RESEARCH HIGHLIHTS

Review of the current research conducted at the Central Banck of Chile

August 2020

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

- Inflationary effects of immigration
- Real effects of monetary shocks: evidence from price microdata
- Interactions between monetary policy and macroprudential policy in Chile

Inflationary effects of immigration

How does a migratory shock affect inflation in the receiving country? In the Central Bank of Chile (CBC) Working Paper No. 872 of April 2020, entitled *"On the Response of Inflation and Monetary Policy to an Immigration Shock"* CBC economists Benjamín García and Juan Guerra-Salas analyze whether the disinflationary pressures associated to the increased labor supply compensate for the inflationary pressures originating in the demand channel associated with the increase in population. In an inflation-targeting regime, the response of monetary policy to a positive migratory shock depends critically on how these opposing forces ultimately act on inflation.

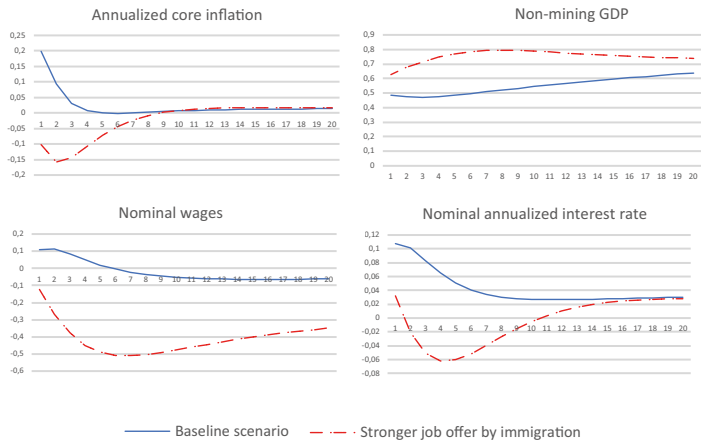
A migratory shock can have inflationary or disinflationary effects, depending on whether the increase in aggregate demand caused by the increase in population compensates or not for the greater labor supply provided by the immigrants.

To answer this question, the authors construct a DSGE model for a small, open economy with nominal rigidities and frictions in the labor market, to model the migratory shock as an exogenous and quasi-permanent increase in the labor force of the economy analyzed. The model is calibrated to the Chilean economy, which is small and open, and has received a substantial inflow of immigrants in recent years. Figure 1 shows the response of its main variables to this migratory shock.

The blue line shows the effects of a migratory shock on the base model specification. At the moment of receiving the migratory inflow, the economy experiences an increase in unemployment, because, when immigrants arrive in the country, they are unemployed and must immediately start looking for work. In this case, the migration shock, by increasing the mass of consumers in the economy, causes an increase in aggregate demand that, on impact, positively affects nominal wages and inflation. The increase in nominal wages is produced by demand-side pressures and because the labor market does not immediately absorb the newcomers. Higher inflation leads to an increase in the nominal interest rate by the monetary authority, which follows a Taylor rule.

The study considers other circumstances by which supply and demand pressures may change and affect inflation differently. One of them is to consider that immigrants are willing to accept lower wages than natives for the same number of hours worked. The dashed red lines in Figure 1 represent the effects of this exercise on the economic variables of interest. In this case, even though many of the new workers remain unemployed in the first periods after their arrival, the strong increase in labor supply exerts strong downward pressure on nominal wages that, despite the pressures on demand, ends up causing a drop in inflation. In this scenario the monetary authority quickly lowers the interest rate in an effort to stabilize inflation. The case of immigrants sending

Figure 1; Response of variables of interest to a migratory inflow



part of their income to their countries of origin in the form of remittances is subsequently analyzed. Here aggregate demand increases less than in the baseline case, since part of the immigrants' labor income is sent abroad instead of being spent on consumption or investment. This decreases pressures on inflation. On the other hand, the depreciation of the nominal exchange rate associated with the capital outflow puts upward pressure on inflation. The net effect on inflation is close to zero.

A fourth case study considers that, in their first jobs, immigrants suffer a temporary loss of productivity. Lower average labor productivity exerts upward pressure on inflation that causes a rise in the nominal interest rate.

These exercises show that the response of inflation to a migratory shock depends critically on the characteristics of immigrants in various dimensions, including their skill levels, the working conditions in which they arrive, or the speed with which they are able to be fully immersed in the labor market. The monetary authority will then require a correct diagnosis of the migration phenomenon when deciding on the policy response.

Real effects of monetary shocks: evidence from price microdata

Microdata on prices are not sufficient to infer how monetary policy influences the economy or to discipline macro models for monetary policy evaluation. The only relevant statistic is the frequency of price changes which must be supplemented with econometric analysis.

