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Firm and household heterogeneity at the Central Bank of Chile*

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Resumen

En esta nota analizamos cómo el Banco Central de Chile ha incorporado la heterogenenidad en su análisis económico, y el trabajo actual para expandir nuestros principales modelos de proyección en esa dirección. Para ello, presentamos análisis recientes en los que la heterogenenidad de firmas y hogares fue clave para comprender la situación económica y apoyar las decisiones de política monetaria. Además, hacemos notar las implicancias de política de incorporar estas heterogeneidades en los modelos macroeconómicos, en relación con los efectos distributivos de la política monetaria.

Abstract

In this note, we discuss how the Central Bank of Chile has incorporated heterogeneity into its economic analysis, and the current work to expand our main projection models in that direction. To do so, we present recent analyses in which the heterogeneity of firms and households was key to understanding the economic situation and supporting monetary policy decisions. We also note the policy implications of incorporating these heterogeneities into macro models, in relation to the distributional effects of monetary policy.

* This note was prepared for the 2025 BIS Emerging Market Deputy Governors' Meeting, "How can central banks account for differences across households and firms in monetary policy?"

Firm and household heterogeneity at the Central Bank of Chile

Stephany Griffith-Jones[1], Mario Giarda[2] and Jorge Arenas[3]

1. Introduction

The heterogeneity of economic agents is a central issue in modern macroeconomics. The asymmetric impacts of shocks in the context of the Covid-19 pandemic showed that data on specific characteristics of households and firms are important to understand the transmission of monetary policy. Several theoretical and methodological improvements have been developed in recent years which allow us to study macroeconomics at a very granular level with both statistical analysis and models.

Given the importance that the Central Bank of Chile (CBC) attaches to this topic and its implications, we organised our annual research conference in 2022 around this topic, leading to a resulting book (see Bauducco et al (eds) (2024)). In this note, we discuss how the CBC has incorporated heterogeneity into its economic analysis, and the current work to expand our main projection models in that direction. To do so, we present recent analyses in which the heterogeneity of firms or households was key to understanding the economic situation and supporting monetary policy decisions. We also discuss the current state of our main projection models, and how certain heterogeneities have been incorporated.

Considering heterogeneity both in macroeconomic analysis and in the expansion of models requires access to excellent micro data on the characteristics of firms and households, and at the CBC we have them. Through the sections of this note we discuss the micro data used in each area of work: Section 2 deals with firm heterogeneity, while Section 3 deals with household heterogeneity. Both sections discuss selected analyses and models. Finally, in Section 4 we note the policy implications of incorporating these heterogeneities into macro models, in relation to the distributional effects of monetary policy.

2. Firm heterogeneity

The CBC has made progress in incorporating firm heterogeneity into several aspects of economic analysis, taking advantage of good data availability. This heterogeneity has been present in macroeconomic analyses for preparing monetary policy meetings, most frequently in the wake of the Covid-19 pandemic. At the same time, we have developed complementary ("satellite") models to support policy decisions that consider firm heterogeneity. Through research, we are also studying how these differences affect certain monetary policy transmission mechanisms. This section begins with a brief mention of firm micro data, then describes the three aspects mentioned above, and

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finally presents a specific case where an exceptional policy measure, introduced as part of support to firms and households in the context of Covid-19, took firm heterogeneity into account.

2.1. Data

The data set available at the CBC covers a broad range of firm-level information, including transaction-level data between firms. This allows us to track prices, sales and purchases at both the firm and product level monthly. We can also classify firms by economic sector, size (based on sales or number of employees), geographic location and employment, among others. On the financial side, we have detailed data on commercial loans, including information on each contract between the firm and the financial institution. Most of these data come from three main administrative sources: the tax authority (Servicio de Impuestos Internos), the financial regulator (Comisión para el Mercado Financiero) and the pension system regulator (Superintendencia de Pensiones). We also conduct surveys on firms' expectations and on banks' perceptions of the credit market.

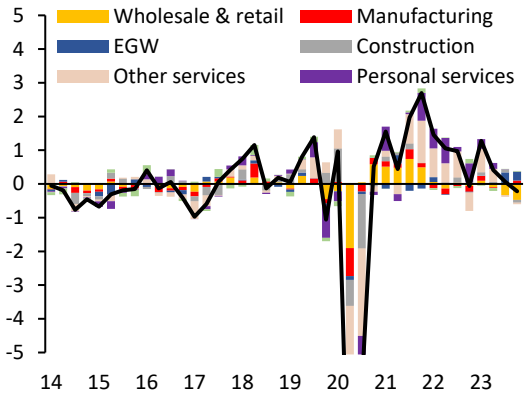
2.2 Selected work

The CBC often uses boxes in its Monetary Policy Reports to present macroeconomic analyses of phenomena relevant to policy decisions. Even before the Covid-19 pandemic, some analyses considered firm heterogeneity, such as those on productivity estimation, production linkages, and investment dynamics in the mining sector (CBC (2012, 2018a,b)). Since 2020, these analyses have become more frequent. Below are some examples that highlight the importance of recognising firm-level differences.

