chile's economic adjustment to external shocks appears significantly improved, and its exchange-rate passthrough has substantially declined. Our results reinforce the case that moving to a clear and credible floating regime can be associated with a reduction in the fear of floating via economic transformation (like smaller balance-sheet mismatches, a larger hedging market, and a lower exchange-rate passthrough).

1. Literature Review

This paper offers a comprehensive overview of how Chile defeated the fear of floating. Remarkably, Chile's interest-rate reaction to the Asian and Russian crises was presented as a classic case of fear of floating.[1] Over the past two decades, Chile has been enjoying a fully flexible exchange-rate regime—after abandoning its crawling peg band in 1999—with extremely rare foreign-exchange intervention and an open capital account.[2] In this context, the paper focuses on policymaking in normal times, and not on tail scenarios, such as the one triggered by the unique circumstances of the social demonstrations in late 2019 or the Covid-19 outbreak. Indeed, over the past two decades, Chilean firms have significantly reduced their balance-sheet currency mismatches, aided by the deepening of internal financial markets, which both reduce the cost of domestic credit and create opportunities to hedge currency exposure. Chile also completed its transition towards a fully-fledged and inflation-targeting regime and benefitted from a robust monetary and fiscal policy design that has contributed to substantial policy credibility. This allows Chile to exhibit a healthy macroeconomic adjustment to external shocks while showing very low volatility of long-term interest rates.

The choice of the exchange-rate regime has been subject to intense debate for decades. On the one hand, the vast literature on optimum currency area highlighted the criteria under which countries may find it desirable to hold a pegged exchange-rate regime: a synchronous business cycle with the anchor country (due to economic structure, diversification, or openness), a large passthrough neutralizing exchange-rate movements, or substantial mobility of factors offering

1. See Calvo and Reinhart (2002).

2. See De Gregorio and Tokman (2004) for a description of previous exchange-rate regimes and the transition towards free floating in 1999.

alternative forms of economic adjustment.[3] A complementary argument is offered by the literature on macroeconomic discipline, which focuses on the benefits of pegging for countries that lack the credibility to manage an independent monetary policy while maintaining macroeconomic stability).[4]

On the other hand, various countries would like to retain monetary-policy independence by floating, as capital controls have become more and more difficult to implement effectively, and the 'trilemma' literature has continued to highlight that, in the absence of strong capital controls, it is virtually impossible to retain monetary independence under a pegged regime.[5] This regime choice is also supported by recent studies that have vindicated the superior economic performance and macroeconomic adjustment to external shocks associated with floating regimes.[6]

However, over the past few decades, floaters have effectively contained the fluctuations in the exchange rate arising from the fear of floating[7] driven by various factors: balance-sheet mismatches, limited hedging opportunities, costs from exchange-rate fluctuations, volatility of imported inflation posing challenges for monetary policy, and difficult access to capital market in the presence of limited

3. The literature on exchange-rate regime choice is very vast; the seminal paper for the optimum currency area argument is Mundell (1961); for surveys and discussions see for example Ricci (2008), Ghosh and others (2010), Rogoff and others (2004), and Mussa and others (2000).

4. See Giavazzi and Pagano (1988).

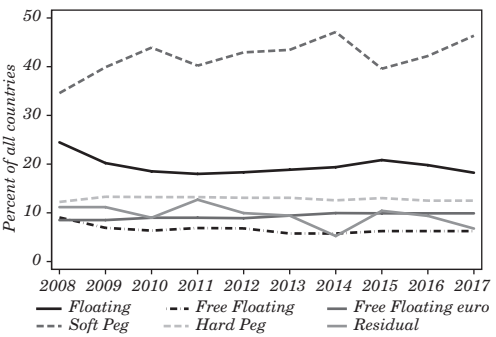
5. For recent studies confirming the trilemma, see Obstfeld (2015), Klein and Shambough (2013), and Ricci and Shi (2016). A classic reference is Obstfeld and others (2005). Aizenman (2017) extends the trilemma to the quadrilemma suggesting that countries have been more and more concerned with financial stability. Rey (2014 and 2015) argues that global credit cycles affect financial conditions in countries irrespective of their exchange-rate regime. Ricci and Shi (2016) show that, on average, floaters appear to be less affected by the U.S. interest rates in the short run.

6. See, for example, Obstfeld and others (2019), Grigoli and others (2019), Ghosh and others (2018), Ben Zeev (2019), International Monetary Fund (2016), Ghosh and others (2010), Levy and Sturzenegger (2003), Edwards and Levy (2003), and Ghosh and others (1996).

7. See Calvo and Reinhart (2002).

credibility.[8] Eichengreen (2019) highlights that, in the last few decades, the strong financial integration has exacerbated the domestic financial instability associated with exchange-rate flexibility, thus intensifying the continued tension among the attempt to maintain monetary-policy independence, the fear of floating, and the ability to maintain capital controls. Ilzetzki and others (2019) find that, although there is some tendency toward more intermediate regimes, the world remains heavily skewed towards less flexible exchange-rate regimes instead of managed-floating and free-floating ones. When looking at the new International Monetary Fund's (IMF) classification of exchange-rate regimes revised in 2018 (figure 1), we see that the number of (non–euro area) freely floating countries remains very small (about 5 percent).

Figure 1. IMF Exchange-Rate Regime Classification



Source: Annual Report on Exchange Arrangements and Exchange Restrictions.

8. For the relevance and macroeconomic effects of balance-sheet mismatches in the context of exchange-rate policy see Aghion and others (2000), Céspedes and others (2004), Kearns and Patel (2016), and Krugman (1999). Exchange-rate fluctuations drive fear of floating in Lahiri and Végh's (2001). As, more generally, Obstfeld and Rogoff (1995) put it: "Although the associated costs have not been quantified rigorously, many economists believe that exchange-rate uncertainty reduces international trade, discourages investment, and compounds the problems people face in insuring their human capital in incomplete asset markets. Furthermore, workers and firms hurt by protracted exchange-rate swings often demand import protection from their governments." This argument was also used in support of the move towards the European monetary union. (See Baldwin (1991) for a quantification of the effect).

This paper describes how Chile has dealt with the two main burdens that have traditionally deterred other emerging market economies (EMEs) from adopting clean floating regimes, namely, financial and price stability.[9,10] In addition, it provides evidence about the benefits of both macroeconomic and financial adjustments to shocks that result from such an exchange-rate regime.

Among the main results, we highlight the following. First, we document a significant, monotonic compression of the complete distribution of foreign-exchange (FX) exposure towards very low current levels, which occurs *after* the transition to exchange-rate flexibility in 1999. Moreover, this decline is mostly driven by an enhanced matching of USD-denominated assets and liabilities—essentially, firms initially indebted in U.S. dollars tend to reduce their foreign-currency liabilities. We also provide evidence about the determinants of FX derivatives use by firms, finding it more prevalent in i) those involved in international trade; ii) firms with larger balance-sheet mismatches; and iii) firms that recently experienced losses (though not gains) due to currency fluctuations. Our results are consistent with previous findings that moving to a floating exchange-rate regime reduces balance-sheet mismatches, as in Martínez and Werner (2002) for Mexico, Cowan and others (2006) for Chile, and Kamil (2012) for six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru). Looking at Brazil, Rossi (2004) finds that the number of companies exposed to currency risk during the floating exchange-rate regime is much lower than under the fixed one, not only as companies trade currency derivatives more extensively to reduce their foreign-exchange-rate exposure, but also as they reduce the currency mismatches on their balance sheets.

Second, the exchange-rate passthrough (ERPT) to domestic prices has monotonically declined. While this trend is consistent with the evidence presented by other authors,[11] our extended sample finds that ERPT has fallen even further in the last decade. This is consistent with the enhanced credibility of Chile's monetary-policy regime, a

9. In addition to financial and price stability, the nature of Chile's productive structure as a resource-intensive economy helps dampen the effect of exchange-rate fluctuations on real economic activity, as compared to more diversified economies with larger manufacturing sectors (Carrière-Swallow and García-Silva, 2013), as in commodity-exporting sectors the response of supply and employment to short-term movements in the exchange rate are more muted than in the manufacturing sector.

10. See Ötker and Vávra (2007) for a broader discussion about the operational aspects of the transition to greater exchange-rate flexibility based on country experiences.

11. See De Gregorio and Tokman (2004), and Justel and Sansone (2016).

dominant topic in the extensive literature linking ERPT to underlying macroeconomic fundamentals and the role of institutions.[12]

Third, the switch to a freely floating regime is associated with a better macroeconomic performance when comparing the last two severe crises—the Asian/Russian crisis, which Chile faced with a crawling peg, and the Global Financial Crisis (GFC), which was confronted after a decade of free floating.[13]

Fourth, the paper also documents the strong financial sector resilience to external shocks, and in particular, the role that exchange-rate flexibility plays in cushioning the impact of global financial shocks on domestic asset prices.[14] Specifically, we document that, as compared to other emerging countries following less clean floats, the reaction of the exchange rate is high relative to the one of long-term bond yields and stock markets, in response to both monetary-policy (MP) shocks in the U.S. and fluctuations in global risk aversion.

Our results are not necessarily inconsistent with recent findings arguing that intermediate floating regimes (i.e., with some intervention) offer better growth performance and macroeconomic adjustment to shocks than both fixed regimes and pure floats, as the latter contain excessive exchange-rate fluctuations.[15] Indeed, the average purely floating country in the sample in these studies may have not yet reached the adequate conditions for the flexible exchange rate to perform well while adequately coping with exchange-rate volatility; namely, a development of financial markets that may provide sufficient domestic funding and/or opportunities for hedging exposure

12. Numerous studies have investigated empirically the characteristics, determinants, and the evolution of ERPT over time and across countries. Céspedes and Valdés (2006) document that greater central-bank independence is associated with lower ERPT. Edwards (2006), and Mishkin and Schmidt-Hebbel (2007) suggest that inflation targeting has contributed to moderating ERPT by enhancing monetary-policy credibility. Carrière-Swallow and others (2016) find a strong link between monetary-policy regime's performance in delivering price stability and low ERPT. Ca'Zorzi and others (2007), and Choudhri and Hakura (2006) find a positive relationship between the ERPT and the average inflation rate. Gopinath and others (2010) show that the currency choice in pricing and invoicing plays an important role for ERPT, and Gopinath and Itskhoki (2010) find that higher frequency of price adjustments is associated with larger ERPT. Caselli and Roitman (2016) find important nonlinearities in ERPT during large depreciation episodes in EMEs.

13. See Cowan and De Gregorio (2007) for a comparison of the first episode with the late 1970s.

14. See Blanchard and others (2015), Obstfeld and others (2019), and Cáceres and Lindow (2018).

15. See Frankel and others (2019), and Obstfeld and others (2019).

through FX derivatives. In the case of Chile, the surge of pension funds as vehicles of investment for mandatory pension savings has been crucial in lowering the cost of local credit, thereby reducing the incentives of firms to undertake currency risk on their balance sheets by borrowing abroad. Moreover, as pension funds invest abroad a sizeable share as well, their demand for FX derivatives has contributed to the development of the hedging market, lowering insurance costs for nonfinancial corporates. That said, the significant decline in currency exposure and the surge in the derivatives market after the introduction of the freely floating scheme in Chile suggests that these factors may be, at least partially, endogenous to the currency regime in place.

This paper may also address a recent argument put forward by Diamond and others (2018) for exchange-rate intervention as a "macro-prudential tool to mitigate adverse monetary-policy spillovers from source countries." To the extent that limited balance-sheet exposure and strong hedging reduce the effect of exchange-rate fluctuations on the net worth of companies while good institutions enhance governance and pledgeability (these outcomes being crucial in their analysis), there is a smaller "rationale for countries to limit exchange-rate movements to avoid spillovers affecting financial stability from accommodative monetary policies in funding countries."

In future work, it would be valuable to assess the extent to which these desirable economic transformations observed *after* a move to a floating regime—smaller balance-sheet mismatch, a larger hedging market, and smaller passthrough—correspond to endogenous response to the change in regime, *vis-à-vis* a by-product of a gradual deepening of financial markets and enhanced credibility as countries develop. Such an analysis would complement and generalize the findings of the "endogenous optimum currency area literature" which highlights that a move to a fixed exchange rate endogenously makes the shocks more symmetric across pegging countries, thus validating the choice of the exchange-rate regime.[16]

16. See Frankel and Rose (1998), and Ricci (2006).

2. The Transition towards Fearless Floating: Key Elements

2.1 Evolution of Currency Exposure and the Role of Derivatives

A first burden to overcome in order to cope with the fear of floating is the financial stability risk involved in currency mismatches of both financial and nonfinancial corporations. In this section, we document the evolution of exposure to exchange-rate risks for different agents, starting in the years before the flexible regime choice of 1999, to the present. Subsection 2.1.1 briefly discusses the situation for banks and regulated financial institutions, showing that the adjustment towards low currency exposure occurred well before 1999, following the adoption of new banking regulation as in response to the early-1980s financial crisis in Chile.

In subsection 2.1.2, we provide new evidence about the evolution of net currency exposure for nonfinancial corporates based on a panel of large, supervised firms. We highlight two results. First, there is a significant reduction in currency exposure that starts with the introduction of the freely floating regime. Importantly, to appreciate this result, it is necessary to look at the whole distribution of firms—while the average/median firm shows very little currency mismatch in its balance sheet to begin with, the most exposed quartiles do exhibit important initial currency exposures that progressively compress to very low levels today. Second, and perhaps contrary to common wisdom, such a decline is quantitatively more related to changes in exposure than to increased use of derivatives. Indeed, the data strongly suggest that the bulk of the reduction in balance-sheet exposure stems from reducing the stock of USD-denominated liabilities and of USD-denominated assets for those firms initially exposed to a peso depreciation/appreciation, respectively.

Subsection 2.1.3 delves deeper into the use of derivatives by nonfinancial corporates. We find that they are more likely to be used in firms related to international trade, in those with larger balance-sheet currency exposure and, crucially, in those that have recently experienced losses (but not gains) stemming from FX exposure. Complementing this point, subsection 2.1.4 documents that firms with recent losses from exchange rate fluctuations are also more prone to reducing their overall balance sheet currency mismatch in the following quarters.

2.1.1 Low Currency Exposure in Financial Institutions

The balance-sheet currency mismatch (defined as FX liabilities minus FX assets, implying that a positive mismatch is a short FX position) for Chilean banks and other supervised financial institutions has been consistently close to zero even before the nominal exchange rate (NER) was set free to float. Low currency exposure in banks is partly a reflection of several layers of regulation that can be traced to the aftermath of the financial crisis in the early 1980s. While several external factors contributed to the deterioration of the macroeconomic outlook for Chile in 1982, the consensus points out to domestic elements as amplifiers of the downturn. In particular, weak regulation and supervision of the financial sector led to widespread lending in U.S. dollars to local firms, many of them interrelated (through ownership ties). While banks themselves did not exhibit major balance-sheet mismatches, firms did. As external interest rates rose and the price of copper fell dramatically, a large devaluation of the Chilean peso (CLP) became inevitable, and this rendered many firms that had borrowed in U.S. dollars insolvent. The devaluation had a major impact on inflation, but more importantly, on the solvency of the main banks, at the same time as external credit was drying up due to the sudden stop. All this led to a sharp contraction in local credit, widespread intervention by regulators, and a massive rescue package by the Central Bank.