How much do prices react to monetary policy? This is a critical question to learn about the influence of a central bank on the real economy. If a central bank, for instance, decreases interest rates, households respond spending more. How much of the increased spending translates into higher demand for physical goods, and thus induces higher real activity, depends on the magnitude prices react. This question is also important to discipline the macro models that central banks use since only models that replicate the influence of monetary policy on the real economy are suitable for policy evaluation.

This is however a difficult question to answer. The literature then has focused on the related, less ambitious question of clarifying which observable statistics in micro data provide information about the responsiveness of aggregate prices to monetary policy. This question has been tackled so far using models. Using a model of exogeneous timing of price adjustment, Calvo (1983) suggests that the frequency of price changes is critical – the less often prices change at the micro level, the less aggregate prices react to monetary policy. Using a model of endogenous timing of price adjustment, Golosov and Lucas (2007) point out that, in addition to frequency, the extent in which prices change is important; even if few prices respond to monetary policy, if those which do change do it by a lot, aggregate price response to monetary policy is stronger. Midrigan (2011) argues that this mechanism is less strong than originally thought because a large fraction of prices in micro data actually change by little. Many others have proposed other micro statistics, but Alvarez, Le Bihan and Lippi (2016) condensed 20 years of research in a single theorem: In a large family of models, the ratio between the fourth moment of the empirical distribution of price changes (the "kurtosis") and the frequency of price changes is a sufficient statistics for the responsiveness of aggregate prices to monetary policy. Thus, this ratio observable from micro data is the only information needed to learn about in which countries or under which conditions monetary policy has more/less influence on the real economy.

In the paper *"The Real Effects of Monetary Shocks: Evidence from Micro Pricing Moments"* (Central Bank of Chile No. 875, April 2020), CBC economist Ernesto Pastén, in collaboration with Gee Hee Hong, Matthew Klepacz and Raphael Schoenle, take a different perspective to answer this question. Instead of studying model predictions, this paper estimates the empirical relationship between observable micro statistics and the responsiveness of prices to monetary policy. Using US data, this paper sorts micro data of prices into bins defined at fine degree of disaggregation and computes several statistics to each bin, including frequency and kurtosis. Then, they estimate the responsiveness of prices in each bin to the non-forecastable component of monetary policy decisions. This is because, in reality, monetary policy responds to economic conditions which are also observable for firms and affect their decisions. Thus, to isolate the causal effect of monetary policy on prices, one must use its non-forecastable component (called "monetary shocks") or, in other words, the part of monetary policy decisions that do not respond to observable conditions.

The table below summarizes the main empirical result of the paper.

Frequency	Kurtosis	Avg. change	St. dev.	% small change	%pos. change	Profit
0,411**	-0,166	-0,202	0,014	-0,106	0,070	-0,439**

This table reports estimates of the responsiveness of prices to monetary policy shocks depending on a number of candidate statistics: frequency of price changes, kurtosis, average absolute size and standard

deviation of log price changes (respectively, Av.size and S.D.), the ratio of small log price changes (Small.ch) and the fraction of price changes that are positive (Positive.ch). We also include firms' profits. Significance at 1% and 5% are denoted by ** and *. There are two main findings. First, the only micro statistics significant is frequency. Not in this Table, but the paper also shows that the ratio of kurtosis over frequency is also significant but only because frequency is. Second, firms' profits are significant, which implies that no micro statistics is sufficient. Hence, micro data alone cannot tell about the strength of the leverage of monetary policy on the real economy.

Yet, it is useful exercise to tease out which model ingredients prevent alternative models of endogenous price adjustment to match empirical results found here. After all, centrals banks use macro models to evaluate policies that are more elaborated and from a much broader perspective than simply measuring the impact of monetary shocks. The main conclusions are that continuous-time models provide poor approximation to phenomena observed in discrete time, and that model predictions are highly sensitive to the exact way to account for the large number of small price changes observed in micro data.

Interactions between monetary policy and macroprudential policy in Chile

Local macroprudential policies can attenuate (in the case of reserve requirements in foreign currency) or exacerbate (in the case of LTV ratio) the pass-through of external monetary policy to domestic credit.

The 2007-09 Global Financial Crisis prompted the use of macroprudential policies to strengthen the resilience of financial systems to stressful situations. In this new context, it is crucial to understand the interaction between these policies and monetary policy, both nationally and across borders, especially in a small open economy like Chile. In the CBC Working Paper No. 870 of April 2020, entitled *"International and domestic interactions of macroprudential and monetary policies: the case of Chile,"* CBC economists Tomás Gómez, Alejandro Jara, and David Moreno study the above-mentioned interactions focusing on their impact on bank credit growth in Chile. The analysis focuses on the 12 internationally active banks during the period 2001-2017, which accounted for a combined 95% of the assets of the banking system at the end of the period considered.