Sectoral factors have been important for explaining recent inflation dynamics. In Chile and other economies, goods and services inflation have not followed similar trends. After excluding volatile items, goods inflation in Chile peaked at 14.9% in November 2022, while services inflation reached 8.5% in March 2023. Since then, goods inflation has declined faster, standing at 2.7% in November 2024, compared with 5.0% for services inflation in the same month. To understand these differences, Vivanco et al (2024) estimated sector-level output gaps and found negative gaps in goods-related sectors and gaps close to zero in services-related sectors (see Figure 1). These results are consistent with the observed inflation patterns. Considering heterogeneity in these gaps provided a more accurate view of costs, margins, etc and helped explain differences in relative prices across sectors.

Figure 1: Sectoral output gaps

A. Sectors' contributions to non-mining GDP gap at factor costs (1) (percent of potential)



B. Goods and services gaps (2) (percent of potential)

Note: (1) Sector gaps estimated using median of 6 univariate filters. Sector aggregation based on nominal GDP weights. (2) Gaps using 6 univariate filters of activity subsectors related to consumption of goods and services, aggregated using weights from the input-output matrix. Source: Vivanco et al (2024).

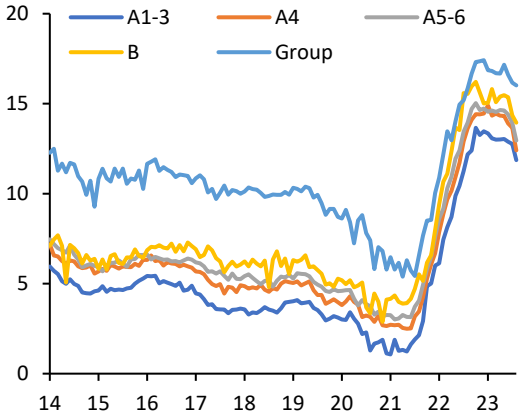
Another analysis that drew on firm heterogeneity examined the exchange rate pass-through (ERPT) according to firms' markups. In González et al (2024), monthly firm-level data were used to distinguish the ERPT based on firms' use of imported inputs and their markups. The results showed that the depreciation of the Chilean peso in the second half of 2023 (by 6.2% and 5.4% in the last two quarters, respectively) had a limited impact on prices. Firms more exposed to exchange rate fluctuations and with low markups passed on cost increases to sales prices more than firms with high markups. High markups allow firms to absorb cost increases, reducing pressure on prices. These findings align with the negative gaps observed in goods-producing sectors, where the effect of depreciation on prices was limited.

On the financial side, we have examined how credit conditions evolved for different types of firms following the start of cuts to the monetary policy rate (MPR) in July 2023. In the September 2023 *Monetary Policy Report*, we showed that commercial lending interest rates were falling as expected, indicating that one of the monetary policy transmission channels was working adequately (CBC (2023a)). By using micro data to characterise firms and their credit operations, it was possible to conclude that changes in average interest rates were mainly driven by the intensive margin; that is, by the average cost faced by firms depending on their risk level and other characteristics. Less risky firms borrowed at lower rates, and the gap between firms with different risk classifications narrowed (see Figure 2).

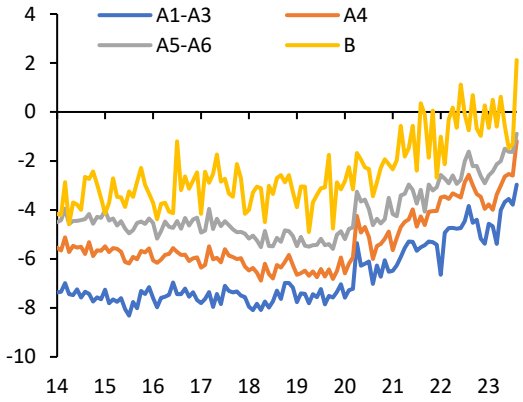
The banking sector had thus begun to pass on the monetary easing that had begun months earlier to the financing condition of firms, particularly to interest rates. Although the level of these interest rates is noted to depend on the credit rating or size of the firms, the evolution followed the usual patterns.

Figure 2: Behavior of interest rates according to risk rating

A. Interest rate by risk rating (percent)



B. Average rate differential across firms according to risk rating (right, differential with respect to group portfolio, percent)



Note: For terms under 12 months. The left panel depicts the average interest rate perceived by firms for new loans they take within each risk rating, weighted by the share of firms belonging to a risk category in total credit. Operations with unusually low rates were eliminated. The right panel shows the average differential according to an econometric estimation between the rates charged by the same bank, for the same credit term and in the same month to firms with a given risk rating with respect to the rates charged to firms belonging to the group portfolio. Loans for a term of less than 0.1 months and firms with less than five employees are excluded. The results for August only consider the first days of the month. For the last months, preliminary risk rating data are used, which are subject to revision. Sources: CBC (2023a).

The extensive data also facilitated firm-level productivity estimates. Aggregate data show a downward trend in productivity in Chile since 2011, with annual average growth of –0.4% between 2011 and 2019, well below the 2% average between 2000 and 2010 (Aguirre et al (2021)). To understand the microeconomic factors behind this decline, productivity was estimated using firm-level data. Three main findings emerged: (i) the firm-level data matched the aggregate productivity trend, with a sustained decline from 2011 onwards; (ii) the drop was mainly due to lower productivity in incumbent firms rather than changes in entry and exit dynamics; and (iii) two thirds of the productivity decline among incumbent firms related to changes within these firms, while the remainder stemmed from reallocation between firms. Sectors like transport, trade and manufacturing recorded positive productivity growth, while services, construction and agriculture saw declines. Smaller firms experienced greater productivity gains than larger firms (Aguirre et al (2021)). This analysis offered a more detailed perspective on Chile's productivity trends, showing the value of having firm-level data.

