

This issue of Research Highlights reviews the following subjects that have been recently analyzed at the Central Bank of Chile (CBC):

- **Stocks, bonds and US dollar: measuring domestic and international developments in an emerging market**
- **Exchange rate volatility and the effectiveness of FX interventions: the case of Chile**
- **The evolution of macroprudential policy use in Chile, Latin America and the OECD**

## Stocks, bonds and US dollar: measuring domestic and international developments in an emerging market

The global economy has been exposed to a multiplicity of shocks, which motivates the following question: What factors explain interest rate movements in Latam/Chile? Do they reflect better economic prospects and/or a more contractionary monetary policy? Do they reflect greater local/external uncertainty? In a context of rising external rates (particularly in the United States), how does this affect Chilean and emerging market rates, and by how much?

As a contribution to answering these questions, the paper "[Stocks, Bonds and the US Dollar - Measuring Domestic and International Market Developments in an Emerging Market](#)" by CBC economist [Nicolas Eterovic](#) and Dalibor S. Eterovic (The Rohatyn Group and Columbia Business School) expand the existing methodology, applied to developed markets, to estimate high-frequency shocks to emerging markets. Emerging markets are characteristically small, so they are more susceptible to external shocks relative to size and are highly exposed to exchange rate fluctuations, generally associated with global appreciations of the "big dollar."

The literature on high-frequency shocks is not new and it has focused on identifying the causality of monetary policy shocks in small time windows around policy announcements (Kuttner, 2001;

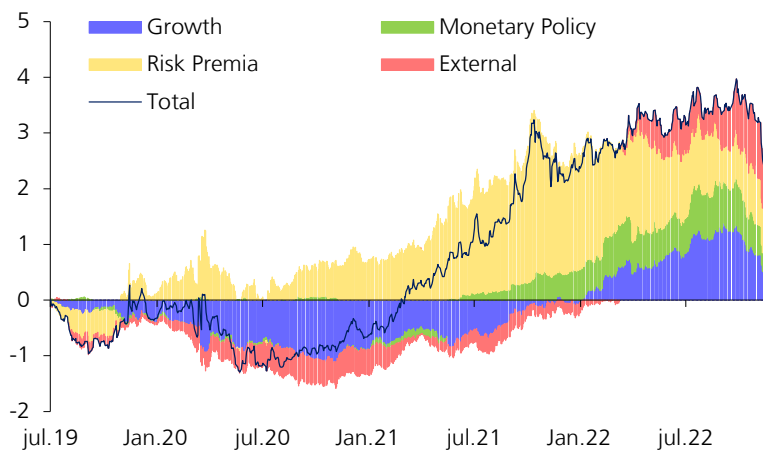
*External shocks are transmitted to local assets through risk aversion and pure risk premiums*

Cochrane and Piazzesi, 2002; Bernanke and Kuttner, 2005; Gurkaynak et al., 2005; Nakamura and Steinsson, 2018). At the same time, there is a new literature, which exploits the correlation between interest rates and the stock market to extract monetary policy and growth shocks. A growth shock is one in which both the stock market and rates have positive correlation, while with a

monetary policy shock the correlation is negative. The intuition is straightforward: monetary policy shocks raise the discount rate at which earnings streams are discounted, which should negatively impact stock prices.

On the other hand, in the face of a growth shock, the positive effect of higher cash flows more than offsets the effects of higher discount rates (Matheson and Stavrev, 2014). Cieslak and Schrimpf (2019) and Cieslak and Pang (2021), incorporate rates at different maturities to identify risk premium shocks in the long part of the curve. In this way, a "hedging" shock is identified where the rate and the stock market move in the same direction; and a "pure risk" shock is identified where the rate and the stock market move in opposite directions. These shocks differ from monetary policy and growth shocks in that they impose size constraints at different points along the curve. This paper adapts the identification strategy of Cieslak and Pang (2021) for a small open economy and estimates external shocks (e.g., monetary policy, growth, pure risk premium and U.S. hedging), as well as local shocks. The Chilean

Figure 1: Structural decomposition of the Chilean zero-rates at 10 years (\*)



(\*) Structural decomposition long rates from a BVAR based on the identification strategy proposed by Eterovic and Eterovic (2022), incorporating an external block. The external block encompasses all US shocks (e.g., monetary policy, growth, risk aversion and risk premia shocks), which have been added up for simplicity. Source: Central Bank of Chile based on RiskAmerica.

financial market is used as a case study, because it provides a good example of a small open economy with liquid financial markets.