As for the effect of international monetary policy disturbances on bank credit growth, the results point to the existence of heterogeneity among the various macroprudential policies: higher capital requirements or higher reserve requirements for foreign currency deposits attenuate the pass-through of external monetary policy on domestic credit, while those policies that restrict mortgage loans to a fraction of the value of the home (LTV) amplify it. These results exploit the increased regulatory capital requirements for those banks that become systemic via mergers or acquisitions that boost their market power, as well as the heterogeneity in the exposure of banks to macroprudential policies resulting from their different balance sheets. The latter allows for the introduction into the analysis of changes affecting the entire banking sector, such as the increase in the LTV ceiling allowed for mortgages financed through letters of credit and the variations in the currencies accepted for the settlement of reserve requirements associated with foreign currency deposits.

Regarding the effects of macroprudential policies in the rest of the world on bank credit growth in Chile, the authors find that these are amplified when local monetary policy is in a contractionary phase, i.e., when interest rates are higher (see column 4 in table below). For this analysis, the authors explore the variation in banks' exposure to different jurisdictions, in which regulatory changes in macroprudential policies occurred. They also take advantage of the different nationalities where the parent companies of the foreign banks operating in Chile reside. Finally, regarding the pass-through of domestic monetary policy shocks (columns 5 and 6), the authors build a metric for the exogenous component of domestic interest rate movements and thus alleviate potential endogeneity problems. Their results indicate that reserve requirements for foreign currency deposits amplify short-term effects on bank credit, but mitigate them over longer horizons.

	(1)	(2)	(3)	(4)	(5)	(6)
	External monetary policy			Domestic monetary policy	Domestic monetary policy	
	Domestic prudential policy			External prudential policy (Capital req't)	MPR change	Surprise at 6 months
	Capital req't	Reserve req't	LTV		Domestic prudential policy (Reserve req't)	
Combined impact on total credit	2,91**	3,20**	-1,41***	-0,69***	-0,04	7,77**

The table presents results taken from the Central Bank Working Paper "International and domestic interactions of macroprudential and monetary policies: the case of Chile". The sample of banks includes 15 internationally active entities between 2001 and 2017. The standard errors are robust to cross-section dependence in panel estimates. ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

Recent Articles Published in Academic Journals by Central Bank Researchers, April-August 2020

Arroyo, F. “Old crop versus new crop prices: Explaining the correlation”. Journal of Futures Markets, vol. 40(7), 1192-1208.

Bauducco, S. and R. Caputo. “Wicksellian Rules and the Taylor Principle: Some Practical Implications,” The Scandinavian Journal of Economics, vol. 122(1):340-368.

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.

Cobb, M. “Aggregate density forecasting from disaggregate components using Bayesian VARs”. Empirical Economics, vol. 58(1), 287-312.

Forero, 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.

Fornero, J., M. Fuentes and A. Gatty. “How do manufacturing exports react to RER and foreign demand? The Chilean case,” The World Economy vol. 43(1), 274-300.

Garcia-Cicco, J. y M. Garcia-Schmidt. "Revisiting the exchange rate pass-through: a general equilibrium perspective," forthcoming. Journal of International Economics.

Gonzalez, M., and R. Tadle. “Signaling and Financial Market Impact of Chile´s Central Bank Communication: a Content Analysis Approach,” forthcoming, Economía.

Guerra-Salas, J., M. Kirchner and R. Tranamil-Vidal. “Search frictions and the business cycle in a small open economy DSGE model”, forthcoming, Review of Economic Dynamics.

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

Pastén, E., R. Schoenle, and M. Weber. “The Propagation of Monetary Policy Shocks in a Heterogeneous Production Economy,” forthcoming, Journal of Monetary Economics.

Pasten, E. “Prudential Policies and Bailouts – A Delicate Interaction,” forthcoming, Review of Economic Dynamics.

Pedersen, M., and Caputo, R. “The Changing Nature of the Real Exchange Rate: The Role of Central Bank Preferences,” in press, Economic Modelling, Elsevier.

Recent working papers of the Central Bank of Chile

Number	Titles	Authors	Date
887	Railroads, specialization, and population growth in small open economies: Evidence from the First Globalization	Andrés Forero / Francisco A. Gallego / Felipe González / Matías Tapia	September 2020
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