The 1986 Banking Law reformed many aspects, including limitations to credit to related parties. In terms of currency mismatches in the balance sheets of the banks themselves, Matus (2015) describes the evolution of regulation. The first explicit limitation goes back to May 1982, which imposed a limit to the difference between credit and deposits in foreign currency of 10 percent of capital plus reserves. In August 1982, this limit was extended to 20 percent, and the definition of assets and liabilities subject to the limit was widened. In 1998 the regulation was updated to incorporate the fact that foreign currencies, different from the U.S. dollar, were also relevant. Finally, in 2005, further regulatory changes were introduced related to the measurement of market risk to consider foreign-currency, credit, and interest-rate exposure.[17] All these reforms contributed to inducing

17. In particular, the new limit establishes that the sum of risk-weighted assets times the minimum share established in article 66 of the Banking Law, plus the sum of risk stemming from interest-rate and foreign-currency risk should not go above 100 percent of effective equity of the bank. Foreign-currency exposure also includes net positions in FX-derivative contracts.

banks to reduce their currency mismatches and keep them contained. Next section focuses on nonfinancial institutions.

2.1.2 Declining Currency Exposure in Nonfinancial Corporations

The exposure to currency risk of nonfinancial corporations in Chile has been addressed in several previous studies.[18] In this section, we study the evolution of currency exposure based on standardized accounting information available for the sample of firms supervised by the securities-issuance regulator (previously SVS, now CMF[19]). This balance-sheet information is then merged with two datasets: i) the derivatives registry, which records virtually all FX-derivative contracts and counterparties; and ii) the customs registry, which records all goods exports and imports for the universe of Chilean firms.

Relative to previous papers, for instance, Cowan and others (2006), our sample has the following advantages. First, it has broader firm coverage—we observe 267 firms in 1997 and up to 373 firms in 2012, quarterly, for all but the first three years of our sample.[20] We were able to reconstruct these historical data from three sources: a) manual input from physical archives of annual reports for years prior to 1999, b) information from the so-called annex number 5 to statements of income submitted to the CMF for years 2000–2008, and c) information reported through the CMF to the Central Bank of Chile (CBC) for 2009–2018.[21] Second, rather than focusing on just the first few years after the inception of the floating regime, we can extend the sample by about 16 years (in total spanning from 1997 to 2018). Third, we can study separately the behavior of firms involved in international trade from those more focused on the domestic economy. This turns out to be a relevant separation to make, as shown below.

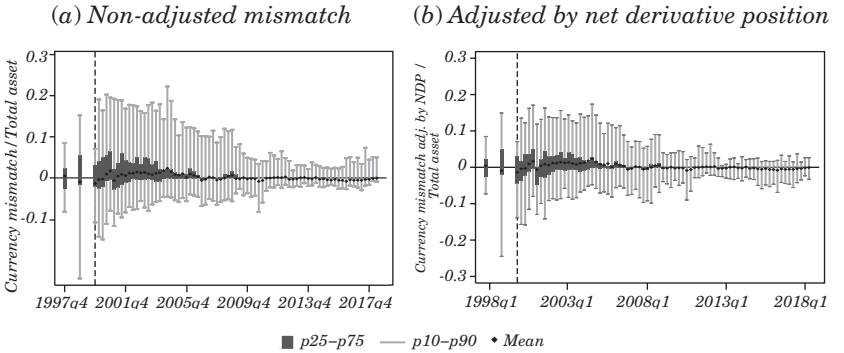
18. See De Gregorio and Tokman (2004), Caballero and others (2005), Chan-Lau (2005), Cowan and others (2006).

19. *Superintendencia de Valores y Seguros* (SVS), and *Comisión para el Mercado Financiero* (CMF), respectively.

20. Cowan and others (2006) use FECU data from 1995 to 2003 on a yearly basis, at around 132 average firms per year. We observe an average of 324 firms per year.

21. In the analysis below, we exclude firms with accounting in USD, for two reasons. First, from a financial stability perspective, our focus is on domestic firms since many corporations with USD accounting are subsidiaries of larger multinationals, such as mining companies. Second, for such multinationals, the currency exposure of local subsidiaries may give an incomplete picture of the overall exposure of the parent company across its different countries of operation.

Figure 2. Evolution of Balance-Sheet Net Currency Exposure in Supervised Firms
(USD liabilities – USD assets, as a fraction of total assets)

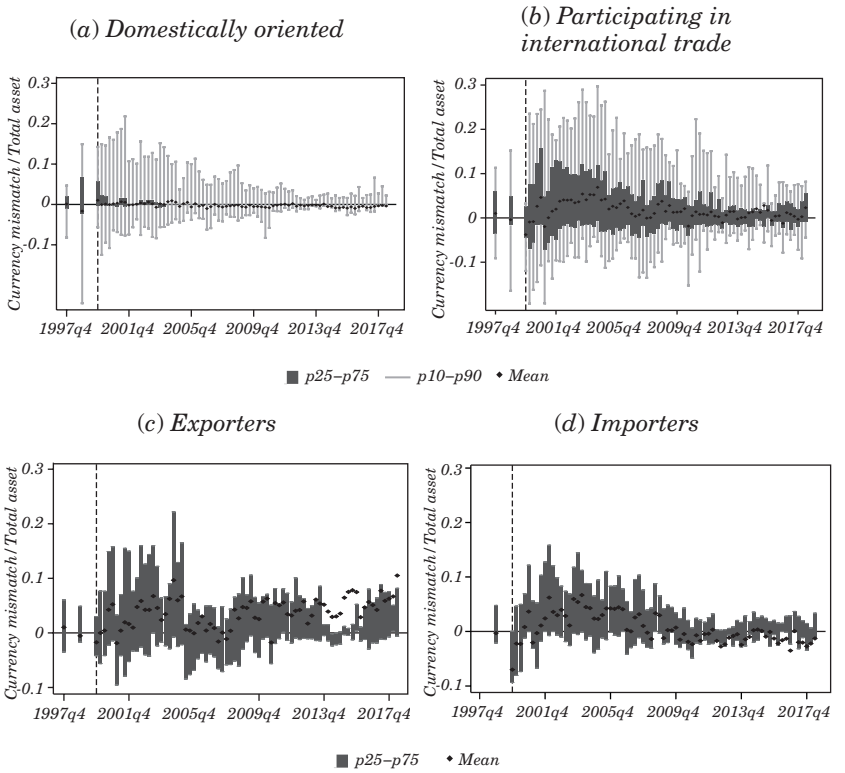


Source: Authors' calculations based on Central Bank of Chile and Financial Market Commission data.
Notes: Yearly data for 1997–1999, quarterly data from 2000q1. The squares show the mean exposure, the dark gray bars contain the interquartile range, and the endpoint of the light gray bars denote the 10th and 90th percentiles of the distribution.

Figure 2 shows the net currency exposure, as a share of total assets, for the complete distribution of firms from the fourth quarter of 1997 to the second quarter of 2018 (for years 1997–1999 we have yearly information only). FX exposure or currency mismatch on balance sheets is defined as the difference between foreign-currency-denominated liabilities and foreign-currency-denominated assets, as a share of total assets. Panel a) plots the FX exposure not adjusted by the net derivative position (NDP), while panel b) makes this adjustment.

Notably, while either the mean or median of the distribution show quite low levels of net FX exposure even at the start of the regime change in 1999—as documented in previous studies—, the conclusion is rather different if one considers the broader distribution. For instance, firms in the 90th percentile show initial exposures of up to 20 percent of total assets (that is, USD liabilities exceeded USD assets by 20 percent of total assets). Likewise, firms in the 10th percentile show a negative initial exposure of around 15 percent of total assets. From a financial stability perspective, it is precisely these firms at the tails of the distribution that matter most. Thus, as a first main result in this section, we highlight the fact that the complete distribution of firms' FX exposure shows a significant, progressive, and almost monotonic compression towards the current low levels of balance-sheet mismatch (with a mild increase in the last few years).

Figure 3. Balance-Sheet Net Currency Exposure in Domestically and Trade-Oriented Firms



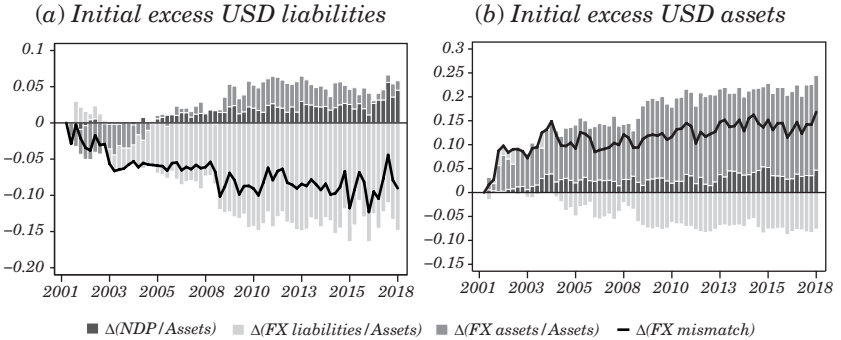
Source: Authors' calculations based on Central Bank of Chile and Financial Market Commission data.
Notes: Yearly data for 1997–1999, quarterly data from 2000q1. The definition of an importer (exporter) requires imports (exports) to be at least 10 percent of total sales. Sample sizes for exporters ranges from 32 to 73 firms and from 58 to 130 firms for importers, depending on the period.

Interestingly, the behaviors of domestically oriented and international trade-related firms evolve differently (figure 3). On the one hand, firms not related to trade (panel a)) initially show less exposure to exchange-rate risk, although there is a fair amount of FX mismatch in the top deciles at the start of the sample, which then compresses toward zero almost monotonically over time. On the other hand, firms related to international trade (panel b)) show a wider distribution of FX exposure in their balance sheets, which tends to persist throughout the sample. Further separating the latter group,

we find that exporters (panel c)) are generally short on the dollar in their balance sheets (a natural hedge), with the mean fluctuating just below or around 10 percent of total assets, while importers (panel d)) show a more compressed exposure, with the mean converging towards zero, from mostly positive values at the earlier sample.

As a second result, we stress the fact that the bulk of this adjustment seems to be driven by an adjustment of assets/liabilities mismatch, with net derivatives positions playing some but not the dominant role. This can be seen comparing panels a) and b) of figure 3, which suggest that, whether or not we adjust our measure of net currency exposure by derivatives positions, the evolution of the distribution of firms' balance-sheet exposure shows a similar pattern.[22] To look at this point further, figure 5 focuses on the quartiles of the most exposed firms and describes how the reduction of currency mismatch was accomplished. To avoid compositional effects, the figure studies the evolution of the balance sheets for a given set of firms throughout the sample.[23]

Figure 4. Cumulative Reduction of Initial FX Exposure



Source: Authors' calculations based on Central Bank of Chile, Financial Market Commission and Chilean Customs data.
Notes: Information for firms at the top (panel (a)) 25 percent, and bottom (panel(b)) 25 percent of the distribution of currency mismatch in the initial period (2001q1). Assets and NDP to assets are shown with the opposite sign. Each panel uses information of 42 firms on the top/bottom of the 2001q1 currency mismatch distribution.

22. This result is consistent with the evidence presented by Alfaro and others (2020), who highlight that FX derivatives are more likely to be used to hedge cash-flow currency mismatches than overall balance-sheet positions, partly due to the increasing cost of financial derivatives on maturity.

23. This selection criterion forces us to start the figure in 2001, as the share of firms operating in 1999 that persisted for the next twenty years is too low for the results to be representative. The sample considered here accounts for about 16% (8% on each side) of the total unbalanced panel plotted in figure 3.

Panel a) of figure 4 shows the cumulative reduction in the initial FX exposure of the firms in the 25th percentile most exposed to a currency depreciation (that is, the USD-liabilities position exceeds the corresponding USD-asset position). The starting point is normalized at zero, so the decrease (increase) in panel a) (panel b)) corresponds to the reduction in the initial positive (negative) mismatch. For these firms, the bulk of the mismatch reduction is explained through a fall in USD liabilities (light gray bars). Net derivative positions seem to go the other way, that is, the change actually contributes to increasing exposure. One possible interpretation is that, at the beginning, firms were partly hedging their USD-denominated liabilities by holding either USD assets (medium gray bars), and/or a positive net position on FX derivatives (long USD). Overall, as USD-denominated liabilities drop throughout the sample, so does the need for holding assets and derivatives. Panel b) shows the corresponding behavior for the 25th percentile of firms most exposed to a currency appreciation (USD-denominated assets exceed USD liabilities). Likewise, most of the reduction in exposure was achieved through a reduction in USD asset holdings, while initial USD liabilities (probably held initially as a hedge) also dropped.

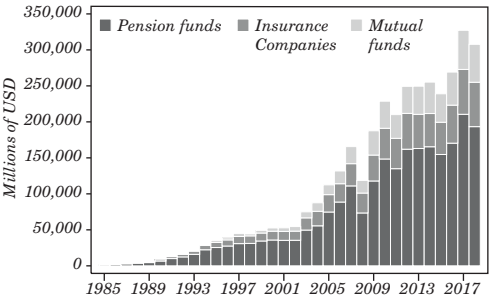
These results may contrast somewhat with the often heard view that the development of the derivatives market was the main vehicle through which firms reduced their balance-sheet currency exposure. Instead, the evidence presented here suggests that firms that were likely benefiting from a more developed capital market with cheaper credit (in the case they had excess USD liabilities) or better investment opportunities abroad (to the extent they had excess USD assets) faced progressively fewer incentives to do so and acted by reducing the corresponding exposure directly in their balance sheet. This is not to imply that firms do not use derivatives at least partly to hedge either balance-sheet exposure and/or revenue risks in the case they participate in international trade (both elements appear significant in the panel regressions studied in the following section), but their quantitative importance should be assessed with this evidence in mind.

In summary, nonfinancial corporations have significantly reduced balance-sheet exposure to foreign currency. The fact that this begins to occur shortly after the switch to free floating in 1999 is suggestive that firms' choices may be partly endogenous to the exchange-rate regime. However, an alternative, complementary hypothesis may also have played an important role. Namely, the deepening of financial markets—in particular, the growth in importance of pension funds and other institutional investors—also increased availability of

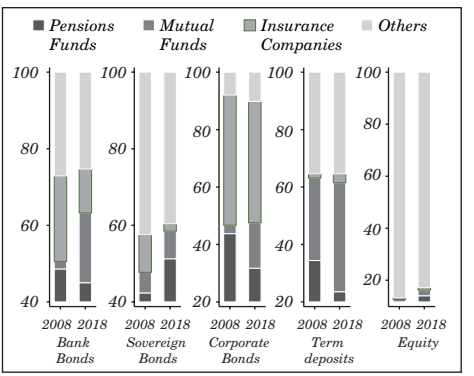
domestic credit and better local investment opportunities, as well as higher liquidity in the derivatives market. In particular, figure 5 shows the evolution of internal credit supply by institutional investors, which have progressively built up corporate debt in their portfolios, leading to a current participation in this market close to 85 percent. As a result, reliance on banking credit of these corporations has gone from an estimate of 91 percent of debt in 1986 to around 25 percent in recent years.[24]

Figure 5. Evolution of Credit Supply by Institutional Investor

(*a*) *Total assets under management by institutional investor (millions of USD)*



(*b*) *Main holders of financial instruments (percentage)*



Source: Berstein and Marcel (2019), based on data from *Depósito Central de Valores* and *Bolsa de Comercio de Santiago*.