2.3 Modelling: satellite models

Although our main projection models, especially XMAS[4], do not incorporate much firm-level heterogeneity beyond the mining sector, we do have complementary satellite models that include certain heterogeneities between firms. This section describes two such models: one for projecting the mining sector, and another for exploring conditional ERPT in tradable and non-tradable sectors.

Mining plays a key role in Chile's economy. It currently represents about 12% of GDP, though it exceeded 20% in 2006 and 2007, during the commodity price boom. Its investment dynamics depend primarily on global factors and the strategies of large mining companies, rather than domestic conditions. As a result, monetary policy has limited influence, justifying the separate treatment of this sector in projection models.

In XMAS, mining sector investment is modelled by assuming that mining firms take prices as given, and that production depends on past investment decisions. Investment is chosen to maximise returns, although it takes time to produce results (CBC (2020a)).

To complement the mining activity projections, a nowcasting model is used to estimate current production. For medium-term projections, time series models are used for each large mining firm. Medium-sized and small firms are grouped together and represented by a single model (CBC (2020a)).

The exchange rate channel is also relevant for a small, open economy like Chile. To understand how exchange rate movements affect inflation, García and García-Cicco (2020) developed a DSGE model with tradable and non-tradable sectors. They estimate the ERPT conditional on the type of shock that drives the exchange rate. The results show that the ERPT is high and persistent for shocks associated with uncovered interest rate parity (UIP), and lower with quicker pass-through for shocks related to external prices.

Differences in both magnitude and timing of the ERPT have important policy implications. It is well known that monetary policy acts with delay, so it cannot react to counteract a shock that has small and short-term effects, such as those on external prices. On the contrary, in the face of shocks to the UIP, which have large effects and take time to be passed on to domestic prices, monetary policy should react to reduce inflationary pressures (García and García-Cicco (2020)). For this reason, it is important to distinguish the sources that cause shocks in order to adjust the response of monetary policy.

2.4 Firm heterogeneity and monetary policy transmission

Ongoing research examines how different monetary policy transmission mechanisms depend on firm-level differences. Two studies are highlighted here. The first looks at the role of firms' access to finance in monetary policy transmission, and the second focuses on how firms' markups influence their response to monetary policy shocks.

[4] XMAS: "Extended Model for Macroeconomic Analysis and Simulations". This is our medium-scale dynamic stochastic general equilibrium (DSGE) model, which we use for medium-run macroeconomic forecasts.

Aruoba et al (2022) analyse the impact of monetary policy on Chilean firms' investment and employment decisions based on their access to credit markets. The authors use firm-level and credit contract data, as well as a series of monetary policy surprises. They consider firms' credit access, debt delinquency and leverage, controlling for their size and age.

They find that firms with access to credit respond significantly to monetary policy surprises, unlike those without access, which show no change in investment or employment. Among firms with credit access, payment capacity and debt levels also affect how policy changes pass through. Firms with higher delinquency or more leverage respond less. Using these findings, they develop a partial equilibrium model in which credit access is endogenous and monetary policy transmission depends on firms' credit histories.

Giarda et al (2024) examine the cyclicality of Chilean firms' markups and its effects on monetary policy transmission. Using firm-level data, they find that markups are generally countercyclical, but vary widely. They also show that markup dispersion rises during recessions, possibly indicating less efficient resource allocation.

These two studies are part of a broader research agenda at the CBC, which takes advantage of detailed data to continue studying firm heterogeneity and its role in monetary policy transmission, and also considers how to integrate these differences into the models commonly used for projections.

2.5 Firm heterogeneity in the design of Covid-19 support policies

Finally, we describe how a specific form of heterogeneity among Chilean firms was considered in designing a support policy at the start of the Covid-19 pandemic.

Besides reducing the MPR to its technical minimum in April 2020 (0.5%), the CBC implemented other measures to meet the liquidity needs of firms most affected by the pandemic. One such measure was the Credit Facility Conditional on Increased Loans (FCIL), which gave banks access to CBC credit lines under favourable conditions (CBC (2020b)).

Since sharp declines in firms' sales were expected, especially for small and medium-sized firms, the FCIL's design directly considered this heterogeneity to ensure that the monetary stimulus was transmitted as intended. The initial unconditional credit line was set at 3% of the total commercial and consumer loan portfolio. An additional line, proportional to this base, depended on the increase in lending and on the share of resources allocated to smaller firms.[5] This additional line could be several times larger than the base line. The FCIL had three phases, amounting to loans totalling US$ 40 billion. Along with other support measures, this allowed financial institutions to grant more than US$ 20 billion in commercial loans (CBC (2023b)).

Again, the availability and frequency of firm-level data was crucial for designing the first stage of the FCIL and for monitoring the loans. Initially, estimates were made of how much additional bank credit would be needed to cover projected operational deficits. Surveys were also helpful in identifying

[5] With annual sales of less than US$ 3.4 million.

firms' financing needs. Having access to these microeconomic data sources increased the precision and effectiveness of the policy's design, making it more likely to achieve its objectives.

