A Baseline HANK for Chile *

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Abstract

In this paper, we build–and calibrate– different Heterogeneous Agents New Keynesian models (HANK) for Chile. We show that in the data, there is substantial heterogeneity in assets holdings, income sources, levels, and cyclicality along the distribution of Chilean households. Considering those facts, we calibrate three models to study the transmission mechanisms of fiscal and monetary policy shocks through consumption. First, we compare labor market setups (search and matching and sticky wages frictions) and financial market setups (a model with liquid and illiquid assets and a model only with liquid assets). We show that with SAM, there are larger MPCs; hence, the direct effect of fiscal policies is more significant than in the sticky wages model. Also, we show that the monetary policy response in SAM is more persistent because unemployment (and hence labor income) is persistent. Second, we compare the asset structure of households. We find that the response to monetary policy shocks is more persistence due to a higher persistence of capital due to the cost of illiquidity. We conclude that including SAM and (or) two assets generates higher persistence on macroeconomic aggregates.

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[*] The opinions and mistakes are my exclusive responsibility and do not necessarily represent the opinion of the Central Bank of Chile or its board.

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1 Introduction

This paper presents a basic framework for Heterogeneous Agents New Keynesian (HANK) models to serve as the foundation for the development of the heterogeneous agents applied modeling agenda at the Central Bank of Chile (CBC). The objective of this agenda is for these models to serve as a complement to the analysis done with the CBC's existing suite of models (see Central Bank of Chile, 2020). In this paper, we formulate and calibrate different specifications of HANK models for the Chilean economy, analyzing the role of different model features on the transmission and propagation of shocks.

The goal of the paper, and one of the HANK literature's main contributions, is to provide a framework that can account for households' high average marginal propensity to consume (MPC), as found in empirical studies, while also delivering realistic dynamics for the response of aggregate consumption to income shocks. Compared to a standard Representative Agent New Keynesian (RANK) framework, a simple way to achieve higher average MPCs is to just assume that a portion of agents live hand-to-mouth with rule-of-thumb behaviors, in what are usually referred to as Two Agents New Keynesian (TANK) models[1]. However, as demonstrated by Auclert et al. (2018a), TANK models fail to generate the dynamic response of consumption to transfer shocks observed in the data, where households are shown to distribute their consumption smoothly over time. To replicate these observed dynamics, the authors propose a modeling framework that incorporates a continuum of agents that can smooth consumption but are subject to idiosyncratic shocks and Bewley (1986)-Huggett (1993)-Aiyagari (1994)-type borrowing constraints. According to their analysis, these features in HANK models allow them to better capture the observed consumption response to fiscal transfers and the general equilibrium effects of aggregate shocks. This happens as HANK models deliver significant changes to the transmission of shocks, as Auclert (2019) and Kaplan et al. (2018) emphasize. They show that monetary policy shocks' indirect, general equilibrium effects on consumption, negligible in RANK models and low in TANK models, become significant in HANK models. In HANK models, while a change in the interest rate still induces a direct response of consumption through intertemporal-substitution effects, there are also relevant general equilibrium channels, with households being highly responsive to factors beyond the interest rate, and where income risk and asset distribution play a significant role. In this class of models, the main driver behind the households' responses to shocks is their average MPC, which, in turn, is shaped by

[1] Classic examples of TANK models include Campbell and Mankiw (1989), Galí et al. (2007), or Bilbiie (2008), among others. Models calibrated for the Chilean economy include Medina and Soto (2016) and García et al. (2019)

income and assets distribution, as well as their idiosyncratic income risk. Specifically, greater income risk and lower asset holdings increase the likelihood of hitting the borrowing constraint, generating precautionary savings that alter the curvature of the consumption policy function and, consequently, the desired consumption change following an increase in assets. As we show in this paper, this channel is more pronounced in models that feature search and matching frictions and involuntary unemployment, as the probability of facing (possibly extended) unemployment spells increases the household's income risk, intensifying precautionary motives and increasing MPCs. Moreover, due to market incompleteness, heterogeneity in income risk across different types of income or across the income distribution are also relevant for the aggregate response to shocks. Accounting for this additional source of heterogeneity is important because of two empirical facts for which we show evidence in this paper. First, markups are countercyclical, making profits less procyclical than labor income. Second, labor income, in response to an adverse foreign financial shock responds differently across the income distribution, with labor income declining four times more strongly in the fisrt quintile of the income distribution than in the fifth quintile.[2].