24. See Marcel (2019).

2.1.3 A Closer Look at the Growing Derivatives Market

The market for FX-derivatives contracts has increased substantially since the transition to the freely floating regime in 1999. While FX derivatives have not been the main vehicle through which most nonfinancial corporations have compressed their balance-sheet mismatches after the adoption of the floating regime, it has played a role for some firms and especially other agents (figure 6). This section documents the overall evolution of the FX-derivatives market and the participation of different economic agents and provides evidence from panel regressions to understand the drivers of derivatives use by nonfinancial corporates.

Data of FX derivatives come from the Central Bank of Chile registry of derivatives, which compiles transaction-level information reported by participants of the so-called Formal Exchange Market (MCF, for its acronym in Spanish), which comprises commercial banks and other financial institutions.[25] These institutions are required to inform the Central Bank of Chile of transactions within a 24-hour window. These data constitute almost all the FX-derivatives transactions conducted in Chile since 1997 and amounts to more than three million observations involving more than 11 thousand firms.[26]

Figure 6 shows the gross (panel a)) and net (panel b)) positions in FX derivatives, both long or from the buyer's side (positive sign), and short or from the seller's side (negative sign).[27] The gross FX-derivatives positions in panel a) show a few interesting aspects. First, the figure documents the almost ten-fold increase in the size of notional positions traded in the market since the beginning of the clean floating regime in 1999, bringing the gross derivative position on each side of the market to represent roughly 60 percent of current GDP.[28]

25. The requirement of information is detailed in Chapter IX of the *Compendio de Normas de Cambios Internacionales* available at *https://www.bcentral.cl/en/cnci-capitulos*.

26. The first record of information goes back to 1993; however, only after 1997 the market starts showing more transactions. A detailed description of the data can be found in Rodríguez and Villena (2016).

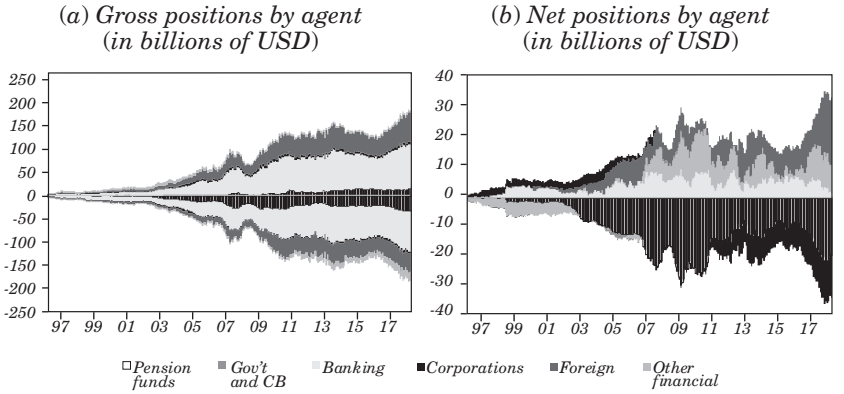
27. In this section, we only consider derivatives that involve the Chilean peso or UF ("*Unidad de fomento*", Chilean inflation-indexed unit of account) on one side. That is, we exclude all observations that involve two foreign currencies on both sides of the contracts, as these contracts may aim at something different than removing foreign-currency risk from balance sheets and cash flows denominated in pesos.

28. The numerator in this calculation corresponds to the monthly average of all outstanding notional amounts traded throughout 2018. The denominator corresponds to annual GDP, each quarter evaluated at spot exchange rates.

Second, it also shows the relative sizes of the main players. As is well known, pension funds (center bars) play a relevant role, taking mostly (but not exclusively) short positions on foreign currency (as confirmed by their net positions in panel b)). This makes sense since pension funds allocate a significant fraction of domestic savings in foreign securities (approximately around 40 percent of their portfolio in 2018), for which they are required to partially hedge currency exposure—thus becoming natural sellers of USD forward contracts.[29] Pension funds were not active participants in this market at its onset, since regulation did not allow these institutions to invest abroad until the year 2001.

Foreign investors also play a relevant role and hold a more balanced mix of buyer/seller forward positions. This is also to be expected since nonresidents encompass a multitude of different agents with diverse economic and financial exposures, and possibly different expectations on the future evolution of the peso/U.S. dollar and/or the profitability of a given interest-rate differential.

Figure 6. Main Participants in Chile's Derivatives Market



Source: Authors' calculations based on Central Bank of Chile data.
Notes: Data subject to revisions for the pre-2007 data. Both panels show positions from the perspective of the referred agent. By definition, the net derivative position of all local agents must mirror the (inverse) position of nonresidents.

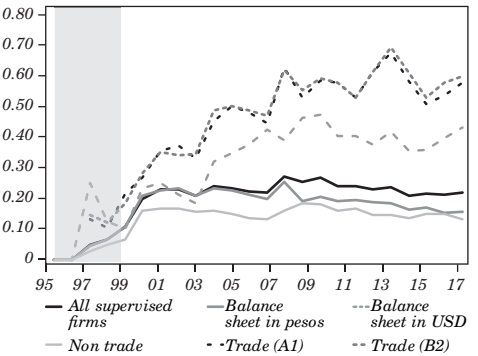
29. The so-called *Reform to Capital Markets I* (Law 19,769)—among other things—allowed the investment portfolio of pension funds to be divided into five different new ones; with different associated risk profiles—usually referred to as '*multifondos*'. The same law allowed these funds (in different degrees) to invest in foreign assets and imposed the maximum share of these investments that can lack hedging against currency risk.

Finally, the light gray area show the gross positions of banks. Together with other financial institutions (gray outer area), banks constitute the largest participants in the FX-derivatives market.

Banks' gross derivative positions (panel a)) are an order of magnitude larger than their net positions (panel a)). They generally act as market makers and counterpart to other agents in the economy seeking to buy/sell FX derivatives. However, in the end, they retain very little currency exposure, and most of their net derivative position is offset in the spot market (consistent with the evidence presented in subsection 2.1.1). Nonfinancial corporates, on the other hand, account for a small fraction of the market. This suggests that, rather than providing a pivotal role in the spreading of FX-derivative contracts, nonfinancial corporates have benefited from the increased depth and liquidity brought about to these markets by other large players.

We now zoom in on the spreading and the reason for the use of derivatives by nonfinancial corporates for which we have better information–the subset of supervised firms with publicly available balance sheets and income statements. First, figure 7 shows that the fraction of supervised firms that use derivatives rose to around 20 percent by the early 2000s and remained roughly at that level. However, the percentage continued to increase until the global crisis for firms with balance sheets denominated in U.S. dollars and for firms participating actively in international trade, reaching about 40 and 60 percent, respectively. Moreover, the usage per firm increased substantially for all firms.

Figure 7. Derivatives Use among Groups of Supervised Firms
(fraction)



Source: Authors' calculations.
Notes: Shaded area shows period prior to adopting a floating exchange-rate regime. Firms that trade are defined as those that engage in any type of international trade in a given period. Trade (*B*2) firms are those whose imports/exports are above 5% of their corresponding assets, (*A*1) more than 10% of their sales.

The main determinants behind the decision to use derivatives are empirically investigated in the (logit) panel regressions shown in table 1. The dependent variable of this regression is a dummy which takes the value of one if a firm uses FX derivatives in the corresponding quarter—either long or short positions. The independent variables include an accounting line in the firm's income statement that specifically quantifies gains (positive) or losses (negative) due to exchange-rate (ER) fluctuations ("Income due to ER variation"), the level of the currency mismatch in the previous period as a fraction of total assets, interactions of these variables, and the firm's participation in international trade. Notably, by using microdata from income statements, we have a direct proxy for how exchange-rate volatility affects a firm; a single variable neatly picks up this effect.

First, from columns 1 and 3 we learn that firms that have experienced losses due to exchange-rate fluctuations ("Income due to ER variation < 0") are more prone to use derivatives in the next period. To facilitate interpretation, we separate our accounting variable in gains (positive) and losses (absolute value of a negative variable) realizations in columns 2 and 4 to 7. Notice that the reaction is asymmetric, as the effect is not significant if firms experienced gains ("Income due to ER variation > 0"), but instead losses from ER variation (which are positive in absolute value) increase the probability of using FX-derivatives.

Second, firms with a higher difference between FX liabilities and assets (which in our definition corresponds to higher balance-sheet mismatches) are more likely to rely on derivatives. This is true both when this difference is positive (the higher the FX liabilities relative to assets—i.e., larger absolute value of balance-sheet mismatches when positive—, the more likely is the use of derivatives) and when it is negative (the higher the FX assets relative to liabilities—i.e., a larger absolute value of balance-sheet mismatches when negative—, the less likely is the use of derivatives).

Third, the previous result that firms making losses from ER variation are more likely to use derivatives depends on firms having positive currency mismatches. Indeed, columns 5 to 7 show that losses due to ER fluctuations are more likely to be associated with the use of FX derivatives if the currency mismatch is on the positive side (that is, more liabilities than assets denominated in FX currency). In particular, since table 1 shows the average marginal effects, and the standard deviation of losses due to ER variation is 1 percent of assets, then a one standard deviation higher losses when the balance-sheet currency mismatch is positive entails a 7 percent higher probability of using FX derivatives in the following period.

Table 1. Determinants of Participation in the FX-Derivatives Market

Dependent variable: dummy = 1 if firm uses FX derivatives (binary choice model: logit for panel data)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income ER variation if >0, lag		-1.418		-2.060	-1.637	-1.579	-1.602
		(2.682)		(2.576)	(2.595)	(2.569)	(2.593)
abs(Income ER variation if <0), lag		6.319**		4.022			
		(3.083)		(3.058)			
Income ER variation lag	-3.629**		-3.053*				
	(1.742)		(1.665)				
Balance sheet mismatch			0.725***				
			(0.135)				
abs(Balance sheet mismatch if <0), lag				0.843***	0.790***	0.774***	0.792***
				(0.201)	(0.207)	(0.205)	(0.208)
Balance sheet mismatch if >0, lag				-0.562**	-0.535**	-0.532**	-0.532**
				(0.222)	(0.220)	(0.219)	(0.219)
abs(Income ER variation if <0) * 1(mismatch > 0)					7.504*	7.343*	7.686*
					(4.459)	(4.417)	(4.467)
abs(Income ER variation if <0) * 1(mismatch < 0)					1.164	1.365	1.146
					(4.120)	(4.070)	(4.127)
Flag A importer/exporter						0.0725	
						(0.0722)	
Flag B importer/exporter							-0.0519
							(0.0612)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,181	2,181	2,181	2,181	2,181	2,181	2,181

Source: Authors' research.
Notes: Average maginal effects reported. The variable "Income due to ER variation" corresponds to the account with the same name in the Income Statement for each firm, and does not include income/loss due to inflation. Flag A (Flag B) defines whether a firm is an importer/exporter if its import/exports represent more than 10% (5%) of total sales (assets). Includes firm fixed effects in all specifications.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

This evidence speaks to the idea that firms adapt to the financial conditions they face. We have already established that the enhanced financial development and more availability of funds and investment opportunities facilitated the access of firms with positive (negative) mismatches to alternative sources of funding (projects). The evidence presented here complements this analysis by establishing that firms with skin in the game that lost money with greater ER volatility are more likely to hedge.

Table 2 shows the results of a panel regression exercise investigating the net position (as opposed to the probability as in table 1) of the use of FX derivates by firms, hence conditional on using such derivatives. In other words, it considers the same independent variables as in the logit regression of table 1, but the dependent variable is the end-of-quarter net derivative position (in absolute value) for each firm, which tries to capture the intensive margin use of derivatives.

First, from columns 3 to 7, we see that the extent of the use of FX derivatives is mostly associated with the size of currency mismatch in its balance sheet, independently of the sign of the mismatch. In other words, firms with larger absolute values of mismatches engage in larger amounts of derivative contracts (captured in rows 4 and 5 in columns 3 to 7). In terms of the effect, the NDP is about 2 percent higher if the firm incurs a one standard deviation increase in the absolute value of the balance-sheet currency mismatch (columns 4 to 7).

In addition, we also find evidence that losses from ER variation in the presence of a positive currency mismatch also affect the amount of NDP (table 2 columns 4 to 7) and not just whether firms engage in derivatives (as from table 1): in terms of the effect, the NDP is about 2.3 percent higher if the firm incurs a one standard deviation loss due to ER variation when balance-sheet currency mismatch is positive (row 7, columns 4 to 7).

Table 2. Participation in FX-Derivatives Market (Intensive Margin)

Dependent variable: absolute value of net derivative position (% assets) (panel data model)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income ER variation, lag	0.0526						
	(0.531)						
Income ER variation if >0, lag		1.153	0.948	0.892	0.918	0.917	0.869
		(1.054)	(1.041)	(1.037)	(1.040)	(1.038)	(0.988)
abs (Income ER variation if <0), lag		0.895	0,403	0.396			
		(1.020)	(1.030)	(1.030)			
Balance sheet mismatch > 0			0.188***	0.168***	0.183***	0.183***	0.186***
			-0,0504	(0.0519)	(0.0523)	(0.0524)	(0.0520)
abs (Balance sheet mismatch, if < 0)				0.244***	0.229***	0.229***	0.227***
				(0.0866)	(0.0834)	(0.0833)	(0.0836)
abs (Income ER variation if < 0) * 1 (mismatch > 0)					2.302*	2.302*	2.197*
					(1.170)	(1.170)	(1.119)
abs (Income ER variation if < 0) * 1 (mismatch < 0)					-0.713	-0.712	-0.918
					(1.394)	(1.394)	(1.181)
Flag A importer/exporter						-0.000579	
						(0.00768)	
Flag B importer/exporter							-0.0289
							(0.0273)

Table 2. Participation in FX-Derivatives Market (Intensive Margin) (continued)

Dependent variable: absolute value of net derivative position (% assets) (panel data model)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	0.0671***	0.0635***	0.0331***	0.0414***	0.0410***	0.0412***	0.0550***
	(0.000308)	(0.00312)	-0.00892	(0.00695)	(0.00690)	(0.00712)	(0.0133)
Observations	1,116	1,116	1,116	1,116	1,116	1,116	1,116
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	116	116	116	116	116	116	116
R^2	0.590	0.591	0.610	0.610	0.613	0.613	0.617

Source: Authors' research.
Notes: The variable "Income due to ER change" corresponds to the account with the same name in the Income Statement for each firm, and does not include income/loss due to inflation. Any variable followed by <0(>0) is the same continous varible truncated at zero, and not an indicator variable. Indicator (dummy) variables are expressed by 1(true expression) notation. Flag A (Flag B) defines whether a firm is an importer/exporter if its import/exports represent more than 10% (5%) of total sales (assets). Standard errorrs are clustered at firm level.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Adjustment of Currency Mismatch

Dependent variable: absolute value of net derivative position (% assets) (panel data model)						
	(1)	(2)	(3)	(4)	(5)	(6)
Mismatch, delta lag	0.321**	0.321**	0.323**	0.301**	0.301**	0.301**
	(0.133)	(0.133)	(0.133)	(0.130)	(0.130)	(0.130)
Income ER variation, lag	-0.349*	-0.349*				
	(0.211)	(0.211)				
Income ER variation if >0, lag			-0.295	-0.560	-0.557	-0.560
			(0.381)	(0.386)	(0.388)	(0.386)
Income ER variation if <0, lag			-0.926**			
			(0.455)			
(Income ER variation < 0) * 1(mismatch < 0)				2.023***	2.026***	2.023***
				(0.664)	(0.664)	(0.664)
(Income ER variation < 0) * 1(mismatch > 0)				-3.420***	-3.436***	-3.422***
				(0.747)	(0.756)	(0.749)
Flag A importer/exporter					0.00484	
					(0.00739)	
Flag B importer/exporter						0.000601
						(0.00288)
Constant	0.00953*	0.00953*	0.0100*	0.0109**	0.00984*	0.0107**
	(0.00514)	(0.00514)	(0.00521)	(0.00514)	(0.00541)	(0.00523)