3. Household heterogeneity

On the side of household heterogeneity, we have advanced in several dimensions that we will address in more detail below. First, we describe the available data and the possibilities raised by new sources that will be open to us soon. Second, we mention a selection of analyses we have conducted recently that consider heterogeneity at the centre of our policy work, including events during Covid-19. Finally, we briefly describe the heterogeneous agent New Keynesian (HANK) models we are developing, the DSGE model we use for forecasting, and how we extended the latter to account for features present in models with household heterogeneity.

3.1 Data

We use high-quality administrative databases. These databases allow us to evaluate the impact of aggregate phenomena on households in a much more granular way. The following is a list and description of a selection of databases.

We have access to administrative records on employer-employee databases, which we access from the tax authority and the pension regulator. These databases contain the formal employment history of the universe of employees in Chile. We also have access to demographic features of workers like education, age, gender and more. We can use these data to evaluate the role of firms in shaping employment and earnings fluctuations since we also have information on firm features. Moreover, these databases have monthly frequency, which is a rare feature. Monthly data allow us to study several relevant questions about the effects of business cycles and to track the economy at a higher frequency than before. Monthly frequency allows us to study the effects of different types of shocks more precisely too.

We also have data on credit and debit card transactions. These data are available at the transaction level daily and include the sector and location in which the transaction was made. They allow us to study high-frequency consumption by different types of goods purchased. However, these data do not include information on the individual who made the purchase. We can still learn about consumption heterogeneity by using location. We can study consumption at the municipal level. In Chile, municipalities are the smaller administrative units and, according to our analysis, broadly represent the income of their inhabitants well. One of the examples below (from a box in a Monetary Policy Report) uses these data to help us calibrate the effects of aggregate fluctuations on consumption in a more granular way.

3.2 Selected analysis

3.2.1 Income and consumption during 2020

In the December 2020 *Monetary Policy Report*, we analysed the fall in household income and the effect of support policies during Covid-19 (Barrero et al (2020)). In addition, we analysed households' marginal and average propensities to consume by quintile of income. This analysis was crucial to

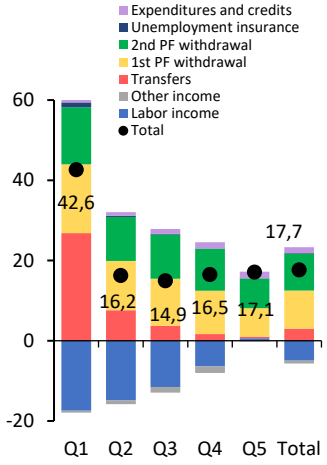
studying the macroeconomic impact of fiscal support given to households through its effects on consumption and savings.

The first part of the analysis was focused on income. We showed that for two quarters (the second and third) of 2020, income fell by more than 10%, totalling a decrease of 5.7% in the year. This fall of 5.7% was highly heterogeneous, with the drop decreasing for higher incomes. We found that the fall in income of the first quintile (poorest) was 17.9%, that of the second quintile was 15.8%, and the income of the fifth quintile increased by 0.5% (see Figure 3.A).

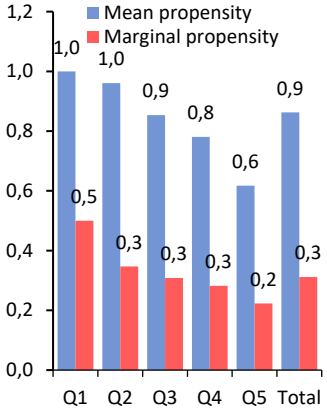
Figure 3: Income changes, income support and propensity to consume by quintile in 2020

A. Income change (annual change, percent)

B. Income support (annual change, percent)



C. Mean and marginal propensities to consume (percentage of the available resources)



Source: Barrero et al (2020).

Like many countries, Chile approved several policies to aid individuals who were not allowed to work, and who, as the previous figure shows, had suffered a significant drop in income. Several measures were taken, but two stood out and were part of the analysis of the box: fiscal transfers and pension fund withdrawals. The former were stimulus cheques to households that were highly targeted but small at the beginning of the pandemic. The latter was part of a Congress initiative to allow workers to withdraw 10% of their pension fund. Figure 3.B shows a snapshot of the different kinds of help given to households of different quintiles. The lowest quintiles received fiscal transfers and withdrawals, while the highest received mainly withdrawals. In Figure 3.B, we can also see the significant increase in income for all quintiles in 2020. The increase was heterogeneous, with the lowest quintile having the largest rise (of 42.6%) despite the significant fall in labour income. On average, income increased by 17.7%.

An important question at this point is whether this significant rise in income, when most retail outlets and firms were closed, would generate a significant rise in inflation beyond supply pressures from lockdowns and foreign shocks like global value chain disruptions, which had started to develop at that time. To answer this question, the box provided additional evidence on the marginal and average propensities to consume. In this case, since the rise in income was tilted to the bottom of

the income distribution, it was crucial to estimate how much the different groups would spend out of that income.

Barrero et al (2020) describe these estimates. As explained above, we estimated the average propensity to consume (APC) and the marginal propensity to consume (MPC). The APC is the typical household consumption pattern corresponding to the average consumption share to income. The MPC is the rise in consumption after an increase of one unit of income or the consumption response to an income shock. The idea is to challenge the theory of permanent income which concludes that workers spend the annuity of their lifetime income in present value every period, and hence the MPC is very low. This is a consequence of having complete markets available for all households. We think – and know – that a large proportion of households in Chile do not have access to the financial market, so it is reasonable to think that households have a large MPC. We estimated the MPC to have an idea of the impact the different types of fiscal help had on the economy, and we did this by quintile of the income distribution to account for the previous fact that the changes in income (and help) were highly heterogeneous. Therefore, the consumption response to the extra income from household support is the average change in income weighted by the marginal (or average) propensity to consume.