In this paper, we show three variations of HANK models that we use to study the responses to monetary and fiscal shocks of different kinds (we consider *progressive* and *non-progressive* transfers). First, we build a sticky wages one-asset (SW-OA) HANK model based on the HANK-illiquid setup by Auclert et al. (2018a), where households can hold both liquid and illiquid assets, but can only adjust the holdings and receive income from the former. Next, we show a version that incorporates search and matching frictions to the one-asset model (SAM-OA), and then present a sticky wages two-asset (SW-TA) version where we extend the SW-OA setup by allowing households to (costly) adjust their holdings of illiquid assets. To evaluate the different specifications, we compare their overall response to shocks and their transmission mechanisms. To achieve this, we analyze each model's responses to shocks following Patterson (2023)'s decomposition, which extends the methodology of Kaplan et al. (2018) and Auclert (2019).

We use decompositions of consumption to explain our results. We follow Kaplan et al. (2018) and Patterson (2023) and propose decompositions of the consumption responses to shocks. We split the responses into direct and indirect effects of policies, where those related to the impact of the policy itself are the direct effect; also, we split the responses into average and cross-sectional effects. The average effect is the effect that shocks would have if all consumers had the same MPCs and income responses, and the cross-sectional is the effect that would arise from a relationship between

[2]See Aldunate et al. (2023)

MPCs and the responses of income. Hence, in this work, we are more interested in the transmission mechanisms of policies (which operate through direct-indirect and average-cross-sectional effects) than the total response to shocks.

We show that labor markets and financial structures matter to transmit aggregate shocks in HANK models. First, we highlight that in the comparison between SAM-OA and SW-OA, the transmission of fiscal policy changes substantially. In particular, we show that the SAM-OA operates mainly through average effects (those unrelated to distributional effects of shocks), meaning that the SAM-OA generates less distributional effects than the SW-OA model. However, we show that due to higher MPCs, the SAM-OA model has higher direct effects from fiscal transfers. Regarding monetary policy, we show that the responses to monetary policy shocks in both models are similar on impact. However, the consumption response in SAM-OA is more persistent due to the response of unemployment (which operates through cross-sectional effects). Finally, we compare out SW-OA model with the SW-TA model to analyze the effects of monetary policy shocks.

The main contribution of this paper is the more in depth analysis of the transmission mechanisms in HANK. We first highlight that different assumptions in the labor markets structure matter for the transmission of the different shocks. In particular, we show that in the model with SAM frictions, unemployment plays an important role. SAM generates more precautionary motives in households, which rises the MPCs with respect to a model without these frictions, making the direct response of consumption to fiscal transfer stronger than in the alternative model. Therefore, the labor markets' setup matters.

Second, we study the role of financial markets in the transmission of shocks, showing that for our calibration, the transmission mechanism of monetary policy is not very different in a two-asset than in the one-asset fully illiquid model. However, the effect of monetary policy shocks are more persistent because the capital stock is more persistent due to the illiquidity cost.

The remainder of the paper is as follows. In section 2 we describe how we analyze the responses of consumption to different shocks, by presenting the consumption decompositions we will use throughout the paper. Section 3 shows empirical facts about heterogeneity that matter in HANK models, and relate them to the components of the consumption decomposition. Section 4 describes the models. In section 5 we compare the results of the SAM-OA and SW-OA. In section 6 we compare the results of the SW-OA with the SW-TA. Finally, we conclude in section 7 .

2 Sources of Consumption Fluctuations

Based on Patterson (2023) and Kaplan et al. (2018), below we compare the different model assumptions using decompositions of consumption. As Kaplan et al. (2018) show, the transmission mechanism of monetary policy (and hence, of different shocks) changes when we have high MPCs. They show that for monetary policy shocks indirect effects dominate in the total effect of raising the interest rate. This is, monetary policy transmit to consumption mainly through variables other than the interest rate itself, namely labor income, fiscal policy and others. This gives rise to a simple decomposition of the effects of shocks, between *direct* and *indirect* effects. On the other hand, Patterson (2023) shows that in models with inequality, the cross-sectional relationship between MPCs and income fluctuations may be a source of business cycles amplification. This analysis is based on the fact that households' income fluctuations may be different between types of households, and if there is a cross-sectional relationship between MPCs and income fluctuations, there might be amplification of shocks. Hence, we must consider *average* and *cross-sectional* effects of shocks (this as shown in Section 3.4. Following those ideas, we propose that those decomposition schemes are useful for analyzing the effects of different assumptions on consumption.