Table 3. Adjustment of Currency Mismatch (continued)

Dependent variable: absolute value of net derivative position (% assets) (panel data model)						
	(1)	(2)	(3)	(4)	(5)	(6)
Observations	4,961	4,961	4,961	4,961	4,961	4,961
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	303	303	303	303	303	303
R^2	0.0306	0.0306	0.0291	0.0107	0.0106	0.0107

Source: Authors' research.
Notes: The variable "Income due to ER variation" corresponds to the account with the same name in the Income Statement for each firm, and does not include income/loss due to inflation. Flag A (Flag B) defines whether a firm is an importer/exporter if its import/exports represent more than 10% (5%) of total sales (assets). Standard errorrs are clustered at firm level.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

2.1.4 Consistency between Regression Analysis on Derivatives and Mismatches

In table 3 we focus on the change in the balance-sheet mismatch and thus complement the previous descriptive analysis on the secular reduction in balance-sheet foreign-currency mismatches following the adoption of a floating exchange-rate regime. The dependent variable in our panel regression exercise is the change in the balance-sheet currency mismatch (scaled by total assets). The independent variables are the same as those used in tables 1 and 2, notably the account in the income statement measuring profits/losses directly linked to balance-sheet foreign-currency mismatch and ER fluctuations

Not surprisingly, in line with the previous results, we find that negative profits directly linked to currency mismatches result in the reduction of these mismatches in the following period as revealed by column 3: indeed, losses from exchange rates corresponding to a rise in the variable "abs (Income ER variation<0)" entail a reduction in currency mismatches. Put differently, with further losses due to currency mismatches, firms are likely to reduce mismatches. As before, there is no evidence that positive profits motivate an increase in currency mismatches. In columns 4 to 6, we examine whether the relation between ER losses and reduction of mismatches depends on the sign of the mismatches (by interacting of losses from ER variation and dummies that take a value of one if the initial level of currency mismatch was positive or negative): irrespective of whether the balance-sheet mismatch is positive or negative, ER losses are associated with the reduction of the absolute value of the balance-sheet mismatch in the following period, i.e., bringing the mismatches towards zero. These results are consistent with the evidence sketched in figure 3 and are also consistent with the idea of a learning process of firms to a new environment of higher ER fluctuations.

2.2 Evolution of the Exchange-Rate Passthrough over Time

A second burden to overcome in order to float with comfort is the difficulty of meeting inflation targets when confronted with wide fluctuations in the value of the currency. In Chile, the definition of the inflation goal as an *inflation forecast targeting*—based on a convergence of projected inflation towards 3 percent over the two-

year policy horizon—provides the first key ingredient that facilitates the handling of temporary ER fluctuations. Of course, achieving the inflation forecast goal is easier if the degree of ERPT to domestic prices is low/moderate. Naturally, and as stated in the various papers cited in the introduction document, ERPT is not exogenous, with credibility in the institutional and monetary framework playing an important role in its moderation. This section begins with a brief review of the evolution of both the link between monetary-policy credibility and ERPT and some key institutional quality proxies for Chile. Following a large literature, it then documents a further reduction of the degree of ERPT over time for Chile.

2.2.1 ERPT and Credibility

Institutional settings and the credibility of policy frameworks play a key role in determining the effectiveness of macroeconomic policies, including the transmission of monetary policy and the exchange-rate passthrough.[30] In this context, countries with a more credible monetary-policy record would typically have lower ERPT to consumer prices. For instance, in a recent paper, Arias and Kirchner (2019) estimate a large scale DSGE model for Chile, relaxing the assumption of rational expectations by assuming agents learn about the underlying structural parameters of the economy by observing actual inflation. In their setting, agents place a larger weight on recent inflation forecast errors when making forecasts, to the extent that errors have accumulated in one particular direction—a notion closely related to the concept of expectations becoming unanchored.[31] Intuitively, when expectations become more reactive to inflation surprises, a given fluctuation in the exchange rate will tend to have a larger impact on inflation, as firms and workers reshape their expectations about future inflation and adjust pricing decisions accordingly.

Figure 8 reproduces the ERPT—defined as the cumulative effect on total CPI divided by the cumulative response of the nominal exchange rate—that arises from the two main exogenous shocks that drive the lion's share of nominal exchange-rate variation in Arias and Kirchner (2019): a shock to imported prices in panel a) and a shock

30. See Carrière-Swallow and others (2016), Edwards (2006), and Mishkin and Schmidt-Hebbel (2007).

31. See Bernanke (2007), and Carvalho and others (2017).

to the uncovered interest rate parity (UIP) relationship in panel b).[32] The figure confirms the qualitative intuition: in a situation when expectations are well anchored (for instance, when inflation forecast errors of agents have been unbiased), the impact on inflation of an exchange-rate depreciation is lower than when expectations are unanchored and agents become more reactive to inflation shocks in forming their forecasts. The difference is especially marked over the shorter run in the case of import prices, which is the shock that accounts for the largest share of the variability of the exchange rate in their model.

In light of this argument, it is crucial to notice that the anchoring of expectations, and hence of monetary-policy credibility, has been gradually improving over time in Chile. Panel a) of figure 9 shows that the inflation expectations' anchoring index, constructed by Bems and others (2018), has mainly followed an upward trajectory since the introduction of the fully floating regime in Chile. While Chile's score was close to the median of the set of EMEs in 1999, it has climbed to the top among EMEs over the last decade, suggesting continued gains in monetary-policy credibility.

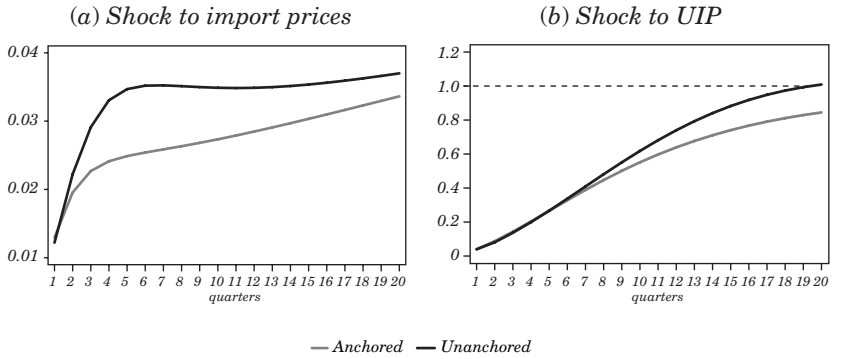
Naturally, the degree to which inflation expectations are anchored is intimately tied to the level of credibility about the ability and willingness of central banks to achieve their targets. In turn, this is related to the quality of institutions. Figure 9, panel b), suggests that Chile has been an outperformer among a set of comparator emerging markets in terms of regulatory quality for the last few decades, a proxy for the quality of institutions.[33] This finding suggests that Chile enjoys more favorable perceptions relative to other EMEs about the ability of public institutions to implement sound policies and regulations that would promote private sector development. Such perceptions are likely to reflect underlying institutional strengths that have helped foment economic activity in Chile over a prolonged period.

32. For more details, see Arias and Kirchner (2019). We thank the authors for kindly computing the impulse responses, which were not a part of the original publication.

33. The Regulatory Quality forms part of the World Bank's Worldwide Governance Indicators. The sample includes Argentina, Brazil, China, Colombia, Czech Republic, Hungary, Egypt, India, Indonesia, Iran, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Peru, Philippines, Poland, Russia, South Africa, South Korea, Thailand, Turkey, Uruguay, and Vietnam.

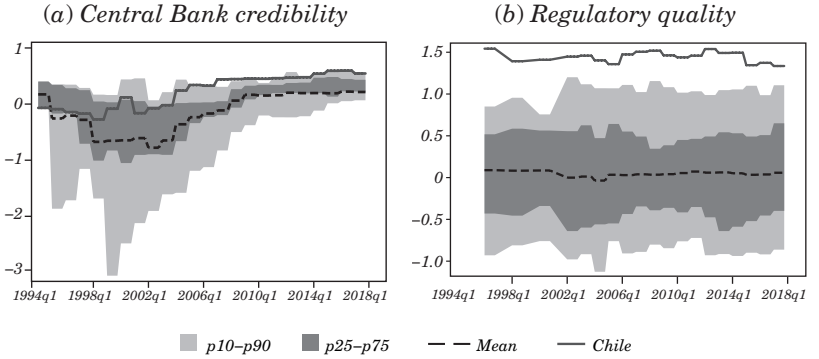
Overall, this section argues that an increasing central-bank credibility and anchoring of expectations, coupled with high quality institutional and regulatory environments, have favored, *ceteris paribus*, a low and declining ERPT in Chile.

Figure 8. Simulated ERPT under Alternative Inflation Expectations Regimes



Source: Simulations based on the model of Arias and Kirchner (2019).

Figure 9. Institutions and Credibility



Source: World Bank World Governance Indicators, and Bems and others (2018).
Note: Dark gray columns denote the 25th and 75th percentiles, light gray columns denote the 10th and 90th percentiles, and dark gray line denotes Chile.

2.2.2 Univariate Regressions

As a first approach to estimating ERPT, we focus on univariate OLS regressions of different measures of inflation on the change in the CLP/USD nominal exchange rate given by the following specification:

$$y_t = \alpha + \beta_0 x_t + \sum_{i=1}^{12} \beta_i x_{t-i} + \varepsilon_t \quad (1)$$

where y_t is the month-on-month (mom) percentage change in the CPI (or the alternative subcomponent of the CPI), x_t is the mom percentage change in the CLP/USD nominal exchange rate, x_{t-i} is the change in the exchange rate lagged by i months, and ε_t is the error term. All results are based on monthly data and month-on-month changes in the corresponding variables.

The pass-through is calculated as the sum of the coefficients $\beta_0 + \sum_{i=1}^{12} \beta_i$, which show the cumulative response of inflation to the contemporaneous and 12 lags changes in the nominal exchange rate. Table 4 shows the results for the complete sample (1982–2019) as well as for the pre- and post-flexibility samples. Figure 10 complements these results by plotting the sum of the coefficient based on a 72-month rolling window, for both CPI and core inflation (i.e., CPI excluding food and energy).[34] The estimated ERPT (contemporaneous plus 12 lags) has been larger in the pre-1999 period than in the post-1999 period. In addition, both of these coefficient sums are significant at the 1 percent significant level when tested through a joint F test, and they are also statistically different (in the simple sense that they are outside each other's confidence interval).

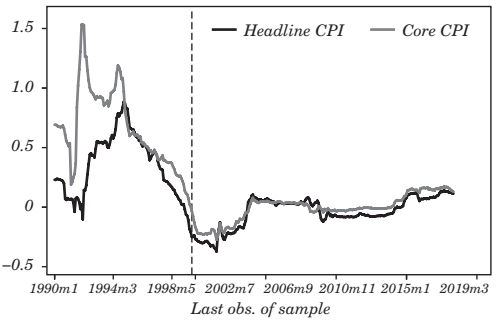
Table 4. ERPT in Univariate OLS Regressions

	Full sample (1982-2019)	*Pre-September 1999*	*Post-September 1999*
Sum of coefficients			
(conteporaneous plus 12 lags)	0.167	0.45	0.04
F-test statistic	31.73	26.57	7.03
P-value	0.000	0.000	0.009

Source: Authors' calculations.

34. Results based on alternative rolling windows ranging from 24 to 96 months are broadly consistent.

Figure 10. ERPT Rolling Coefficient Estimates for Headline and Core CPI



Source: Authors' calculations.
Note: Horizontal axis shows the last observation of a rolling-window subsample.

Figure 10 provides several observations about the ERPT to headline inflation. First, the ERPT was higher in the pre-floating period than in the period afterward. Second, it has already been on a steep downward path during the transition to the fully flexible regime and reached its lowest level around the official start of the fully flexible regime in September 1999.[35] Third, the ERPT increased somewhat over the free-floating period though always remaining below the pre-floating period levels. Figure 10 also presents the results from similar regressions for the core CPI inflation. As in the case of headline inflation, the ERPT was on a downward trend over the transition toward the freely floating exchange-rate regime and reached its lowest point around the official start of full floating in September 1999. However, the key difference is that ERPT is much more marked for the decline of core inflation, than for that of headline inflation.

2.2.3 Results from VAR Estimations

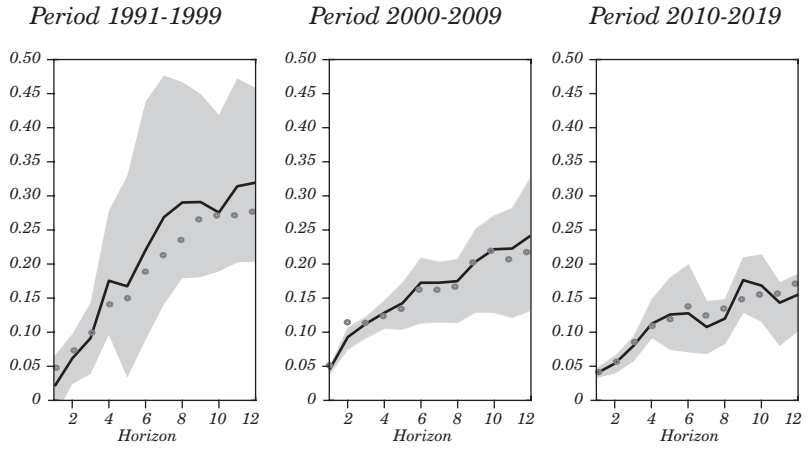
An alternative empirical approach to investigate the ERPT is through the estimation of VAR, which also helps address some possible concerns related to potential endogeneity of the variables included in the regressions in subsection 2.2.2.

35. The significant drop in ERPT to even negative values could be related to the economic downturn in this period.

Following a specification similar to that used in Albagli and others (2015), and Justel and Sansone (2016), the VAR comprises blocks of exogenous and endogenous variables. The exogenous block includes i) U.S. industrial production, ii) U.S. CPI, iii) Oil prices (WTI), iv) world food prices (FAO), and v) the fed funds rate. As an endogenous set of local variables, the VAR includes, in this order: i) real monthly GDP (Imacec), ii) the monetary-policy rate, iii) CLP/USD nominal exchange rate, and iv) CPI. Identification of structural errors follows a simple Cholesky decomposition. All variables are expressed in mom log differences, except the monetary-policy rates that are expressed in differences (and divided by 100).

The ERPT is calculated as the ratio of the cumulative response of inflation and the cumulative response of the NER change to an autonomous shock of the NER over twelve months. Figure 11 shows the results for Chile's ERPT for three subsamples: i) the pre-floating period (1991–1999); ii) the period between the beginning of the freely floating regime and the subprime crisis (2000–2009), and for the last decade (2010–2019). In the figure plots, the dots show the estimated results for the actual subsample, while the solid lines and the shaded area show the median and interquartile range estimations that arise from a block-bootstrap exercise (5,000 replications) for each-subsample.

Figure 11. ERPT from VAR Regressions (Block trap)



Source: Authors' calculations using data from the Central Bank of Chile, FRED, FAO, and Bloomberg.
Note: VAR includes both exogenous and endogenous blocks, following Albagli and others (2015), and Justel and Sansone (2016). The dots show results for the actual subsamples; black lines and the gray area show the median and interquartile range estimations from 5,000 block-bootstrap replications.