To estimate these APC and MPC figures, we used the Family Budget Survey ("Encuesta de Presupuestos Familiares") carried out by the National Statistical Agency to define bundles in the consumer price index. This survey contains information on income, consumption of different goods and assets, and demographic characteristics. It gives a good snapshot of households' consumption and income patterns at a given time. The drawback of the survey is that it is carried out every five years, so it is impossible to conduct a time-varying analysis. With this survey, the APC is estimated using the average ratio of consumption to income. The MPC is identified using pseudo panels looking at the change in consumption after increases in income between the surveys in 2017, 2012 and 2007 for groups of workers who share the same characteristics and are from the same quintile.

Figure 3.C shows our estimated values for the APC and MPC. The APC is high in our sample, with values close to 1 from quintile 1 to quintile 3, while it is down to 0.6 for the fifth quintile. On the other hand, a more suitable estimate is the MPC, which we find is close to 0.3 on average. The MPC is high in the bottom quintile (0.5). It is somewhat lower in quintiles 2 to 4 (0.3) and, as expected, the lowest in quintile 5 (0.2). Naturally, we find a decreasing pattern of MPCs along the income distribution, which is a fact that is present in many studies in other economies (see Japelli and Pistaferri (2020)).

Finally, the box takes a stance on the expected increase in consumption due to the high support provided to households, with an estimated 2–4% of GDP of consumption in excess during 2020–21 due to household assistance. Notice that these estimates were given in late 2020, when we had significant uncertainty and did not have clarity on the policies that would be implemented next. The effects of these policies on inflation at that point were not analyzed. After this time (by 2021), several additional household assistance measures (that doubled the size and were untargeted with respect to previous policies) were taken. Afterwards, these policies most likely generated a significant rise in inflation. We will refer to this in the next section when we introduce models with heterogeneity to analyse this question and complement this with the measures taken in 2021.

3.2.2 Labour market heterogeneity and the recovery of employment

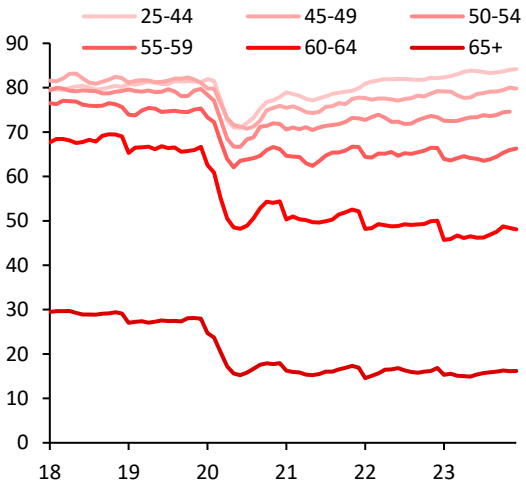
A second box we want to highlight was published recently in the *Monetary Policy Report* of March 2024 (Bauducco et al (2024)). We were very concerned about the slow recovery of employment after Covid-19, and one way to analyse this is by studying whether there were significant compositional effects on employment recovery. This box was about the labour market participation of older people. The question was why labour market participation did not recover in Chile as it did in comparable countries after Covid-19.

This box shows that the labour market participation of seniors (55 years or older) did not recover after Covid-19 and this mainly explains the slow recovery of labour market participation in Chile. Using data from the Employment Survey of the National Statistical Office (INE), we decompose labour market participation by age. We carried out the analysis from 2018 to 2024, and the main result is presented in Figure 4. Naturally, we find that labour market participation falls with age. Today, people aged 25–44 have the most significant participation rate of about 84%, while labour market participation of people aged 60–64 is about 48%.

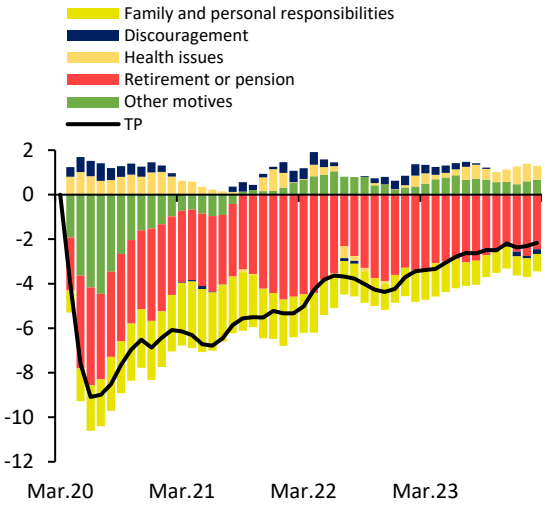
The most striking result of Figure 4.A is not that, but rather the evolution of participation rates by age. While participation rates among people at prime age (25–55) recovered almost wholly , the rate for people aged 55+ remained persistently low after the pandemic. The participation rate of workers aged 55–59 dropped by 10 points and remained at those levels until early 2024. The participation rate for individuals aged 60–64 fell dramatically by about 20 points and remained at those levels thereafter.