This paper contributes to the literature on spillovers to emerging markets on three important dimensions. First, by including an exogenous block of structural shocks, it is possible to map the relative contribution of external shocks in specific time periods in a unified way. Second, by distinguishing external risk premia from global risk aversion shocks, it is possible to better understand the different pass-through channels of external (US) monetary

policy to emerging markets. Finally, the identified shocks also capture the effects of central bank communication (Central Bank of Chile and the U.S. Federal Reserve).

The main findings of the paper are the following (figure 1). First, the dynamics of financial assets in specific time periods are decomposed in a very precise way, irrespective of whether the shocks originate at home or in the U.S. It is shown that U.S. shocks to Chilean assets have great importance.

Specifically, U.S. shocks explain around 12% of the volatility of short and long rates, and 25% of stock market volatility. Second, these external shocks are transmitted to local assets through risk aversion and pure risk premiums, followed in importance by U.S. monetary policy shocks. Finally, the historical decompositions are able to isolate the effects of the Central Bank of Chile's monetary policy meetings, where the effects are even larger when they are accompanied by a Monetary Policy Report.

## Exchange rate volatility and the effectiveness of FX interventions: the case of Chile

Under floating exchange rates regimes, central banks occasionally intervene in the exchange rate market for many reasons. As part of its macroprudential toolkit, foreign exchange (FX) interventions are mainly used by central banks to deal with financial stability concerns associated with excess exchange rate volatility and sudden changes in capital inflows (BIS, 2019). On the same ground, FX interventions in emerging economies are sometimes justified as being consistent with international reserve accumulation programs that aim to build reserves for precautionary reasons (Arslan & Cantú, 2019). Nonetheless, historically FX interventions have also been used to respond to different objectives than pursuing financial stability. Given this, there are no definitive conclusions on the effectiveness of these policies, among other issues, because of the wide variety of success criteria used in the empirical literature. Which are the key characteristics behind them? What are the main impacts they have? The answer to these questions is not obvious since the drivers of exchange rate fluctuations are still an intense object of study in the literature.

In the paper [“Exchange rate volatility and the effectiveness of FX interventions: the case of Chile”](#) CBC economists [Alejandro Jara](#) and Marco Piña, propose an alternative methodological approach for assessing the effectiveness of interventions when the objective of the FX intervention is to reduce volatility. The novelty of their empirical strategy is twofold. On the one hand, they look at the probability of being at a high and low exchange rate volatility state, as an additional metric to evaluate the effectiveness of FX interventions. They do so by estimating a Markov-Switching GARCH model of the exchange rate volatility with regime changes (Beine et al., 2003; Haas et al., 2004). Secondly, they implement a high-frequency Local Projection setting (Jordà, 2005), accounting for a wide range of domestic and foreign financial factors as control

*Their results indicates that the exchange rate volatility in Chile can be characterized by a model of regime changes with two states (low and high volatility). Also, they show that FX interventions in Chile occur during different states of volatility—not only states of high volatility—, showing that the central bank’s motives to intervene have been different over time, consistent with the literature (Hansen and Morales, 2019; García, 2022). Regarding the effectiveness of FX interventions, they show that the 2019 intervention effectively reduced the exchange rate volatility for more than 20 days after the intervention, also reducing the probability of being in a high volatility state.*

variables, which allows to assess the impact of the interventions on exchange rate volatility, volatility states, and their persistence over time.

This methodology is applied over five FX interventions that occurred in Chile since establishing a fully flexible exchange rate regime in September 1999 until the last dates included in their analysis in early 2020. In doing so, they also add to the existing empirical evidence by including the 2019 intervention in the analysis. Their results indicates that the exchange rate volatility in Chile can be characterized by a model of regime changes with two states (low and high volatility). Also, they show that FX interventions in Chile occur during different states of volatility—not only states of high volatility—, showing that the central bank’s motives to intervene have been different over time, consistent with the literature (Hansen and Morales, 2019; García, 2022). Regarding the effectiveness of FX interventions, they show that the 2019 intervention effectively reduced the exchange

rate volatility for more than 20 days after the intervention, also reducing the probability of being in a high volatility state (see Figure 2).

