

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

- **Estimating the Shadow Monetary Policy Rate in Chile: The Importance of External Factors**
- **Contribution of Small and Medium-sized Enterprises to Exported Value Added**
- **Uncertainty, Risk, and Price Setting: Evidence from CPI Microdata**

## Estimating the Shadow Monetary Policy Rate in Chile: The Importance of External Factors

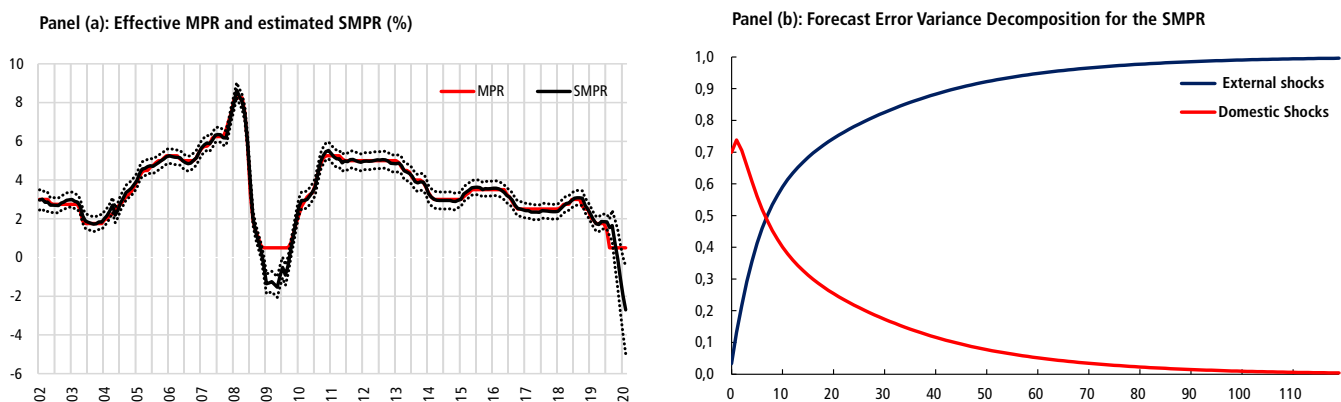
The global financial crisis of 2008-09 and recently the Covid-19 pandemic-generated international economic crisis have prompted unprecedented macroeconomic policy responses in both developed and emerging economies. In the particular case of monetary policy, monetary policy interest rates (MPR) in many economies approached the lower bound during these episodes of crisis, leading central banks to implement unconventional policies to provide additional liquidity to financial markets. One way of quantifying the scope of monetary policy in these crisis periods where the MPR is at its lower bound, is to use the concept of “shadow monetary policy rate” (SMPR) defined as the monetary policy interest rate in a counterfactual scenario where there is no lower bound of the nominal interest rate; in other words, a scenario where nominal interest

*"For the periods 2009-2010 and 2020-2021, the estimated SMPR was in negative territory for several months, attesting to the Central Bank's expansionary monetary stance"*

rates could take negative values. The SMPR is a useful analytical tool as it provides information on the stance of monetary policy in both crisis and normal periods. However, the SMPR is not directly observable. Nevertheless, the literature has modeled this rate as a latent variable that can be inferred using observable monetary indicators such as the interest rate, monetary aggregates and the balance sheets of the monetary authority. In their work *"Estimating Shadow Policy Rates in a Small*

*Open Economy and the Role of Foreign Factors"* Central Bank of Chile economists, [Jorge Fornero](#), [Markus Kirchner](#) and [Carlos Molina](#) estimate the value of Chile's SMPR with the purpose of assessing the monetary stance of the BCCh in scenarios where the benchmark rate has hit its lower bound (i.e., it is at or near zero). The authors extend the methodology developed by Lombardi and Zhu (2018) to calculate the SMPR by adding characteristics of small, open economies. The paper uses a dynamic factor model,