The figure reveals that Chile's ERPT has dropped significantly and monotonically across the subsamples considered. Before the transition to free floating, the estimated ERPT at a 12month horizon is about 32 percent (using the bootstrap median). In the first decade afterwards, it drops to 24 percent and then reaches 15 percent in the last decade.[36]

2.2.4 The Rare Use of Foreign-Exchange Intervention

It can be argued that comfort in floating should imply that exchange-rate interventions (FXI) should be—if any at all—very infrequent. Indeed, this is the experience in Chile over the past two decades. With the adoption of the floating regime in 1999, the Central Bank of Chile has intervened in the USD spot market four times in two decades. The intervention episodes of 2001/2002 and 2019, during which the Central Bank sold reserves, were justified based on a comprehensive assessment that unusual circumstances—usually a crisis—had led to excessive bouts of exchange-rate volatility that could be harmful to the correct functioning of markets. The interventions in which the Central Bank bought U.S. dollars, in 2008 and 2011, were in turn motivated by the wish to accumulate reserves. Also, each time a plan was put in place, it was transparently communicated to the public and its reasoning explained in advance.

More specifically, in 2001, shortly after the Asian crisis and the formal adoption of the inflation-targeting scheme, the Chilean peso depreciated sharply in the aftermath of the Argentine crisis. The CBC sold U.S. dollars to limit the associated inflationary effects in a context in which weak economic activity made raising the interest rate not optimal.[37] In 2008, in an inflationary context with notable currency appreciation, the CBC engaged in a program of reserves accumulation of USD 8 billion, justified under the logic of strengthening the international liquidity position of the Chilean economy to confront a potential worsening of the international conditions. The program was interrupted by Lehman Brothers' collapse and did not complete its initial target.[38] The rationale for the 2011 program was based on the

36. Using a similar methodology, Justel and Sansone (2016) also find a reduction of ERPT for Chile.

37. See Claro and Soto (2013) for more details.

38. During the crisis, a comprehensive set of policies were adopted to help secure liquidity and normal functioning in the USD-denominated market, particularly through swaps. Calani and others (2011) provide the detailed list of instruments, dates, and amounts used by the CBC. Notably, the CBC did not engage in an outright intervention.

assessment that the level of international reserves (as a fraction of GDP) was low in comparison to similar economies and the appreciated currency facilitated reserves accumulation. Notably, both the 2008 and 2011 programs were based on pre-announced amounts and not on ER target levels. Finally, the 2019 ER intervention was announced after one of the sharpest depreciations of the Chilean peso, in the middle of a domestic political crisis. The CBC announced a calendar for selling USD 10 billion in the spot market and USD 10 billion in the forward market. On this occasion too, no specific exchange-rate target level was announced, but it was the view of the CBC Board that the exchange-rate volatility had reached excessive levels, thus impeding the normal functioning of the price formation process. If not addressed, such excessive volatility could distort the functioning of both financial markets and real economy. A more in-depth description of earlier intervention episodes and their motivation can be found in Vial (2019).

Finally, it can be argued that ER interventions do not necessarily have to be carried out by the Central Bank.[39] Instead, the government can—and effectively does—participate in the foreign-currency market by selling proceeds of newly issued sovereign debt and through the management of its sovereign wealth funds. The most notable wealth fund is the Economic and Social Stabilization Fund (FEES, for its acronym in Spanish). The largest fund withdrawal from FEES was in 2009 (around 9 billion), and the funds were used to finance the fiscal deficit, contribute to the Pension Reserve Fund (around 1 billion), and to inject capital to mining company Codelco (around 1 billion) and *Banco Estado* (around 0.5 billion). The Fiscal Responsibility Law (Law 20.208) ensures that withdrawals from FEES—hence, ER operations—by the Ministry of Finance are to be related to funding the fiscal deficit or prepayment of sovereign debt. However, the government does not withdraw funds from sovereign wealth funds to explicitly target the value of the ER, which could be considered as an ER intervention.

3. Macroeconomic Adjustment: a Tale of Two Crises

The two main economic crises faced by Chile in the last two decades serve as a natural laboratory for checking how the different exchange-rate regimes in operation affected the macroeconomic adjustment.

39. We thank Guillermo Calvo for this comment.

In this section, we show that the Chilean economy indeed responded quite differently to the Asian/Russian crisis of 97–98 and to the Global Financial Crisis roughly a decade later. Besides the different nature and size of the shocks endured, this is likely also a consequence of the changes in the policy framework that took place in between, which include not only the free-float of the currency but also the introduction of the cyclically adjusted fiscal balance rule in 2001. Overall, while the first episode indicates the fear of floating highlighted by Calvo and Reinhart (2002) quite clearly (interest rates were jacked up), the second episode summarizes the comfort with floating fairly neatly as well (interest rates were slashed, letting the exchange rate go).

3.1 Key Findings from the Crisis Episodes: Chile (1997–98 vs. 2008)

Figure 12 shows the behavior of several key economic and financial indicators around the time of eruption of these crisis episodes. The attack on the Thai baht in 1997Q3 is taken as the start of the Asian financial crisis, and the collapse of Lehman Brothers as the start of the Global Financial Crisis (note that it was the combination of the Asian and Russian crises that affected Chile in the first episode, but for ease of comparability across countries in the subsequent exercise, we maintain the origin of the shock as 1997Q3). The analysis covers a 30-quarter period (7½-year), from 10 quarters before the start of the crisis until 20 quarters afterward.

The findings presented in figure 12 suggest that the macroeconomic adjustment was generally better in the second episode relative to the first one, especially when considering the stronger external shock in the second crisis. In particular, the key findings from the analysis that compares the magnitude of exogenous shocks, policy responses, and Chile's macroeconomic performance in the two crisis episodes include the following:

3.1.1 Exogenous shocks

The exogenous adverse shock in the second crisis episode was considerably stronger than the exogenous shock in the first episode. First, the collapse in trading partners' real growth was much deeper in the second episode. Second, the decline in (non-FDI) capital inflows was much sharper in the second crisis episode. Third, the drop in real copper prices was also more profound in the second episode.

3.1.2 Policy responses

Interest rates show two very different trajectories: while they were hiked after the first crisis in order to defend the exchange rate showing the fear of floating, they were significantly slashed after the second crisis, letting the exchange rate assume its shock-absorbing role and stimulating the rebound of the economy. After several quarters, the strategy was reversed in the first crisis episode as well, when interest rates were eventually reduced.

The **fiscal deficit** widened more and faster in the second episode, thus reflecting the cyclically adjusted fiscal balance rule as well as the deviations from the rule purposed by the authorities following the eruption of the GFC. At least to some extent, the faster reaction of fiscal policy in this episode was made possible by the earlier introduction of the fully flexible exchange-rate policy, which reduced the concerns about the impact of fiscal expansion on the sustainability of the exchange-rate regime. In addition, the fiscal balance started improving faster and more markedly in the second episode, thus reflecting also the constraint imposed by the cyclically adjusted fiscal rule.

Both the nominal effective exchange rate (NEER) and the real effective exchange rate (REER) depreciated more and faster, and subsequently also recovered faster after the second crisis episode. While the movements of the NEER and REER reflected also movements in copper prices, the reaction of the NEER and REER preceded the changes in copper prices in the second episode.

3.1.3 Outcomes

Real GDP growth experienced a faster recovery after the second crisis despite the stronger shock, while the tight monetary policy associated with the fear of floating during the first episode contributed to the decline in growth via a contraction in private credit and hence real private investment.

The **unemployment rate** increased following both crisis episodes (though its upward trend started somewhat later in the first episode, in line with the later impact on real GDP growth). Nonetheless, despite a weaker shock, the unemployment rate registered a sharper increase after the first crisis and stayed considerably higher for several years afterwards, as compared to both the pre-crisis period and the second crisis episode. Conversely, the unemployment rate started declining quite quickly after the second crisis and dropped below pre-crisis levels within several quarters.

Inflation continued its downward trend after the first crisis, while it spiked before dropping sharply after the second crisis, thus reflecting in part the passthrough from the exchange-rate movements.

The **external current account deficit** widened sharply at the start of both crisis episodes but recovered considerably faster after the second crisis. Note that this improvement preceded the recovery of copper prices by several quarters, which suggests that other mechanisms beyond copper prices (like the floating exchange rate) were at play.

Movements of the current account balance reflect underlying changes in **real exports** and **real imports**. The milder drop in real exports growth, coupled with the fast switch away from imports, helps explain the faster recovery of the current account balance in the second crisis episode, which points also to an adjustment role of the exchange rate.

Real private credit growth experienced a protracted decline in the first episode, thus **contributing to the prolongation of the economic downturn**. After the eruption of the second crisis (also significantly affected by the global concerns about credit markets), the growth of real private credit experienced a fast decline, which was however followed by a V-shaped recovery with the implementation of monetary easing. Real private investment followed a growth pattern similar to the one of the GDP, but its level ended up recovering much less in the first episode.

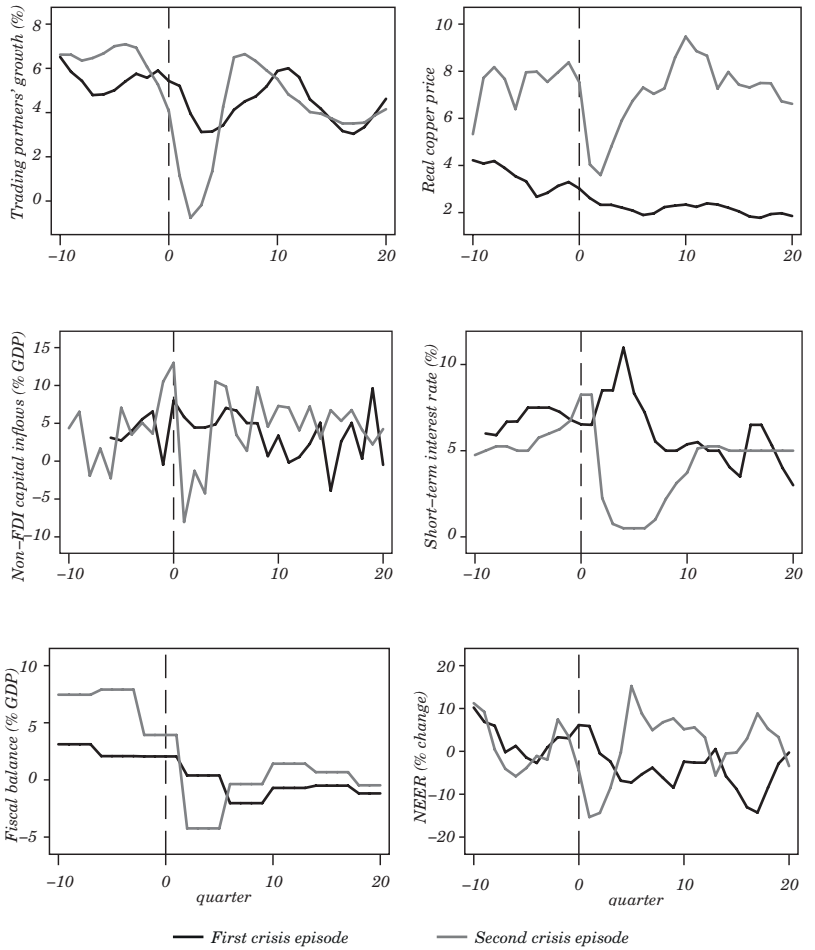
3.2 Comparing Chile with key EMEs over the Two Crisis Episodes

The previous section showed that Chile's macroeconomic adjustment was easier under the fully flexible exchange-rate regime in the aftermath of the Global Financial Crisis relative to the episode of the Asian/Russian crisis in the late 1990s. A complementary approach to looking at the performance of Chile is to compare the evolution of its macroeconomic and financial indicators with those of other EMEs over the same crisis episodes. The analysis encompasses 25 key EMEs that had good coverage for quarterly data for the set of indicators over the periods 1995q1–2000q1 and 2006q1–2011q1, respectively.[40]

40. The EMEs included in the analysis are Argentina, Brazil, China, Colombia, Czech Republic, Hungary, Egypt, India, Indonesia, Iran, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Peru, Philippines, Poland, Russia, South Africa, South Korea, Thailand, Turkey, Uruguay, and Vietnam. While South Korea has been classified as an advanced economy in the meantime, it was considered as an EME for part of the period covered in the comparison.

Figure 12. Chile's Macroeconomic Performance in Two Crisis Episodes (1997–98 vs. 2008)

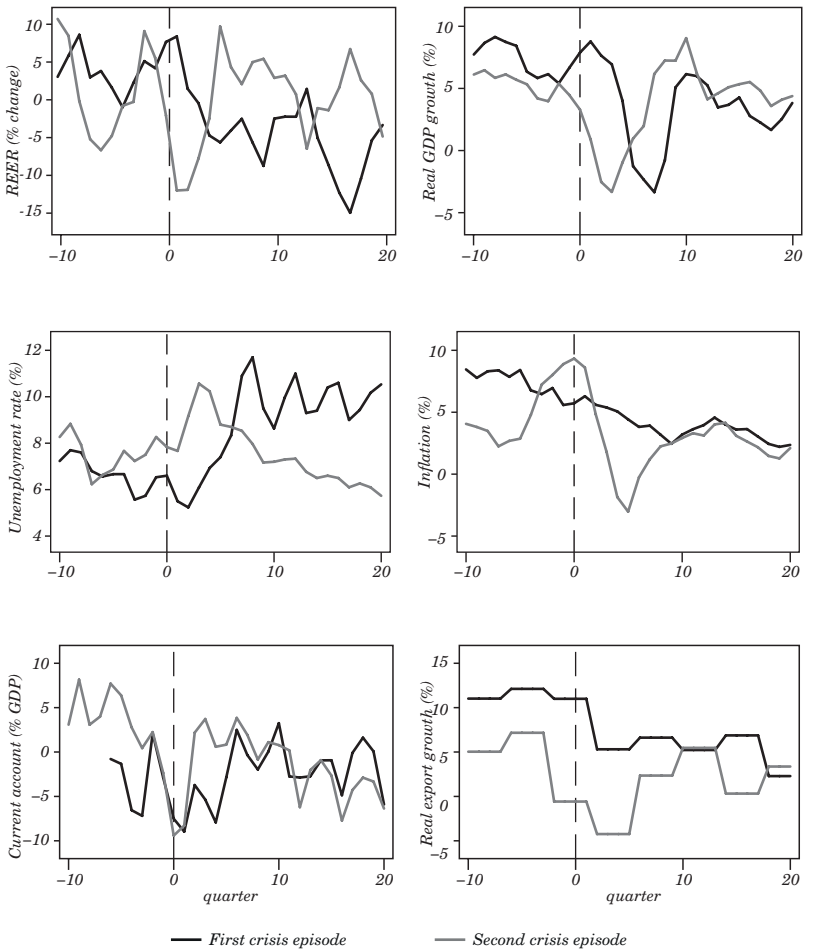
Panel A



Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg, and authors' calculations.
Note: Black lines mark first crisis episode, and gray lines mark the second crisis episode. The vertical line marks the start of the crisis episodes.