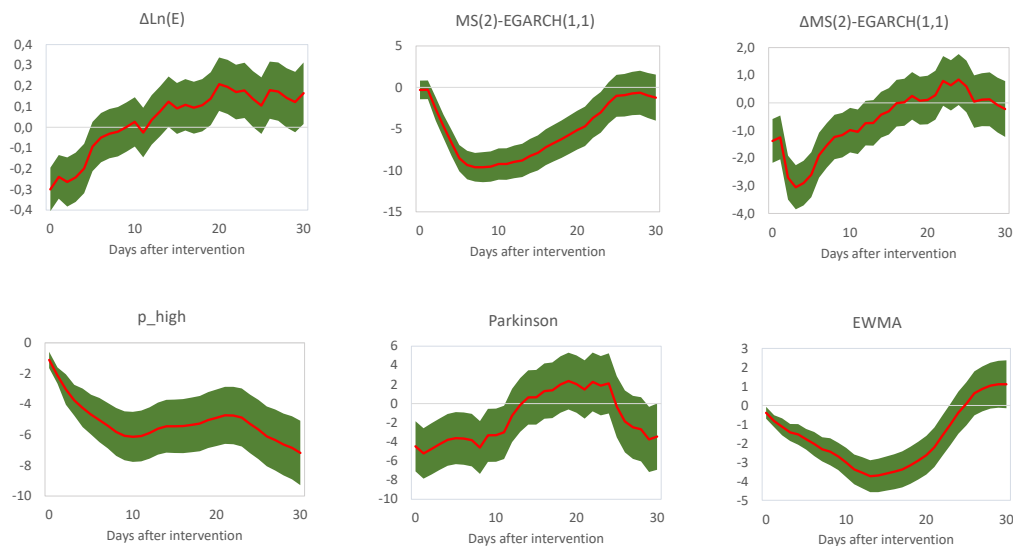
Regarding the interventions of 2008 and 2011, whose purpose was to build international reserves for precautionary reasons, did not generate the same impact on the exchange rate returns and volatility, despite responding to similar objectives. In particular, the 2008 intervention is associated with an increase in the exchange rate daily return, consistent with what has been emphasized by Gamboa-Estrada (2019) and the idea that this intervention occurred during a period when the Chilean peso was internationally strong (Claro & Soto, 2013). However, the 2011 intervention has a negligible impact on the exchange rate returns. Moreover, the probability of being in a state of high exchange rate volatility increases after these interventions. This transitory drop in exchange rate volatility and subsequent increase in the probability of being in a high volatility state is particularly evident after the 2011 intervention.

Overall, their main findings are consistent with the existing literature that emphasizes that the impact of FX interventions on the exchange rate dynamic depends on the design of the intervention

(Disyatat & Galati, 2007; García-Verdú & Zerecero, 2013; Janot & Macedo, 2016). Concerning further research on this topic, they suggest measuring the non-linear effects of FX intervention (Viola et

al. (2019)) and explore more in depth the role of different FX intervention designs, such as those focused on the spot versus forward FX market.

Figure 2: Effectiveness of the 2019 FXI



## The evolution of macroprudential policy use in Chile, Latin America and the OECD

After several financial crises in the last 30 years - such as the Asian crisis (1997), the Global Financial Crisis (2008) or the European sovereign debt crisis (2010) - regulators across several countries adopted stronger bank capital requirements and other financial regulations.

In the paper “[The evolution of macroprudential policy use in Chile, Latin America and the OECD](#)”, CBC economist [Carlos Madeira](#) studies how Chile evolved in terms of its financial regulation relative to other countries. The paper uses the Integrated Macroprudential Policy (iMaPP) database of the International Monetary Fund for 134 countries to compare the evolution of 17 different macroprudential policies in Chile and the rest of the world during the period from 1990 to 2020. In particular, the paper compares Chile to other economies over time, both in terms of financial and banking regulation and in terms of its current account openness.