Figure 4: Labour participation and recovery of employment

A. Labour force participation by age in 2020 (percent)



B. Change in participation rate of individuals aged 55+ due to inactivity (1) (2) (difference w.r.t. March 2020, percentage points)



Note: (1) Internally deseasonalized levels using X13-ARIMA-SEATS. (2) Since the participation rate is equal to 1-(inactivity/working-age population), the participation rate can be decomposed into the different motives for inactivity. Source: own calculations based on data from the National Employment Survey (ENE) and Chile's Internal Revenue Service (SII). Source: Bauducco et al (2024).

All these results suggest that there was a structural change in labour markets around – or shortly after – Covid-19. To explore this, we analysed the reason why people aged 55+ remained inactive, as shown in Figure 4.B. This shows that the main reason people stayed out of the labour market was due to retirement.

This box suggests that to understand the dynamics and state of the labour market it is crucial to analyse the composition of the labour force and the reason why workers transition between different states. In this case, the age composition proved to be important in explaining the persistent decline in aggregate labour market participation rates, with a major reason being retirement, which implies this situation will be much longer-lasting than expected.

3.2.3 Consumption by quintile and class of goods

In the June 2023 *Monetary Policy Report*, we included a box in which we studied the heterogeneity in household consumption (García et al (2023b)). At that time, there was a concern about how aggregate demand was going to recover. As previous analysis shows, an important feature of the Covid-19 period and the aid provided was that they were highly heterogeneous, so in June 2023, with the economy converging to more normal levels in terms of the output gap and consumption, it was important to study this question.

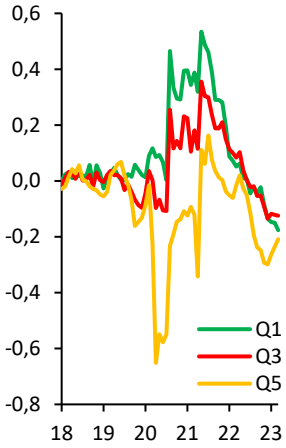
The box analyses two dimensions of consumption: the income quintile of consumers and the class of goods. We used data from credit and debit card transactions and split them into quintiles and between goods and services. First, we show that the evolution of quintile consumption is highly heterogeneous. The evolution of the first and fifth quintiles went in opposite directions during 2020: the first quintile showed a significant increase, while the fifth quintile had a significant decrease. We posit that this is due to the heterogeneous MPCs of different households in combination with the type of goods the different households consume.

A recent working paper (García et al (2023a)) highlights that consumption bundles are heterogeneous and depend on income level. We show that consumption shares in services are increasing with income while food is decreasing, and they also fluctuate with income accordingly. This fact, in principle, explains why the consumption of the fifth quintile households fell by so much: we did not allow them to go to their favourite restaurants! Because of that, they cut consumption substantially. The case of the bottom quintiles is different; they received significant amounts of help that they spent on durables and food, which explains the relatively lower fall in goods we show.

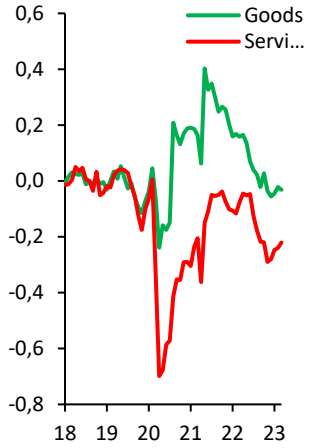
This analysis helps us understand the impact of macro fluctuations on different types of households, allowing us to calibrate our macroeconomic policies more precisely.

Figure 5: Evolution of private consumption

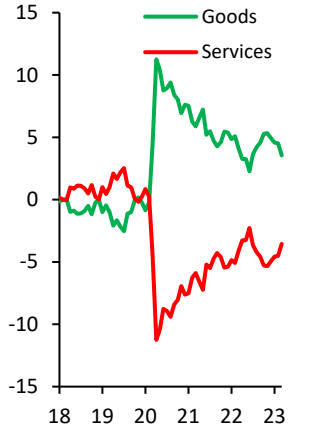
A. By quintile (log deviation with respect to growth)



B. By sectors (lof deviation with respect to growth)



C. Changes in shares in consumer basket (percentage points)



Note: Panels (a) and (b) show the evolution of the (log)level of the respective consumption discounted from the average growth between 2015 and September 2019. Quintile decomposition considers only face-to-face purchases. Panel (c) shows change in share in the consumer basket of the goods and services sectors, in percentage points. Source: García et al (2023b).

3.3 Modelling

Next, we will briefly refer to the models we are starting to use at the central bank that take into consideration household heterogeneity and the heterogeneous responses of income and consumption to different shocks. We start with a brief description of the HANK models we are developing and then describe the heterogeneity we include in the large-scale DSGE model we use and how we augment it to account for the main features HANK models have.

3.3.1 HANK models for Chile

Emerging economies have high inequality; their business cycles are significantly volatile. Because of that, their households are subject to significant income risk (through both real wage fluctuations and unemployment) and have low access to financial markets. An important question to answer when planning policy measures is that of the share of constrained households. To be able to analyse the channel through which monetary and fiscal policy operates, it is essential to get the shares of "Hand-to-Mouth" people correct.