Figure 12. Chile's Macroeconomic Performance in Two Crisis Episodes (1997–98 vs. 2008) (continued)

Panel B

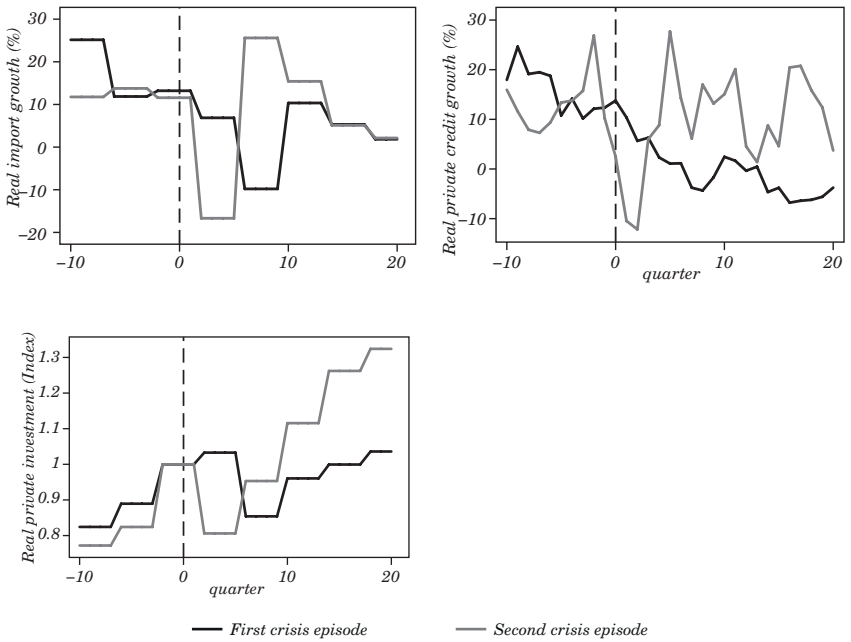


Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg and authors' calculations.

Note: Black lines correspond to first crisis episode, and gray lines correspond to the second crisis episode. The vertical line marks the start of the crisis episodes.

Figure 12. Chile's Macroeconomic Performance in Two Crisis Episodes (1997–98 vs. 2008) (continued)

Panel C



Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg, and authors' calculations.
Note: Black lines mark first crisis episode, and gray lines correspond to the second crisis episode. The vertical line marks the start of the crisis episodes.

Figure 13 presents charts that compare the performance of Chile (black solid line) with the inter-quartile range (IQR) of EMEs (darker gray area) and the range between the 10th and the 90th percentile of EMEs (lighter gray area).

The findings in this figure suggest that, in general, Chile had one of the best comparative cross-country experience in both crisis episodes, though key differences in Chile's responses between the two crisis episodes documented earlier seem to remain. Some of the main findings are the following:

3.2.1 Exogenous shocks

The adverse exogenous shock, as measured by the decline in **trading partners' real GDP growth,** was substantially sharper in the second crisis episode for most countries. While trading partners' growth remained in the positive territory for 90 percent of the set of EMEs included in this analysis during the first crisis episode, it turned clearly negative for most EMEs during the second crisis episode. In addition, Chile was substantially more affected by the adverse financing shock during the second crisis episode, when non-FDI capital inflows rapidly turned negative, as compared to the first crisis episode, in which Chile was affected mildly (in contrast to other EMEs).

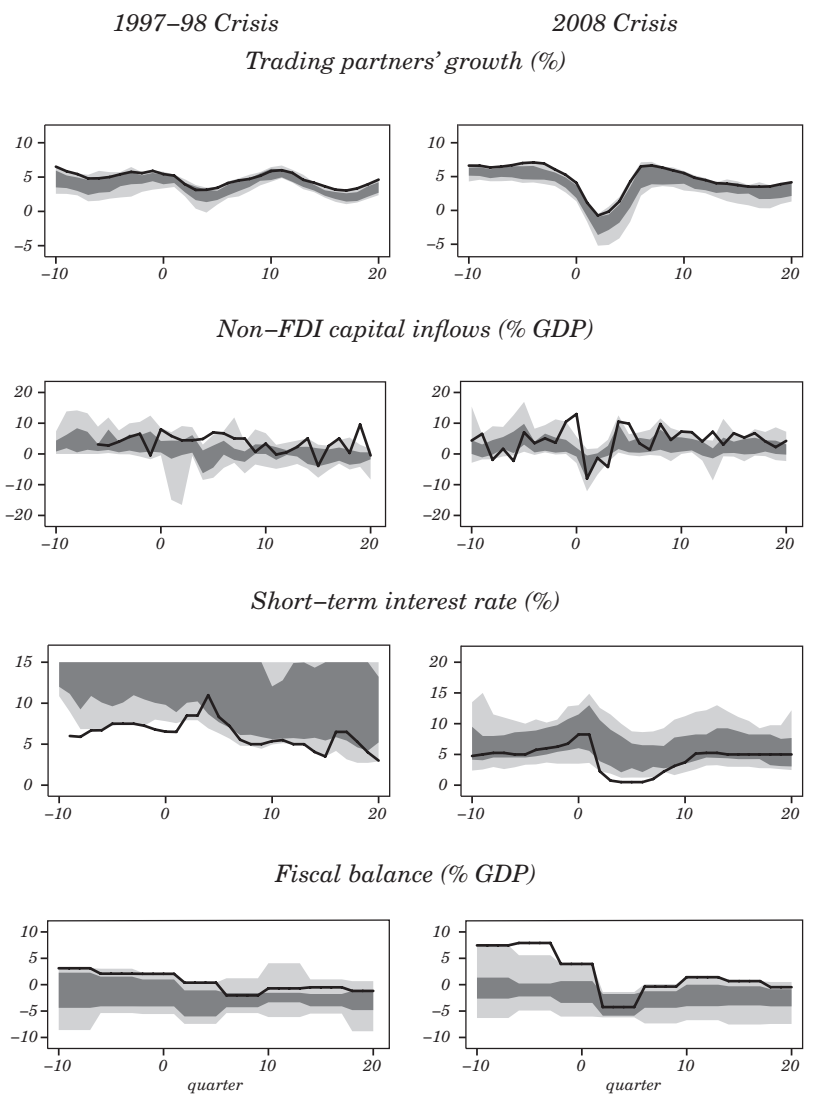
3.2.2 Policy responses

The **short-term interest rates** in Chile were at the bottom of the EMEs distribution at the onset of the first crisis but quickly rose to above the 25th percentile, only to return at the bottom of the distribution after 2 years. (Note that the gray areas showing the top 10th percentile are not in the chart in order to allow comparability of the vertical axis with the second episode, given the high nominal rates of some key outliers). By contrast, rates dropped from the IQR to below the 10th percentile of EMEs in the second crisis and then gradually returned to the IQR.

The **fiscal balance** started at the top of the distribution and then deteriorated after both crises. However, the relative worsening of the fiscal balance was deeper in the second crisis, as much as its recovery towards the top of the distribution was also faster. As seen earlier, this finding provides further evidence about the relatively stronger countercyclical response in the more recent crisis, facilitated by both the cyclically adjusted fiscal balance rule as well as the floating exchange rate.

The **NEER and REER** were relatively stable and remained within the IQR of EMEs in the first crisis, while they dropped below the IQR immediately after the second crisis before rebounding above IQR within 5 quarters after the crisis. This suggested a much stronger exchange-rate fluctuation in Chile, as compared to other typical EMEs. Indeed, while the median country experienced a mild depreciation in both episodes, Chile depreciated by about 20 percent in the second episode, moving from the top to the bottom of the distribution in a few quarters, and the recovery was equally fast. This highlights the important role that the flexible exchange rate played in facilitating the macroeconomic adjustment of the Chilean economy following the Global Financial Crisis.

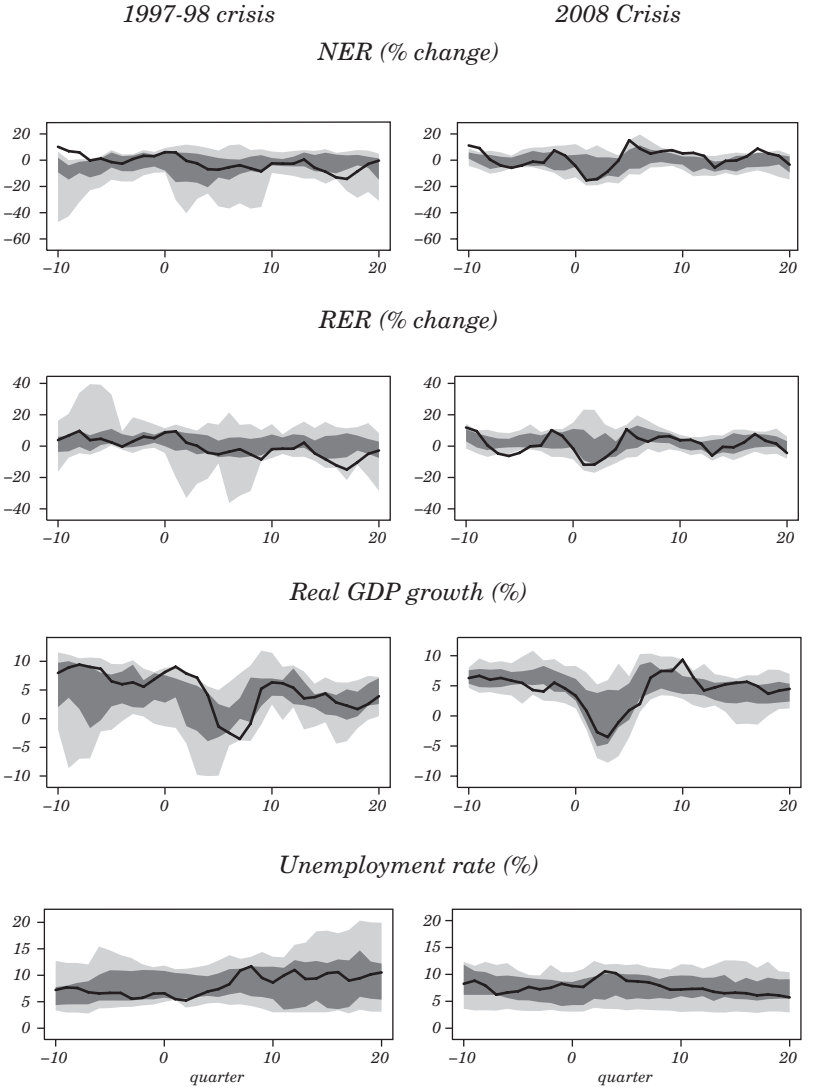
Figure 13. Chile vs. EMEs: Comparison of Response to Two Crisis Episodes



Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg, and authors' calculations.

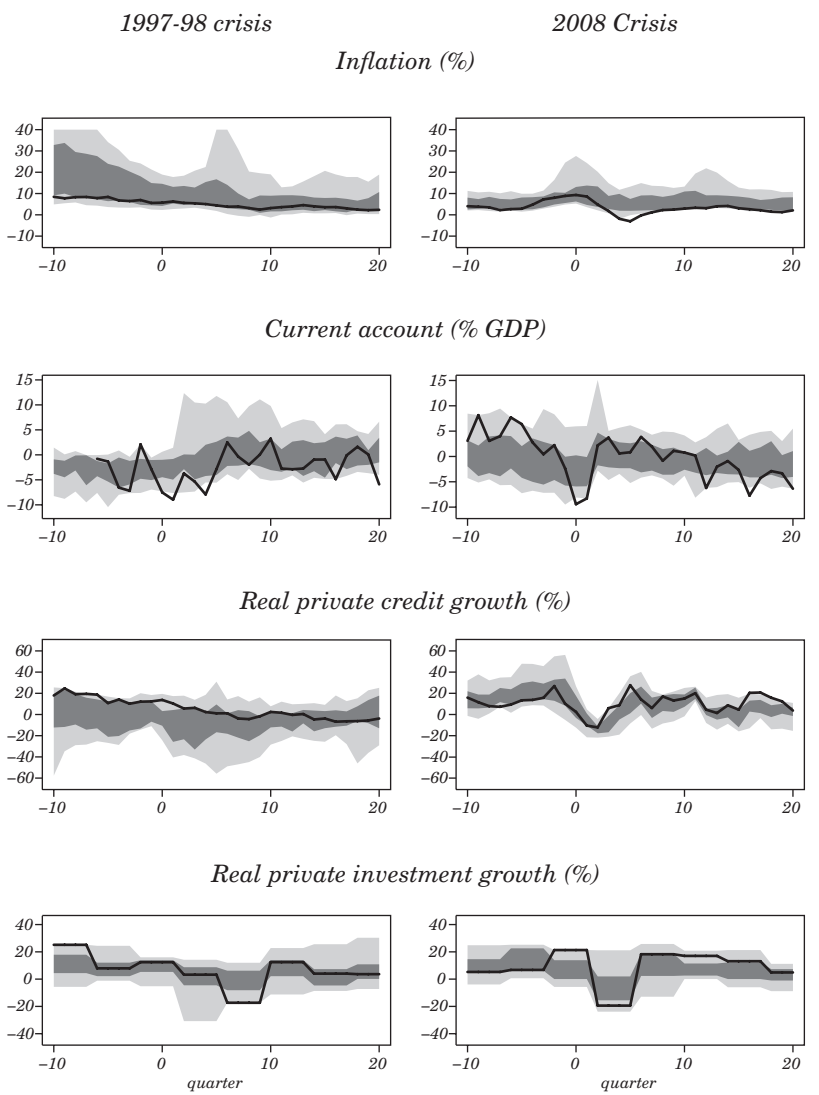
Note: Dark gray areas denote the 25th and 75th percentiles, light gray areas denote the 10th and 90th percentiles, and black solid line denotes Chile. A value of zero in the horizontal axis marks the start of the crisis. The horizontal axis denotes the number of quarters before and after the start of the crisis.

Figure 13. Chile vs. EMEs: Comparison of Response to Two Crisis Episodes (continued)



Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg, and authors' calculations.
Note: Dark gray areas denote the 25th and 75th percentiles, light gray areas denote the 10th and 90th percentiles, and black solid line denotes Chile. A value of zero in the horizontal axis marks the start of the crisis. The horizontal axis denotes the number of quarters before and after the start of the crisis.

Figure 13. Chile vs. EMEs: Comparison of Response to Two Crisis Episodes (continued)



Sources: IMF World Economic Outlook database, International Financial Statistics, INS, Haver, Bloomberg, and authors' calculations.

Note: Dark gray areas denote the 25th and 75th percentiles, light gray areas denote the 10th and 90th percentiles, and black solid line denotes Chile. A value of zero in the horizontal axis marks the start of the crisis. The horizontal axis denotes the number of quarters before and after the start of the crisis.

3.2.3 Outcomes

Real GDP growth in Chile took some time to decline after the Asian crisis but then moved from one of the best of the distribution to the bottom of the distribution, partly owing to the interest-rate reaction due to the fear of floating, which exacerbated the growth decline. However, in the second crisis episode, GDP growth recovered faster and moved quickly towards the upper percentile range of the distribution.

The **unemployment rate** was initially relatively low in the first crisis though kept growing and reached the 75th percentile among EMEs about a year and a half following the eruption of the crisis. In the second crisis, the unemployment rate reached the 75th percentile of EMEs much faster (less than a year following its start) but also dropped faster to a lower position in the IQR of the distribution of EMEs.

The **current account balance** dropped below the 10th percentile in both crisis episodes but recovered much faster in the second episode. Indeed, while the current account balance oscillated closer to the bottom of the IQR for several quarters following the first crisis, it rebounded faster and remained around the upper bound of the IQR in the second crisis.