Figure 1 displays the evolution of a Macroprudential net tightening index, which is the cumulative sum of 17 macroprudential policies since 1990, for Chile and OECD, Advanced Economies (AE), Low Income Countries (LIC), Latin America and the Caribbean (LAC) and LA6. By construction, the index in 1990 starts at zero for Chile and all the countries analyzed. The index basically considers

*From 1990 until now Chile tightened its macroprudential policies in a less intensive way than the average of the Advanced Economies, OECD countries, Emerging Markets, the Latin American and Caribbean.*

for each of the 17 macroprudential policies a unit value for whether there was a tightening of a financial policy and a negative unit value for easing (that is, +1 for a financial tightening measure, 0 no change, -1 easing). The index then consists of the sum of all the policy tightening minus the easing decisions accumulated across all policies for each country since 1990. This index has some flaws since its measurement does not consider the intensity of the tightening and easing decisions. For instance, two countries could appear similar with a tightening of +1, but one of the countries could have implemented a much larger financial control. In the same way, a country could show up with an index of 0 after implementing a tightening (+1) followed by an easing (-1), even if the easing decision does not entirely reverse the first measure.

From 1990 until now Chile tightened its macroprudential policies in a less intensive way than the average of the Advanced Economies, OECD countries, Emerging Markets, the Latin American and Caribbean. This evolution could

be due to Chile starting the 1990’s with an already conservative financial framework established after the 1986 banking law. Chile decreased its macroprudential stance after the Asian crisis, followed by a second easing after the Great Financial Crisis. Chile only started tightening its macroprudential framework again after 2012.

By the end of 2019, Chile had a level of overall macroprudential policy net tightening (in relation to 1990) of 3 measures, which is substantially lower than the 17, 17.1, 9.3, 10 and 13.9 tightening measures for the average of the OECD, Advanced Economies (AE), Low Income Countries (LIC), Latin America and the Caribbean (LAC) and LA6, respectively.

Chile has therefore lagged the macroprudential tightening that was observed across all country groups, especially after 2006. All the groups of countries reduced their macroprudential tightening somewhat in 2020 after the Covid pandemic, therefore Chile followed this international trend and reduced its macroprudential index to 2 by the end of 2020.

<sup>1</sup>The 17 individual financial policies include: Loan-to-value (LTV), Debt Service to Income (DSTI), Limits on Credit Growth (LCG), Loan Loss Provisions (LLP), Loan restrictions (LoanR), Limits and penalties to the loan-to-deposit (LTD), Limits on foreign currency lending (LFC), Reserve Requirements (RR), Liquidity, Limits on foreign exchange exposure (LFX), Leverage limits or unweighted Leverage Ratio (LVR), Countercyclical buffers (CCB), Conservation buffer, Capital requirements, Tax measures, measures to mitigate risks from Systemically Important Financial Institutions (SIFI), and Other (such as stress testing, restrictions on profit distribution and limits on exposures between institutions).