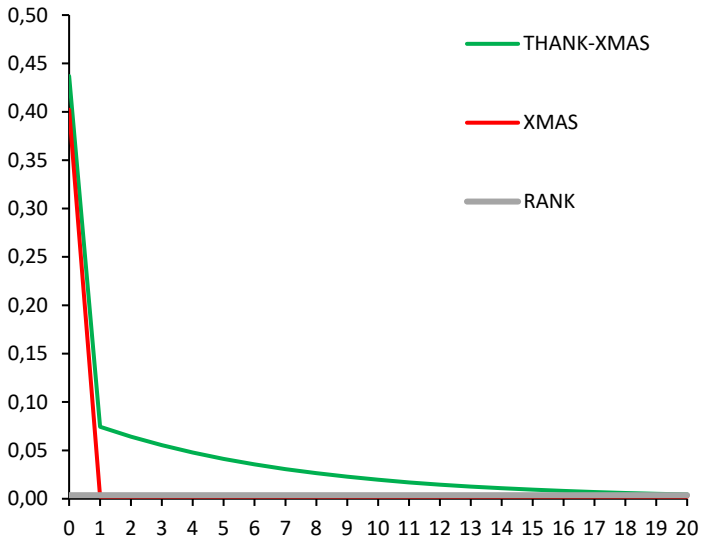
To do so, García et al (2024) use the Encuesta Financiera de Hogares (the Chilean version of the Survey of Consumer Finances) to measure the share of households constrained in Chile – named as "Hand-to-Mouth" households (HtM). The authors identify rich HtM households as those who own illiquid assets but close to zero liquid assets (think about house owners with low income and credit card debt) and poor HtM households as those with no liquid or illiquid assets (following Kaplan et al (2014)). They found that the percentage of HtM is stable at around 39–44%, whereas the poor and rich HtM are distributed around 10% and 32%.

With these statistics, we could calibrate comparable models to study the differences produced in their transmission channels for monetary and fiscal policies. The authors built three HANK models. The first, considered the simplest, was a one-asset and sticky wages model (SW-OA from here on). The second model changed the sticky wages friction and added a simple search and matching mechanism (SAM-OA). Finally, we went back to the sticky wages simplification and added a second and illiquid asset (SW-TA).

The work proposes a transmission of a three-way channel decomposition. There is a direct effect, given by the partial equilibrium effect, through which the shock impacts consumption directly. The second component, named the average channel, corresponds to the average response of consumption to movements of the endogenous variables, representing the average general equilibrium component. Lastly, there is the cross-sectional channel, which involves all the evolution due to distributional/heterogeneous effects of the shock. The main findings can be summarised as follows: In SAM-OA, the transmission operates through average and direct effects, while in SW-OA, it is through cross-sectional effects. Assets also matter; the transmission in the SW-TA model has more substantial direct and average effects than SW-OA.

These models are useful because they give a more realistic response of consumption to fiscal transfers and rises in income. All models generate what Auclert et al (2024) call intertemporal MPC (iMPC), which corresponds to the intertemporal response of consumption to a one-time income shock. Auclert et al (2024) show that in HANK models, the iMPCs are persistent, and more persistent than in two-agent models (as in Galí et al (2007)), showing that this is a better match for the empirical findings in Fagereng et al (2021), who estimate the intertemporal response of consumption to winning the lottery in Norway. As Figure 6 shows, all models have iMPCs: the representative agent model (RANK) has a very low iMPC equal to the interest rate; the TANK model has a high MPC over the period of the shock and then goes on to be close to the interest rate; and the only model that gives a persistent response of consumption is HANK. In the next section we describe how we generate this in the large-scale model of the CBC.

Figure 6: iMPCs under different model's assumptions (by quarters)



Source: García et al (2024).

In Garcia et al (2024), staff members published a study that followed the previous analysis. In this paper, they study the role of progressivity in shaping macroeconomic responses. The analysis had two parts. First, they studied the response of consumption to different types of policies classified as progressive and non-progressive. This distinction was crucial during Covid-19, since the most significant measures differed in that dimension. While fiscal transfers were highly targeted, pension fund withdrawals were mainly given to workers at the top of the income distribution, those who could save more before Covid-19. This paper follows up the analysis of these policies because by mid-2021, there was a third pension fund withdrawal, and fiscal transfers, starting in June 2021, were massive in amount and scope.

In this analysis, we show with micro data that consumption responses to progressive and non-progressive policies differ substantially. We found that municipalities that received more fiscal transfers consumed significantly more than municipalities with less help. We found that non-progressive transfers also positively affect consumption but are milder. This means that targeted transfers have stronger effects on consumption than non-targeted ones. In the paper, we also conduct a more quantitative assessment using a HANK model with labour market frictions. More targeted transfers can have a stronger effect on consumption, and not only is the iMPC the relevant channel, but the role of higher employment in boosting demand and better future perspectives. All these results also depend on policies: loose monetary policy is needed to complement the expansionary effects of transfers, and we need fiscal policy to be financed with debt. The last point is relevant because the Ricardian equivalence does not hold in these models. However, in the future these policies could become inflationary.

3.3.2 Augmented large-scale DSGE (XMAS)

The CBC has a large-scale New Keynesian model which we use as one of our forecasting tools. The model has a simple structure in terms of households, but it assumes there are two types of consumers in the spirit of the Gali et al (2007) and Bilbiie (2008) two-agent New Keynesian model (TANK). A fraction of households have perfect access to financial markets and behave like Ricardian households (R). Thus, they follow a Euler equation. The remainder fraction is out of the financial market and cannot borrow or save; we refer to these households as Non-Ricardian (NR).