Figure 1: Estimated SMPR



Notes: In panel (a), the thick black line depicts the estimated SMPR, and the dotted lines are the corresponding 95% confidence intervals. The thin red line depicts the effective MPR. The figure in panel (b) reports the contributions, as a portion, to the variance of the SMPR's forecast error at different forecast horizons (in months). The shocks affect external factors and domestic factors. The contributions of the shocks to the factors plus the contribution of idiosyncratic shocks sums to 100%. To obtain the contribution of external and domestic factors, the contributions of the shocks to each of the external and domestic factors are aggregated.

where local and external latent factors determine the dynamics of a set of monetary indicators, the interest rate included. In order to take domestic and external factors separately, an exclusion constraint is used, where domestic factors are assumed to have no impact on foreign variables. Once the factors are estimated, the SMPR is recovered as the interest rate prediction using the factor model at the moments where the interest rate is constrained by the technical lower bound.

The evolution of the SMPR is found to be consistent with both the magnitude and the timing of the MPR

decisions made by the Central Bank. For example, in normal (or non-crisis) times, it can be observed (see panel (a) of figure 1) that the estimated SMPR is not statistically different from the MPR. However, for the period 2009-2010 and the period 2020-2021, the estimated SMPR is negative for several months, revealing more accurately the expansionary monetary stance of the Central Bank.

The authors also analyze the impact of external versus domestic monetary policy factors on the SMPR. When decomposing the variance of the SMPR

prediction error (see panel (b) of figure 1), they find that it is influenced more by domestic determinants in the short run (up to six months), while in the long run external factors dominate, explaining close to 80% of the variance decomposition after two years. This corroborates the classic Mundell-Fleming trilemma for horizons no longer than six months, i.e., that it is possible to carry out an autonomous monetary policy under a floating exchange rate and an unrestricted capital account.

## Contribution of Small and Medium-sized Enterprises to Exported Value Added

In Chile, as in many other countries, the capacity of small and medium-sized enterprises (SMEs) to export goods and services has been perceived as indicative of the possibility of extending the benefits of an open economy and globalization. This has motivated various support and promotion policies for exporting SMEs, whose progress has been limited by, among other things, the high costs of accessing international trade networks. However, the contribution of enterprises to exports is not limited to just their role of direct exporter. Many of them contribute to and benefit from international trade as suppliers of inputs or services to other exporting firms, a contribution that can be identified, measured and aggregated. This quantification is precisely the main contribution of the working paper [“Measuring Small and Medium-Sized Enterprises’ Contribution to Trade in Value Added: The Case of Chile 2013-2016”](#) by Central Bank of Chile economists [Mario Marcel](#) and [Diego Vivanco](#).

The authors measure the contribution to exported value added by firm size for the Chilean economy in the period 2013-2016. Previous efforts to measure the value added exported by SMEs have been limited because of difficulties in differentiating imported content by firm size in the production process. The work on Extended Supply and Use Tables (ESUT) led by the OECD provides guidelines to reconcile the use of official National Account statistics with micro-data collected by the Chilean tax authority SII.

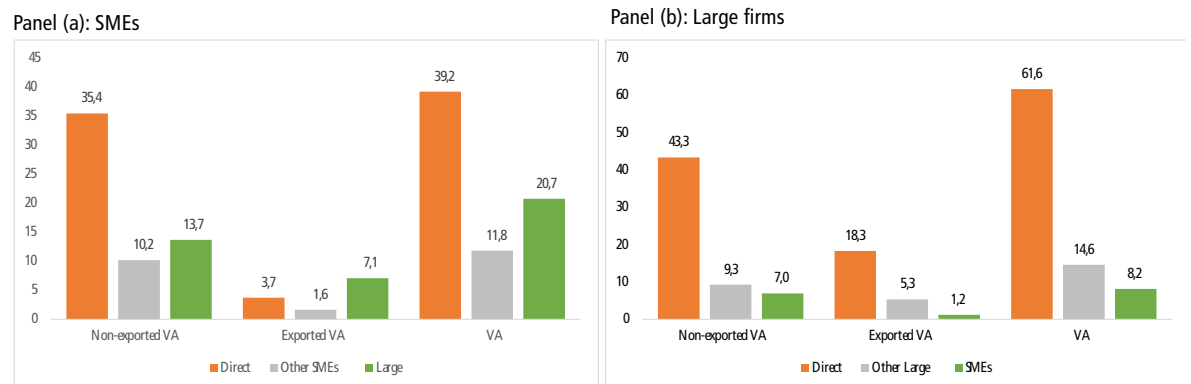
*SMEs participate in the exporting process more than their coefficient as direct exporters would suggest*