Inflation was among the lowest around the first crisis, largely because most EMEs suffered from protracted high inflation, while it was around the median and then dropped below the 10th percentile of EMEs in the second crisis.

As a reflection of the differential responses to the two crisis episodes, Chile's relative standing among EMEs in terms of **real private credit and investment growth** changed substantially following the two crises: it was close to the top of the IQR before the first crisis but gradually converged towards the bottom of the IQR afterwards. In contrast, credit growth was close to the bottom of the IQR before the second crisis but gradually moved toward the top of the IQR afterwards.

3.2.4 Comparison with Peru's experience

How does the performance of Chile's framework compare to Peru, a regional peer with many important economic similarities that followed an alternative multi-instrument inflation framework? While Chile has been following a fully flexible exchange-rate regime and using the monetary-policy rate as the primary policy instrument, Peru has been

complementing such a standard approach with changes in reserve requirements and FX interventions. Recent analysis[41] finds that Peru's policy deviation from the standard approach was temporary and modest, and did not result in superior macroeconomic performance, as both frameworks performed similarly in terms of growth and inflation, and the associated volatilities. At the same time, time Peru's policy choice entailed the need for substantially higher reserves (especially as a ratio to GDP) while resulting in lower exchange-rate volatility.

3.3 Financial Adjustment under Free Floating: a Less Appreciated Tradeoff?

Another consequence of exchange-rate regime choice is the effect it may have on the response of asset prices to global financial shocks. As shown by Blanchard and others (2015), (sterilized) exchange-rate interventions dampen the exchange-rate effects of capital inflows in reaction to financial shocks but, in doing so, reinforce such inflows. Intuitively, in the absence of FXI, foreign capital inflows appreciate the currency of recipient countries, thereby reducing investors' expected returns as the likelihood of a future depreciation of the local currency *vis-à-vis* the U.S. dollar increases (a reversal of the initial appreciation). This market stabilization mechanism is less effective to the extent that central banks contain currency fluctuations through FXI. A similar argument holds for the second moment of returns, as central banks prone to intervention seem to be effective, at least in the short term, in diminishing currency volatility. [42] As documented by recent studies, this mechanism may end up rotating volatility from the exchange rate into domestic asset prices, such as long-term bonds and equities.[43]

This section provides new evidence on how Chile fares in terms of the responses of asset prices to global shocks. To do so, we compile daily data on nominal exchange rates (all expressed as local currency units per U.S. dollar, so an increase corresponds to an appreciation of the U.S. dollar), local 10-yr bond yields, and stock-market returns, for a sample of 10 advanced economies (AEs) and 10 EMEs.[44]

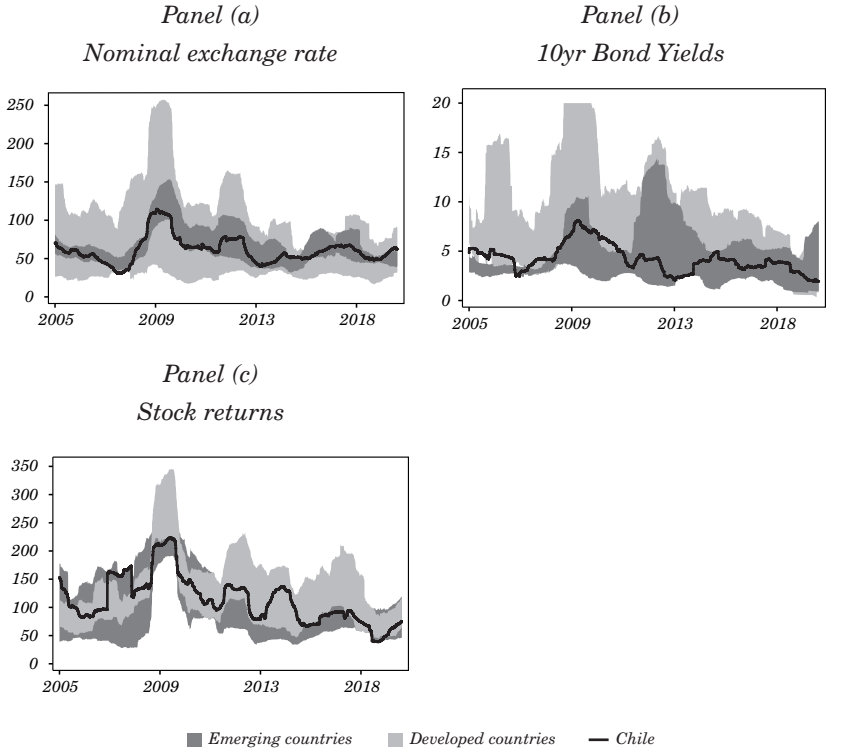
41. See International Monetary Fund (2020).

42. See Fratzscher and others (2019).

43. For recent empirical evidence, see Obstfeld and others (2019), and Albagli and others (2019).

44. The country classification as developed/emerging economy is based on the criteria followed by the IMF. Our sample of developed economies include Canada, France, Germany, Italy, Japan, Norway, Sweden, Switzerland, the Czech Republic, and the United Kingdom. Among emerging countries, we include Chile, Hungary, India, Indonesia, Israel, Mexico, Poland, South Africa, South Korea, Taiwan, and Thailand.

Figure 14. Volatility in Selected Asset Markets



Source: Authors' calculations using data from Bloomberg.
Note: Series plot the upper and lower envelopes of volatility for each country group. Volatility is defined as the 12-month rolling window of daily volatility of each series, defined as changes in basis points (so a drop in the stock market of 1% corresponds to 100 bp).

Figure 14 plots the relative position of the (12-month rolling window) daily volatility of these variables for Chile in relation to the distribution of both country groups (the EME sample in the figure excludes Chile; all variables in daily basis points). To summarize the relevant moments, the figure includes the upper and lower envelopes of each group of countries' volatilities. Panel a) shows NER volatility. Interestingly, the range of NER volatility among EMEs (light gray) contains that of AEs (dark gray). This probably reflects, on the one hand, the relatively high volatility of the countries in this group that either follow regimes closer to free floating and/or are subject to larger shocks; on the other hand, EMEs include several countries which

intervene on a regular basis, thus diminishing their ER volatility. [45] Chile ranks about the middle of the range of both EMEs and AEs, over most of the sample.

Panel b) presents results that contrast those of Panel a). In particular, the volatility of long-term bonds in Chile usually ranks below the minimum volatility among EMEs—the most volatile group in this dimension—and much closer to the middle of the range of AEs.

Panel c) presents the corresponding moments for stock-market returns. Along this dimension, both groups exhibit comparable volatility levels, with Chile ranking at the lower part of the distribution.

As everyday volatility may reflect several factors, many of them idiosyncratic to each country, a regression analysis is implemented to better understand the responses of asset prices to global shocks. Table 5 presents panel regression results for the reaction of currencies, long-term bonds, and local stock-market indexes to U.S. monetary-policy shocks and uncertainty/risk sentiment shocks, run separately for each group of countries. With respect to the first shock, the analysis follows the definition adopted by Albagli and others (2019), which focuses on the change in 2-year U.S. treasuries around a two-day window bracketed around each FOMC meeting. Intuitively, at each meeting, the Fed may signal a change in policy direction and/or speed; the market perception following the meeting should, in turn, be reflected in the change in 2-year yields around the meeting.[46]

As visible in table 5 panel a), in the case of the NER (column 1), the elasticity to U.S. MP shocks is significant for both groups of countries. For instance, a positive one-standard-deviation shock (of about 8 bp) would lead to an appreciation of the U.S. dollar against the average AE currency in the full sample by about 50 bp, or half a percent. Notice that the effect is more marked in the second half of the sample (starting around the peak of the financial crisis, which represents a natural watermark for the start of unconventional MP.[47] The effect is about half for EMEs, depending on the particular sample. In the case of 10-yr domestic yields in column 2, the effect is similar for both country groups, with a coefficient between 0.32 (AEs) and 0.36 (EMEs). That is, the typical U.S. MP shock would move long-term yields by about 2.5 bps, although the effect is larger again in the latter sample

45. See table 12 in Albagli and others (2019) for a summary of papers detailing the currency regimes and intervention policies for the countries included in the sample.

46. Similar strategies are followed by Hanson and Stein (2015), and Gilchrist and others (2019).

47. See Gilchrist and others (2019).

period, especially for EMEs. The reaction of stock-market indexes to these shocks, in column 3, is somewhat more limited. For AEs, it is nonsignificant for the full sample (although positive, significant, but small for the later subsample). In the case of EMEs, it has a more intuitive negative coefficient, which is also significant for the full sample (for instance, the typical shock would lower stock indexes by 10 bp, or just over 0.1 percent, for the full sample).

Interestingly, the reaction of the NER in the case of Chile is similar to the EME group, but the response of 10-yr yields is lower. Indeed, column 4 computes the ratio of columns 1 and 2, showing that the relative response of the exchange rate is higher for Chile than for the EME group as a whole, especially in the post-2008 sample where the difference in terms of the elasticity of 10-year yields with respect to other EMEs seems particularly marked.

Panel b) of table 5 shows the analogous results for uncertainty/risk-sentiment shocks, defined as events when the daily change of the VIX (in absolute value) exceeds two standard deviations of the daily volatility of the index. The typical shock, as defined by these events (a change of 6.2 of the index value), implies a drop in AEs stock indexes of just over 2.7 percent (full sample), while its impact on long-term yields is a more modest 2 bps—not that different from the U.S. MP shock of the average FOMC meeting. Its negative sign suggests that, on average, bonds in AEs react as safe havens to uncertainty/risk-aversion spikes. For EMEs, the impact on stock markets is somewhat smaller —a drop of about 1.7 percent for the average episode considered— although its impact on bond yields is a larger, positive effect of about 5 bp evaluated at the average episode of the full sample. Clearly, as a whole, EMEs fixed-income securities are treated as risky asset classes around such events.

The case of Chile exhibits interesting differences around these events as well. On the one hand, the volatility of the exchange rate is particularly elevated—about 3 times as large as for the other country groups in the full sample. On the other hand, the effects on long-term yields are essentially nil, while the impact on stock markets is comparable to the other EMEs and smaller than AEs for all subsamples considered. Once again, column 5—the ratio between the effects on NER and stock returns—suggests that the burden of the adjustment is borne by the exchange rate, thus helping to cushion what would otherwise likely materialize as higher volatility of domestic asset prices.

Table 5. Global Financial Shocks and Domestic Asset Prices

(*a*) *U.S. MP Shocks*
Changes in 2-yr UST around FOMC meetings[1]

	NER	10-yr yields	Stocks returns	NER/10yr (x10)	NER/Stock
AEs	(1)	(2)	(3)	(4)=(1)/(2)	(5)=(1)/(3)
2000-2008	4.86***	0.26***	0.66	1.9	N.S.
2008-2018	9.51***	0.37***	3.04***	2.6	3.1
Full sample	6.62***	0.32***	0.84	2.1	N.S.
EMEs					
2000-2008	1.83***	0.20***	-0.52	0.9	N.S.
2008-2018	5.81***	0.47***	-2.67**	1.2	-2.2
Full sample	3.10***	0.36***	-1.34**	0.9	-2.3
Chile					
2000-2008	1.42	0.23	-2.54	N.S.	N.S.
2008-2018	4.76*	0.27*	-7.89**	1.8	-0.6
Full sample	2.64**	0.26**	-3.64**	1.0	-0.7

(*b*) *Uncertainty/risk-sentiment shocks*
Daily VIX changes (abs. Val.) >2 st. Dev.[2]

	NER	10-yr yields	Stocks returns	NER/10yr (x10)	NER/Stock
AEs	(1)	(2)	(3)	(4)=(1)/(2)	(5)=(1)/(3)
2000-2008	6.42***	-0.30***	-57.08***	-2.1	-0.1
2008-2018	4.00***	-0.31***	-41.95***	-1.3	-0.1
Full sample	3.97***	-0.34***	-43.96***	-1.2	-0.1
EMEs					
2000-2008	5.72***	1.21***	-36.40***	0.4	-0.2
2008-2018	5.03***	0.87***	-25.58***	0.6	-0.2
Full sample	4.60***	0.80***	-26.81***	0.6	-0.2
Chile					
2000-2008	13.57***	0.01	-35.64***	N.S.	-0.4
2008-2018	12.30***	-0.12	-26.28***	N.S.	-0.5
Full sample	11.90***	-0.14	-27.56***	N.S.	-0.4

Source: Authors' research.
(1) U.S. MP shock: change in 2-yr treasury yields (in bps) between the closing of the day after and the closing of the day before, the FOMC decision and press release. The change in all financial variables (also in bps) are measured in the corresponding two-day window. St. dev. U.S. MP shock: 7.8 bp (full sample).
(2) Uncertainty/risk-sentiment shock: change in the level of VIX, around a two-day window between the closing of the day after and the closing of the day before, a volatility spike event. Such event is defined as a daily change exceeding (in absolute value) two st. dev. of daily volatility. St. dev. of VIX (daily): 1.32 (full sample). St. dev. during volatility spike events: 6.2 (full sample).

While there may be other forces and channels at work, the evidence presented in this section is consistent with the empirical predictions highlighted in the papers discussed above. Namely, that a freely floating regime should rotate volatility away from domestic asset prices and towards the local currency, and that, by following a virtually clean floating regime for most of the last twenty years, Chile has chosen (deliberately or otherwise) a clear position regarding such tradeoff.

Of course, a note of caution is in order in terms of a more structural determination behind these results. In particular, asset markets differ in terms of liquidity and foreign-investor participation. Also, and especially in the case of Chile, pension funds may play a relevant role in cushioning the impact on domestic asset prices by providing liquidity when nonresidents rush to sell securities.[48] These and other related issues warrant further study.

4. Conclusion

This paper provides an overview of the evolution of the Chilean economy in the twenty years following the transition towards a free-floating regime. Specifically, it describes how Chile has dealt with the two main burdens that have traditionally deterred other EMEs in adopting clean floating regimes, namely, financial and price stability. It also provides evidence about the benefits of both macroeconomic and financial adjustment to shocks that result from such an exchange-rate regime. In doing so, the paper focuses on policymaking in normal times (not on tail scenarios such as the situation of late 2019 or Covid-19 in 2020).

Among the main results, we highlight the following. First, the exposure to currency risk in the nonfinancial firms' balance sheets has monotonically compressed towards very low current levels starting *after* the transition to free floating, while hedging markets have significantly developed in parallel. Second, the exchange-rate passthrough onto domestic prices has monotonically declined, in line with enhanced credibility of the monetary-policy regime. Third, the switch to a free-floating regime is associated with a better macroeconomic performance when comparing the last two severe external crises: the Asian/Russian crisis, during which Chile had a crawling peg, and the Global Financial Crisis, which was confronted

48. See Álvarez and others (2019).

after almost a decade of free floating. Fourth, exchange-rate flexibility also appears to play a role in containing the impact on domestic asset prices of global financial shocks, rotating volatility towards the currency.

It is important to place these results in the appropriate context, especially since currently there is heated debate over whether exchange-rate flexibility should be adopted only after countries have achieved certain macroeconomic conditions—such as credible institutions, strong policy frameworks, and/or developed financial markets—, or rather countries should first free-float, expecting macroeconomic conditions to improve endogenously. This is a big question, and one unlikely to be resolved by the experience of a single country. Our contribution to this debate is to show that Chile's experience in the last two decades suggests that the truth may lie somewhere in between. On the one hand, deep financial markets are important in enhancing domestic funding—providing an alternative to foreign-currency borrowing and thereby facilitating the reduction of currency mismatches—and allowing deeper FX hedging opportunities for firms, just as a credible inflation-targeting design is important in achieving a low exchange-rate passthrough. It is also important to note that financial-market deepening was supported by a growing pension-fund industry. On the other hand, the *endogeneity* of such conditions should not be overlooked: freely floating exchange rates will create incentives for the private sector to seek financing at home and/or to hedge FX exposure, thus contributing to the development of financial markets. At the same time, a commitment to a credible and clear free-floating regime will require the authorities to strengthen the quality of the monetary institutional framework, which will enhance its credibility.