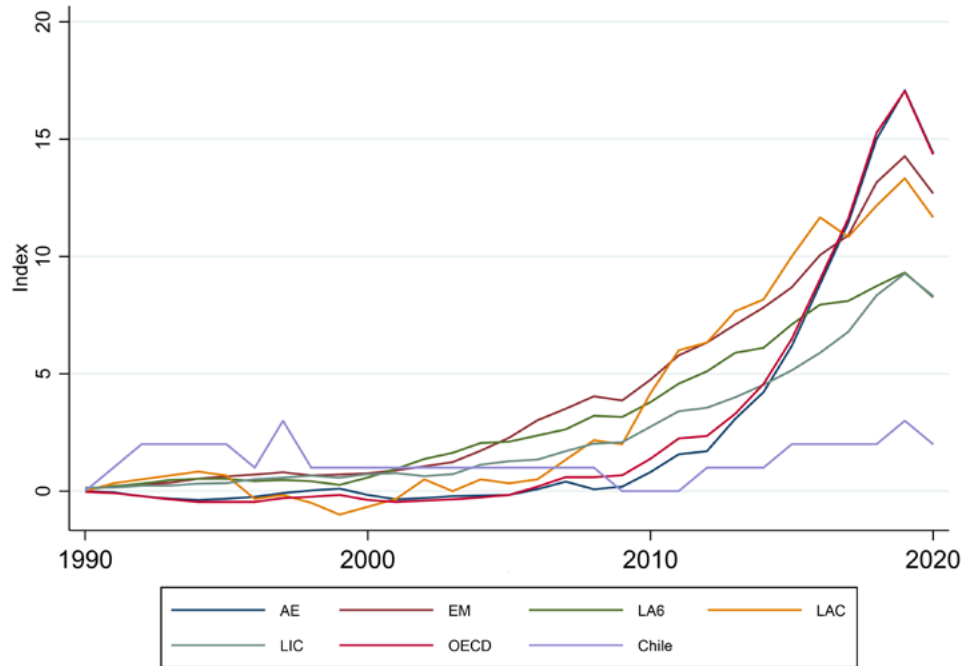
However, with the new General Banking Law of 2019, Chile advanced to a full Basel III regime, becoming comparable to the Advanced Economies and other countries that adopted Basel III.

Chile had very low levels of financial openness between 1970 and 1993. Chile opened significantly in the mid-1990s and currently has levels of financial

openness that are only slightly lower than the average Advanced Economy and OECD. Emerging Markets and Latin American countries also opened significantly during this period, although to a smaller extent than Chile. Furthermore, Chile also eased substantially its capital controls since 1995, with its current net flows' controls being close to the OECD average and just slightly higher than the average Advanced

Economy. Chile has the lowest level of capital inflows controls relative to other economies, but a somewhat higher level of outflow controls than the OECD and Advanced Economies. Overall, Chile became more open after the Asian crisis and the end of its exchange-rate band target in 1999.

Figure 3: Macroprudential net tightening index (cumulative sum of all the 17 policies) across regions (average across all the countries in each year)



## Publications in academic journals by researchers of the Central Bank of Chile

Alfaro, R. and A. Sagner “S&P 500 under a Structural Macro-Financial Model” *Economic Analysis Review*, 36(2), 3-20.

Arriagada, C., Coble, P., Lewis, B., Li, T. *Post-Investment Aftercare Explained: A Guide for FDI Practitioners and Policymakers on How to Grow and Retain Investors*. Forthcoming. Publisher: Routledge - Taylor & Francis Group. London, UK.

Berstein, S., Morales, M. “The Role of a Longevity Insurance for Defined Contribution Pension Systems”, *Mathematics and Economics*.

Bush, G., T. Gómez, A. Jara, D. Moreno, K. Styryn and Y. Ushakova. “Macroprudential policy and the inward transmission of monetary policy: The case of Chile, Mexico, and Russia,” *Review of International Economics*, vol. 29: 37-60.

Cabezas, L. y A. Jara. “Demanda por circulante: hechos estilizados y sustitución por medios de pago electrónicos” forthcoming, *Revista Cepal*.

Carlomagno, G. and A. Espasa. “Discovering specific common trends in a large set of disaggregates: Statistical procedures, their properties, and an empirical application”, forthcoming, *Oxford Bulletin of Economics and Statistics*.  
Carvalho, C., N. Pasca, L. Souza and E. Zilberman. “Macroeconomic Effects of Credit Deepening in Latin America,” forthcoming, *Journal of Money, Credit and Banking*.

Coble, P., Pincheira, P. Forecasting building permits with Google Trends. *Empirical Economics*.

Didier, T., Huneeus, F., Larrain, M., L. Schmukler, S. “Financing firms in hibernation during the COVID-19 pandemic”, *Journal of Financial Stability*, vol. 53.

Fornero, A., F. Gallego, F. Gonzalez y M. Tapia. "Railroads, specialization and population growth in small open economies: evidence from the first globalization", forthcoming, *Journal of Population Economics*.

Garcia-Santana, M., Pijoan-Mas, J., Villacorta, L. “Investment Demand and Structural Change”, *Econometrica*, 2021, 89(6), 2751-2785.