The results emphasize that SMEs participate in the export process more than their coefficient as direct exporters (21%) would suggest, since their contribution to the exported value added is 33%. Moreover, the authors find that SMEs' contribution to the export process is mainly indirect, e.g., in their role as suppliers of goods and/or services to large exporting companies. This finding becomes more relevant when compared with OECD countries, as it places Chile at the top in relative terms. This contrasts with the contribution of SMEs to non-exported value added, which is mostly direct. On the other hand, large companies contribute mainly directly to both exported and non-exported value

added. Figure 2 details the channels through which SMEs (left panel) and large companies (right panel) contribute to the creation of exported and non-exported value added.

However, even after considering the total share of SMEs in the exported value added, this is lower compared with OECD countries, and remains stagnant in the period analyzed. Adopting and applying the approach proposed in the document would not only make it possible to measure more accurately the contribution of SMEs to the country's exports, but would also broaden the perspective for public policies aimed at increasing it.

Figure 2: Value added by size (billions in pesos, current prices)



## Uncertainty, Risk, and Price Setting: Evidence from CPI Microdata

Both economic theory and empirical evidence indicate that the expectations of individuals and firms are key to their decision-making. Therefore, the degree of uncertainty that agents face regarding the future and their perception of risk will be fundamental for their behavior and the performance of the economy. For this reason, analyzing and measuring the impact of uncertainty on decisions helps to understand how the economy responds to different scenarios and developments.

Thus motivated, an extensive recent literature has shown that higher levels of uncertainty regarding the future have an adverse and considerable impact on variables such as investment, consumption, and growth. This result is robust to different measures of uncertainty, such as indicators based on the frequency of use of certain words in the media and social networks, or indexes associated with the volatility of financial assets.

In their paper *“Uncertainty, Risk, and Price-Setting: Evidence from CPI Microdata”*, Central Bank of Chile economists Mario Canales and [Bernabé López-Martín](#) contribute to this literature by studying how uncertainty and risk affect the dynamics of firms' price setting and inflation. This is an important question not only for understanding the behavior of prices over the cycle, but also because it may have implications for the management of monetary policy.

The authors use different measures of risk and uncertainty, including Chile's economic policy uncertainty index (EPU), the VIX for emerging economies, and the volatilities of the nominal exchange rate and the domestic stock market index (IPSA), among others. These measurements are complemented with Chile's CPI microdata, which allows analyzing different dimensions in the behavior of the prices of goods and services.

Using these data, the authors deliver two main messages. First, there is a significant and positive association between uncertainty and the price level. In other words, increases in uncertainty are associated with widespread price increases: contexts of greater uncertainty create inflationary pressures in the economy. This is an important result, since the theoretical and empirical literature has not reached a consensus on whether uncertainty is an inflationary or disinflationary force. Moreover, this provides a relevant background for monetary policy decision making at times when the economy faces greater

*“Increases in uncertainty generate important inflationary pressures in the economy, by speeding up the frequency with which individual prices adjust upwards”*