Overall, the paper shows that the fear of floating can be overcome, to reach a fearless, clear, and credible freely floating regime, which can be conducive to a healthier adjustment to external shocks, while remaining consistent with an inflation *forecast* target at the appropriate horizon, thus facilitating the job of a Central Bank and contributing to its credibility.

References

Aghion, P., P. Bacchetta, and A. Banerjee. 2000. "A Simple Model of Monetary Policy and Currency Crises." *European Economic Review* 44(4–6): 728–38.

Aizenman, J. 2017. "International Reserves, Exchange rates, and Monetary Policy–From the Trilemma to the Quadrilemma." Prepared for the Oxford Research Encyclopedia of Economics and Finance, preliminary version.

Albagli, E., A. Naudon, and R.Vergara. 2015. "Inflation Dynamics in LATAM: A Comparison with Global Trends and Implications for Monetary Policy." Economic Policy Papers No. 58, Central Bank of Chile.

Albagli, E., L. Ceballos, S. Claro, and D. Romero. 2019. "Channels of US Monetary Policy Spillovers to International Bond Markets." *Journal of Financial Economics* 134(2): 447–73.

Alfaro, L., M. Calani, and L. Varela. 2020. "Currency Hedging in Emerging Markets: Managing Cash Flow Exposure." Mimeo, Harvard University and Central Bank of Chile.

Álvarez, N., A. Fernandois, and A. Sagner. 2019. "Rol de Inversionistas Institucionales Domésticos sobre la Volatilidad de Tasas Soberanas de Economías Emergentes." *Economía Chilena* 22(1): 82–101.

Arias, A. and M. Kirchner. 2019. "Shifting Inflation Expectations and Monetary Policy." Working Papers No. 829. Central Bank of Chile.

Baldwin, R.E. 1991. "On the Microeconomics of the European Monetary Union." In *One Market, One Money. An Evaluation of the Potential Benefits and Costs of Forming an Economic and Monetary Union.*, chapter 3. European Economy 44, special edition.

Bems, R., F. Caselli, F. Grigoli, B. Gruss, and W. Lian. 2018. "Expectations' Anchoring and Inflation Persistence." IMF Working Papers No. 18/280.

Ben Zeev, N. 2019. "Global Credit Supply Shocks and Exchange Rate Regimes." *Journal of International* Economics 116(C): 1–32.

Bernanke, B. 2007. "Inflation Expectations and Inflation Forecasting." Speech delivered at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, MA.

Berstein, S. and M. Marcel. 2019. "Sistema Financiero en Chile: Lecciones de la Historia Reciente." Economic Policy Papers No. 67, Central Bank of Chile.

Blanchard, O., G. Adler, and I. Carvalho Filho. 2015. "Can Foreign Exchange Intervention Stem Exchange Rate Pressures from Global Capital Flow Shocks?" IMF Working Papers No. 15/159.

Caballero, R., K. Cowan, and J. Kearns. 2005. "Fear of Sudden Stops: Lessons from Australia and Chile." *Journal of Economic Policy Reform* 8(4): 313–54.

Cáceres, C. and G. Lindow. 2018. "Chile's Resilience to External Financial Shocks." In *Article IV Consultation Staff Report for Chile*, Box 1, International Monetary Fund.

Calani, M., K. Cowan, and P. García-Silva. 2011. "Inflation Targeting in Financially Stable Economies." In *Monetary Policy under Financial Turbulence*, edited by L.F. Céspedes, R. Chang and D. Saravia. Central Bank of Chile.

Calvo, G.A. and C.M. Reinhart. 2002. "Fear of Floating." *Quarterly Journal of Economics* 117(2): 379–408.

Claro, S. and C. Soto. 2013. "Exchange Rate Policy and Exchange Rate Interventions: The Chilean Experience." In *Market Volatility and Foreign Exchange Intervention in EMEs: What Has Changed?* Bank for International Settlements Paper No. 73 (October).

Carrière-Swallow, Y. and P. García-Silva (2013). "Capital Account Policies in Chile: Macro-Financial Considerations along the Path to Liberalization." IMF Working Papers No. 13/107.

Carrière-Swallow, Y., B. Gruss, N. Magud, and F. Valencia. 2016. "Monetary Policy Credibility and Exchange Rate Pass-Through', IMF Working Papers No. 16/240.

Carvalho, C., S. Eusepi, E. Moench, and B. Preston. 2017. "Anchored Inflation Expectations." Mimeo, Banco Central do Brasil, PUC-Rio, Federal Reserve Bank of New York, Deutsche Bundesbank, University of Melbourne.

Caselli, F.G. and A. Roitman. 2016. "Non-Linear Exchange Rate Pass-Through in Emerging Markets." IMF Working Papers 16/1, Washington, DC.

Ca'Zorzi, M., E. Hahn, and M. Sánchez. 2007. Exchange Rate Pass-Through in Emerging Markets, ECB Working Papers No. 739.

Céspedes, L.F., R. Chang, and A. Velasco. 2004. "Balance Sheets and Exchange Rate Policy." *American Economic Review* 94(4): 1183–93.

Céspedes, L.F. and R.O. Valdés. 2006. "Autonomía de Bancos Centrales: La Experiencia Chilena." *Economía Chilena* 9(1): 25–45.

Chan-Lau, J.A. 2005. "Hedging Foreign Exchange Risk in Chile: Markets and Instruments." IMF Working Papers No. 05/37.

Choudhri, E. and D.S. Hakura. 2006. "Exchange Rate Pass-Through to Domestic Prices: Does the Inflationary Environment Matter?" *Journal of International Money and Finance* 25(4): 614–39.

Cowan, K. and J. De Gregorio. 2007. "International Borrowing, Capital Controls, and the Exchange Rate: Lessons from Chile." In *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, edited by S. Edwards. Chicago, IL: University of Chicago Press.

Cowan, K., E. Hansen, and L.O. Herrera. 2006. "Currency Mismatches, Balance Sheet Effects and Hedging in Chilean Non-Financial Corporations." In *External Vulnerability and Preventive Policies*, edited by R.J. Caballero, C. Calderón, and L.F. Céspedes. Central Bank of Chile.

De Gregorio, J. and A. Tokman. 2004. "Overcoming Fear of Floating: Exchange Rate Policies in Chile." Working Papers No. 203, Central Bank of Chile.

Diamond, D.W., Y. Hu, and R.G. Rajan. 2018 "The Spillovers from Easy Liquidity and the Implications for Multilateralism." Also Rajan's Mundell-Fleming Lecture, 19th Jacques Polak Annual Research Conference on "International Spillovers and Cooperation." Washington, DC. *https://www.imf.org/en/News/Seminars/Conferences/2018/02/08/19th-annual-research-conference-on-international-spillovers-and-cooperation*

Edwards, S. 2006. "The Relationship between Exchange Rates and Inflation Targeting Revisited." NBER Working Papers No. 12163.

Edwards, S. and E. Levy. 2003. "Flexible Exchange Rates as Shock Absorbers." NBER Working Papers No. 9867.

Eichengreen, B. 2019. *Globalizing Capital. A History of the International Monetary System*, third edition. Princeton, NJ: Princeton University Press.

Frankel, J., X. Ma, and D. Xie. 2019. "The Impact of Exchange Rate Regimes on Economic Growth with Continuous Classification of de facto Regimes." Mimeo, Harvard University and Tsinghua University.

Frankel, J. and A. Rose. 1998. "The Endogeneity of the Optimum Currency Area Criteria." *Economic Journal* 108(449): 1009–25.

Fratzscher, M., O. Gloede, L. Menkhoff, L. Sarno, and T. Stohr. 2019. "When is Foreign Exchange Intervention Effective? Evidence from 33 Countries." *American Economic Journal: Macroeconomics* 11(1): 135–56.

Ghosh, A.R., M.S. Qureshi, and C.G. Tsangarides. 2018. "Friedman Redux: External Adjustment and Exchange Rate Flexibility." *Economic Journal* 129(617): 408–38.

Ghosh, A.R., J.D. Ostry, and C. Tsangarides. 2010. "Exchange Rate Regimes and the Stability of the International Monetary System." IMF Occasional Papers No. 270.

Ghosh, A.R., J.D. Ostry, A.M. Gulde, and H.C. Wolf. 1996. "Does the Exchange Rate Regime Matter for Inflation and Growth?" IMF Economic Issues No. 2.

Gilchrist, S., V. Yue, and E. Zakrajsek. 2019. "US Monetary Policy and International Bond Markets." NBER Working Paper No. 26012.

Giavazzi, F. and M. Pagano. 1988. "The Advantage of Tying One's Hand: EMS Discipline and Central Bank Credibility." *European Economic Review* 32(5): 1055–75.

Gopinath, G. and O. Itskhoki. 2010. "Frequency of Price Adjustment and Pass-Through." *Quarterly Journal of Economics* 125(2): 675–727.

Gopinath, G., O. Itskhoki, and R. Rigobon. 2010. "Currency Choice and Exchange Rate Pass-Through." *American Economic Review* 100(1): 304–36.

Grigoli, F., A. Herman, A. Swiston. 2019. "A Crude Shock: Explaining the Short-Run Impact of the 2014–16 Oil Price Decline across Exporters." *Energy Economics* 78: 481–93.

Hanson, S.G. and J.C. Stein. 2015. "Monetary Policy and Long-Term Real Rates." *Journal of Financial Economics* 115(3): 429–48.

International Monetary Fund. 2016. *Regional Economic Outlook, Sub-Saharan Africa*, October.

International Monetary Fund. 2018. *Annual Report on Exchange Arrangements and Exchange Restrictions*.

International Monetary Fund. 2020. *Peru: Selected Issues*. IMF Country Report No. 20/4.

Ilzetzki, E., C.M. Reinhart, and K. Rogoff. 2019. "Exchange Arrangements Entering the Twenty-First Century: Which Anchor Will Hold?" *Quarterly Journal of Economics* 134(2): 599–646.

Justel, S. and A. Sansone. 2016. "Exchange Rate Passthrough to Prices: VAR Evidence for Chile." *Economía Chilena* 19(1): 20–37.

Kamil, H. 2012. "How Do Exchange Rate Regimes Affect Firms' Incentives to Hedge Currency Risk? Micro Evidence for Latin America." IMF Working Papers No. 12/69.

Kearns, J. and N. Patel. 2016. "Does the Financial Channel of Exchange Rates Offset the Trade Channel?" *BIS Quarterly Review* (December): 95–113.

Klein, M.W. and J.C. Shambough. 2013. "Rounding the Corners of the Policy Trilemma: Sources of Monetary Policy Autonomy." NBER Working Papers No. 19461.

Krugman, P. 1999. "Balance Sheets, the Transfer Problem and Financial Crises." In *International finance and financial crises*, vol. 6, edited by P. Isard, A. Razin, and A. Rose. Boston, MA: Kluwer Academic.

Lahiri, A. and C.A. Végh. 2001. "Living with the Fear of Floating: An Optimal Policy Perspective." In *Preventing Currency Crises in Emerging Markets,* edited by S. Edwards and J. Frankel. Chicago, IL: University of Chicago Press for the National Bureau of Economic Research.

Levy, E. and F. Sturzenegger. 2003. "To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth." *American Economic Review* 93(4): 1173–93.

Marcel, M. 2019. Opening Remarks, CBC-IADB Joint Workshop on "Basel III in the Context of the Macroprudential Approach." March. Available at *https://www.bcentral.cl/documents/20143/31860/mmc29032019.pdf/2de5a8b3-ddf8-1919-aa5c-482fc0e97c69?version=1.1&t=1553869026193*

Martínez, L. and A. Werner. 2002. "The Exchange Rate Regime and the Currency Composition of Corporate Debt: The Mexican Experience." *Journal of Development Economics* 69(2): 315–34.

Matus, J.M. 2015. "Provisiones por Riesgo de Crédito de la Banca Nacional: Análisis de los Cambios Normativos, Periodo 1975–2014." Estudios Económicos Estadísticos No. 110. Central Bank of Chile.

Mishkin, F.S. and K. Schmidt-Hebbel. 2007. "Does Inflation Targeting Make a Difference?" NBER Working Papers No. 12876.

Mundell, R. 1961. "A Theory of Optimum Currency Areas" *American Economic Review* 51(4): 657–65.

Mussa, M., P. Masson, A. Swoboda, E. Jadresic, P. Mauro, and A. Berg. 2000. "Exchange Rate Regimes in an Increasingly Integrated World Economy." IMF Occasional Papers No. 193.

Obstfeld, M. 2015. "Trilemmas and Tradeoffs: Living with Financial Globalization." In *Global Liquidity, Spillovers to Emerging Markets and Policy Responses*, edited by C. Raddatz, D. Saravia, and J. Ventura. Central Bank of Chile.

Obstfeld, M., J.D. Ostry, and M.S. Qureshi. 2019. "A Tie that Binds: Revisiting the Trilemma in Emerging Market Economies." *Review of Economics and Statistics* 101(2): 279–93.

Obstfeld, M., J.C. Shambaugh, and A.M. Taylor. 2005. "The Trilemma in History: Tradeoffs among Exchange Rates, Monetary Policies, and Capital Mobility." *Review of Economics and Statistics* 87(3): 423–38.

Obstfeld, M. and K. Rogoff. 1995. "The Mirage of Fixed Exchange Rates" *Journal of Economic Perspectives* 9(4): 73–96.

Ötker, I. and D. Vávra. 2007. "Moving to Greater Exchange Rate Flexibility: Operational Aspects Based on Lessons from Detailed Country Experiences." IMF Occasional Papers No. 256.

Ricci, L.A. 2006. "Exchange Rate Regimes, Location, and Specialization." *IMF Staff Papers* 53(1): 50–62.

Ricci, L.A. 2008. "A Model of an Optimum Currency Area." *Economics* 2(8): 1–31.

Ricci, L.A. and W. Shi. 2016. "Trilemma or Dilemma: Inspecting the Heterogeneous Response of Local Currency Interest Rates to Foreign Rates." IMF Working Papers No. 16/75.

Rey, H. 2014. "The International Credit Channel and Monetary Autonomy." IMF 15th Jacques Polak Annual Research Conference, Mundell-Fleming Lecture No. 13, November.

Rey, H. 2015. "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence." CEPR Discussion Papers No. 10591.

Rodríguez, P. and J.M. Villena. 2016. "Derivados de Tipo de Cambio por Sector Financiero: El Caso de Chile." Estudios Económicos Estadísticos No. 118. Central Bank of Chile.

Rogoff, K., A. Husain, A. Mody, R. Brooks, and N. Oomes. 2004. "Evolution and Performance of Exchange Rate Regimes." IMF Occasional Papers No. 229.

Rossi, J.L. 2004. "Foreign Exchange Exposure, Corporate Financial Policies and the Exchange Rate Regime: Evidence from Brazil." Mimeo, Yale University.

Vial, J. 2019. "Reserve Management and FX Intervention: Chile's Experience." BIS Papers No. 104.