Kirchner, M., and M. Rieth. "Sovereign Default Risk, Macroeconomic Fluctuations and Monetary-Fiscal Stabilization", forthcoming, *IMF Economic Review*.

Lopez-Martin, Bernabe and Perez-Reyna, David , “Firm Dynamics and Aggregate Productivity” *Journal of Economic Dynamics and Control*”

Lu, W., F. Zhiyu Feng and C. Zhu. "Financial Integration, Savings Gluts, and Asset Price Booms," forthcoming, *The B.E. Journal of Theoretical Economics*.

Madeira, C. “The impact of the COVID public policies on the Chilean households”, forthcoming, *Applied Economics Letters*.

Martínez, J. F. y D. Oda “Characterization of the Chilean financial cycle, early warning indicators and implications for macro-prudential policies” *Latin America Journal of Central Banking (Online Version Available)*

Morales-Resendiz, R., J. Ponce, P. Picardo, A. Velasco, B. Chen, L. Sanz, G. Guiborg, B. Segendorff, J. L. Vasquez, J. Arroyo, I. Aguirre, N. Haynes, N. Panton, M. Griffiths, C. Pieterz, and A. Hodge “Implementing a retail CBDC: Lessons learned and key insights” *Latin America Journal of Central Banking*

Paraje, G., Colchero, A., Wlasiuk, J. M., Sota, A. M., & Popkin, B. M. The effects of the Chilean food policy package on aggregate employment and real wages. *Food Policy*, 102016.



## Latest working papers of the Central Bank of Chile

| Number | Title  | Authors  | Date           |
|--------|--|--|----------------|
| 967    | <a href="#">The COVID-19 Shock and Firm Financing: Government or Market? Or Both?</a>  | Miguel Acosta-Henao, Andrés Fernández, Patricia Gomez-Gonzalez, Sebnem Kalemli-Ozcan                               | December 2022  |
| 966    | <a href="#">Monetary Policy in Small Open Economies and the International Zero Lower Bound</a>   | Marco Rojas  | December 2022  |
| 965    | <a href="#">Business Cycle Asymmetry and Input-Output Structure: The Role of Firm-to-Firm Networks</a>                                     | Jorge Miranda-Pinto, Alvaro Silva, Eric R. Young   | December 2022  |
| 964    | <a href="#">Stocks, Bonds and the US Dollar - Measuring Domestic and International Market Developments in an Emerging Market</a>           | Nicolas Eterovic, Dalibor Eterovic   | October 2022   |
| 963    | <a href="#">Global Drivers and Macroeconomic Volatility in EMEs: a Dynamic Factor, General Equilibrium Perspective</a>                     | Gent Bajraj, Andrés Fernández, Miguel Fuentes, Benjamín García, Jorge Lorca, Manuel Paillacar, Juan Marcos Wlasiuk | September 2022 |
| 962    | <a href="#">Exchange rate volatility and the effectiveness of FX interventions: the case of Chile</a>                                      | Alejandro Jara, Marco Piña   | September 2022 |
| 961    | <a href="#">Trade Credit and Sectoral Comovement during Recessions</a>   | Jorge Miranda-Pinto, Gang Zhang  | August 2022    |
| 960    | <a href="#">Capital Ratios and the Weighted Average Cost of Capital: Evidence from Chilean Banks</a>                                       | Rodrigo Cifuentes, Tomás Gómez, Alejandro Jara   | August 2022    |
| 959    | <a href="#">The Holt-Winters filter and the one-sided HP filter: A close correspondence</a>  | Rodrigo Alfaro, Mathias Drehmann   | August 2022    |
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| 956    | <a href="#">Four facts about relationship lending: The case of Chile 2012-2019</a>   | Miguel Acosta-Henao, Sangeeta Pratap, Manuel Taboada   | May 2022       |
| 955    | <a href="#">Modeling S&amp;P500 returns with GARCH models</a>  | Rodrigo Alfaro, Alejandra Inzunza  | May 2022       |
| 954    | <a href="#">Unconventional credit policies during crises: A structural analysis of the Chilean experience during the COVID-19 pandemic</a> | Benjamín García, Mario González, Sebastián Guarda, Manuel Paillacar  | May 2022       |
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