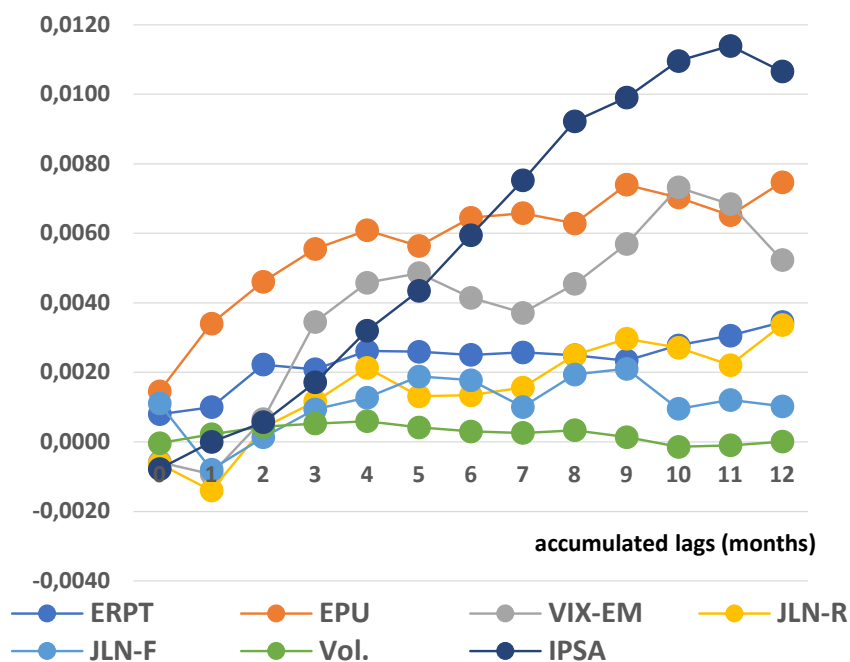
domestic or external uncertainty. Figure 3 shows the cumulative standardized effect on prices, up to 12 months, of the different measures of uncertainty used by the authors. The impact on prices is especially high for increases in stock volatility, the EPU index and the VIX. By comparison, the inflationary effect of these measures is larger than the pass-through coefficient associated with nominal exchange rate movements. This suggests that the effects of uncertainty on inflation are of considerable magnitude.

The second message concerns the details of how this price increase is generated. The authors find that uncertainty increases the frequency of positive price changes at the level of individual varieties and establishments, but reduces the frequency of negative changes. However, it has little or no effect on the

size of these changes. Thus, the inflationary effect of uncertainty does not occur because individual prices move by a greater magnitude when they are changed, but because the increases occur more frequently. This is consistent with international evidence, which suggests that macroeconomic conditions affect the frequency of price adjustments more than they do their magnitude.

Summarizing, this evidence shows that uncertainty is a relevant factor for understanding the dynamics of inflation in Chile, and therefore for monetary policy analysis and decision making. This suggests that timely measurement of the sources of uncertainty in the economy can provide valuable information regarding the future behavior of inflation, and aid the management of monetary policy throughout the cycle.

**Figure 3: Accumulated Effects of Uncertainty Indices and the Exchange Rate on Prices**



ERPT: Exchange Rate Passthrough; JLN-R(F): Real (financial) volatility index; Vol: Exch. Rate Volatility

## Publications in academic journals by researchers of the Central Bank of Chile, January-August 2021

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

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. Styrin and Y. Ushakova. “Macropprudential 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”, forthcoming, *Econometrica*.