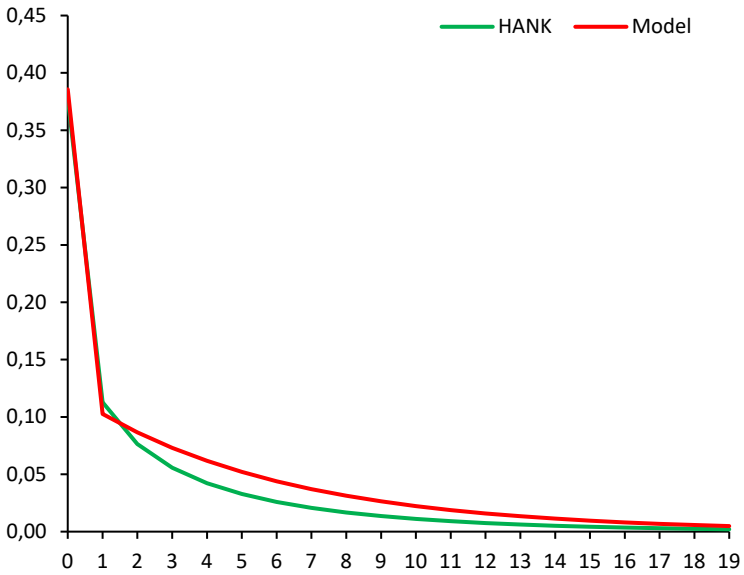
Thus, we assume heterogeneity in the model, with a fraction of “HtM” consumers. This generates a role of disposable income (from labour, fiscal transfers and others) in consumption fluctuations. XMAS delivers high MPCs out of contemporaneous income fluctuations and then allows us to estimate the effects of transfers to households and introduce these effects to the macroeconomic scenario.

Having a share of HtM consumers delivers a high MPC, which is close to the share of HtM. This number is 0.5 in the original XMAS model. However high the number, the assumption of having a two-agent model is somewhat restrictive since all the effects are contemporaneous in TANK, as we explained above.

To augment the XMAS model with a more realistic response of consumption to income shocks that persist over more periods, we follow Bilbiie et al (2024), who introduce a probability of transitioning between Ricardian and Non-Ricardian states. This element delivers a more persistent response of consumption to a one-time increase in income, with the effects more front-loaded than in TANK,

which is only present in the period of the income increase. In a forthcoming working paper, we include this assumption in XMAS and by adjusting the transition probabilities, we match the iMPCs we have for our HANK model (see Figure 7). We show that this assumption allows for the improvement of the model's forecasting ability, enhancing its performance in forecasting consumption, non-mining GDP and core inflation. This model also improves the understanding of fluctuations during Covid-19, giving more prominence to fiscal transfer shocks to explain consumption fluctuations during this period than a model without this feature.

Figure 7: iMPCs in adjusted XMAS and in HANK (by quarters)



4. Concluding remarks and policy implications

The rise of the inclusion of heterogeneity in macroeconomic analyses and models has been beneficial primarily in improving the understanding of monetary policy transmission mechanisms. The rich microdata available in the CBC has allowed us to analyse various heterogeneities of firms and households, which was considered in adjusting monetary policy response during the Covid-19 pandemic.

There are important considerations regarding the implications of models with heterogeneity for monetary policy. These models make the distributional effects of monetary policy explicit. As Violante (2022) argues, several channels of heterogeneity are important in analyzing the transmission of monetary policy, namely wealth levels, portfolio distribution, income, and income risk. Inflation also plays a key role in determining aggregate demand through real income, which, in these models, is a key driver of aggregates. Inflation has distributional effects through real wages if households at the bottom of the distribution rely on labor income more than households at the top, but also in their spending patterns. This generates a trade-off between employment and inflation stabilization at the household level that these models help to understand. Firm heterogeneity also

has implications for monetary policy transmission. Ottonello and Winberry (2020) show that firm investment responds to monetary policy depending on leverage and asset holdings. This note explored some of these facts for Chile, noting that the CBC takes these dimensions seriously.

These findings imply that heterogeneity may be an important dimension for the design of policies. For example, the trade-off between inflation and employment stabilization has more implications in models with heterogeneity than in models with a representative agent. When considering heterogeneity, authorities must take into account that inflation may affect different households differently (through heterogeneity in bundles and differential wage adjustment processes) along with unemployment having a different incidence on different groups of households. These facts may have significant aggregate effects due to MPCs which are most likely high for poor households. Thus, as Sargent (2024) mentions, the dichotomy between stabilization and redistribution disappears, possibly changing optimal monetary policy and the relationship between monetary policy and other policies.

Policy coordination becomes crucial in this environment, and with fiscal policy in particular. Violante (2022) points out that fiscal policy has some advantages in resolving unwanted distributional effects, since it has many instruments. However, making redistribution the exclusive responsibility of this policy can be limited, as it acts with a delay and depends largely on political negotiations. Even if the central bank has a unique mandate, as heterogeneity plays an important role in the economy, the monetary authority should monitor and understand distributional effects of shocks and the feedback with its policy decisions. Finally, central banks can also implement targeted policies in exceptional circumstances like the ones described in this note.

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