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
920	<a href="#">The Effects of Firms' Lobbying on Resource Misallocation</a>	Federico Huneeus, In Song Kim	Agosto 2021
919	<a href="#">Learning Your Own Ability</a>	Carlos Madeira	Agosto 2021
918	<a href="#">Commodities Fundamental Model</a>	Francisco Arroyo Marioli,, Fernando Letelier	Julio 2021
917	<a href="#">Firm Sorting, College Major, and the Gender Earnings Gap</a>	Federico Huneeus, Conrad Miller, Christopher Neilson, Seth Zimmerman	Junio 2021
916	<a href="#">Optimal Monetary Policy and Incomplete Information: Does the Real Exchange Matter?</a>	Rodrigo Caputo, Felipe Leal	Junio 2021
915	<a href="#">Estimating Shadow Policy Rates in a Small Open Economy and the Role of Foreign Factors</a>	Jorge Fornero, Markus Kirchner, Carlos Molina	Mayo 2021
914	<a href="#">Measuring Small and Medium-Size Enterprises Contribution to Trade in Value Added: The case of Chile 2013-2016</a>	Mario Marcel, Diego Vivanco	Mayo 2021
913	<a href="#">Toward a general framework for constructing and evaluating core inflation measures</a>	Guillermo Carlomagno, Jorge Fornero, Andrés Sansone	Mayo 2021
912	<a href="#">Monetary Policy Press Releases: An International Comparison</a>	Mario Gonzalez, Raul Cruz Tadle	Abril 2021
911	<a href="#">The Credit Channel Through the Lens of a Semi-Structural Model</a>	Francisco Arroyo Marioli, Juan Sebastian Becerra, Matias Solorza	Abril 2021
910	<a href="#">Contracts, Firm Dynamics, and Aggregate Productivity</a>	Bernabe Lopez-Martin, David Perez-Reyna	Abril 2021
909	<a href="#">Optimal Spending and Saving Strategies for Commodity-Rich Countries</a>	Alvaro Aguirre	Abril 2021
908	<a href="#">Uncertainty, Risk, and Price-Setting: Evidence from CPI Microdata</a>	Mario Canales, Bernabe Lopez- Martin	Abril 2021
907	<a href="#">Earnings Inequality in Production Networks</a>	Federico Huneeus, Kory Kroft, Kevin Lim	Abril 2021
906	<a href="#">Price setting in Chile: Micro evidence from consumer on-line prices during the social outbreak and Covid-19</a>	Jennifer Peña, Elvira Prades	Marzo 2021
905	<a href="#">Economic Growth at Risk: An Application to Chile</a>	Nicolás Álvarez, Antonio Fernandois, Andrés Sagner	Marzo 2021
904	<a href="#">Production, Investment and Wealth Dynamics under Financial Frictions: An Empirical Investigation of the Self-financing Channel</a>	Alvaro Aguirre, Matias Tapia, Lucciano Villacorta	Marzo 2021

903	Earnings Cyclicity of New and Continuing Jobs: The Role of Tenure and Transition Length	Elías Albagli, Gabriela Contreras, Matías Tapia, Juan M. Wlasiuk	Marzo 2021
902	The Internal Labor Markets of Business Groups	Cristobal Huneeus, Federico Huneeus, Borja Larrain, Mauricio Larrain, Mounu Prem	Marzo 2021
901	A strategic analysis of “Expectations and the neutrality of money”	Gent Bajraj, Neil Wallace	Febrero 2021
900	Forecasting Brazilian Inflation with the Hybrid New Keynesian Phillips Curve: Assessing the Predictive Role of Trading Partners	Carlos Medel	Febrero 2021
899	Searching for the Best Inflation Forecasters within a Consumer Perceptions Survey: Microdata Evidence from Chile	Carlos Medel	Febrero 2021
898	Capital Flows and Emerging Markets Fluctuations	Jorge Lorca	Enero 2021
897	Financial Constraints: a Propagation Mechanism of Foreign Shocks	Rosario Aldunate	Enero 2021
895	Productivity Gaps and Job Flows: Evidence from Censal Microdata	Elías Albagli / Mario Canales / Chad Syverson /Matías Tapia / Juan Wlasiuk	Diciembre 2020
894	The potential impact of financial portability measures on mortgage refinancing: Evidence from Chile	Carlos Madeira	Diciembre 2020
893	Macroprudential Policy and the Inward Transmission of Monetary Policy: the case of Chile, Mexico, and Russia	Georgia Bush / Tomás Gómez / Alejandro Jara / David Moreno / Konstantin Styrin / Yulia Ushakova	Diciembre 2020
892	Labor Earnings Dispersion in Chile: Decomposition, Dynamics and the Role of Firms	Rosario Aldunate / Gabriela Contreras / Matías Tapia	Noviembre 2020
896	Sovereign Default Risk, Macroeconomic Fluctuations and Monetary-Fiscal Stabilization	Markus Kirchner / Malte Rieth	Diciembre 2020