In models with inequality, we must track the responses of heterogeneous households to the different variables. With i denoting an individual, aggregate consumption can be written as $C_t(\boldsymbol{S}) = \int c_t(i;\boldsymbol{S})di$, with $\boldsymbol{S}$ the path (from 0 to T) of a vector of aggregate variables entering individual consumption directly, like interest rates, wages and others. We decompose consumption fluctuations $dC_t(\boldsymbol{S})$ as the total differential of consumption. In a one-asset economy (with $\boldsymbol{S}_t = \{r_t, \chi_t\}$) the differential is given by the derivatives of consumption with respect to r_t and income of other sources χ_t. Denote the former derivative with $\mathcal{Q}_{t,k}(i) = \frac{\partial c_t(i;\boldsymbol{S})}{\partial r_k}$ and the latter with $\mathcal{M}_{t,k}(i) = \frac{\partial c_t(i;\boldsymbol{S})}{\partial \chi_k}$. These are the responses of consumption in period t to an increase of r and y in period k, respectively. Therefore, the vectors $\mathcal{Q}_t(i)$ and $\mathcal{M}_t(i)$ summarize the general equilibrium responses of consumption in t to increases in every period k with $k = [0, ..., T)$. The vector $\mathcal{M}_t(i)$ are the intertemporal MPCs of household i, as explained by Auclert et al. (2018b) and $\mathcal{Q}_t(i)$ are the responses of consumption to interest rate innnovations. Therefore, we can write consumption changes as

$$dC_t = \int \mathcal{Q}_t(i)drdi + \int \mathcal{M}_t(i)d\chi(i)di,$$

which can be rewritten as

$$dC_t = \underbrace{\overline{\mathcal{Q}}_t dr}_{\text{Real Rate}} + \underbrace{\overline{\mathcal{M}}_t d\overline{\chi}}_{\text{Average Effect}} + \underbrace{COV_i(\mathcal{M}_t(i), d\chi(i))}_{\text{Cross-Sectional Effect}}. \tag{1}$$

Equation (1) decomposes consumption fluctuations in three components: the direct effect of *Real Rate* fluctuations (just average effects because r_t is the same for everyone), the *Average Effect* and the *Distributional Effect*. The first component represents the total response of consumption in t to a path in the real interest rate changes dr; the second component is the average responses of consumption to fluctuations in endogenous variables or policies that represent income of households; and the third is the response of consumption to cross-sectional fluctuations in income, representing the relationship between differential responses in income and the MPCs of consumers. This is, given the same average MPCs and a given path in $\overline{\chi}_t$, there are effects from how fluctuations in income distribute among households. We will use these kinds of decompositions in the model to study the effect of different assumptions on consumption fluctuations and we will relate different stylized facts to the concepts in Decomposition 1 in the next section.

Useful Further Consumption Decompositions. The previous decomposition can be made further depending on the model and the variables to analyze. Two useful decompositions appear when we analyze the effects of fiscal transfers and in models with more than one asset. In the case of a fiscal transfer, we can decompose consumption further by separating "direct" effects and "indirect" effects (as in Kaplan et al. (2018) or Auclert (2019)), to understand why the covariance fluctuates, if it is more from direct effects or from general equilibrium effects. This decomposition reads

$$dC_t = \overline{\mathcal{Q}}_t dr + \underbrace{\overline{M}_t d\overline{T} + COV_i(M_t(i), dT(i))}_{\text{Direct}} + \underbrace{\overline{M}_t d\overline{y} + COV_i(M_t(i), dy(i))}_{\text{Indirect}}, \tag{2}$$

whereas the decomposition with two assets is given by

$$dC_t = \overline{\mathcal{Q}}_t dr^b + \overline{\mathcal{G}}_t dr^a + \underbrace{\overline{M}_t d\overline{T} + COV_i(M_t(i), dT(i))}_{\text{Direct}} + \underbrace{\overline{M}_t d\overline{y} + COV_i(M_t(i), dy(i))}_{\text{Indirect}}. \tag{3}$$

3 Facts on Household Heterogeneity in Chile

In this section, we show empirical facts on household heterogeneity in Chile and discuss how all of these facts affect consumption dynamics in the spirit of decompositions like the one shown in

Equation 2. We discuss assets' holdings heterogeneity, the distribution of liquid and illiquid assets, and the corresponding shares of hand-to-mouth. Then we discuss labor income inequality and labor income risk in Chile taking advantage of administrative microdata for Chile at a quarterly frequency, and we finish with the distribution of equity and the cyclicality of markups (which is a key implication of New Keynesian models).

3.1 Assets' Holdings Heterogeneity

We follow Kaplan et al. (2018) to develop our aggregated two-asset (liquid-illiquid) structure. For this purpose, we use financial statements of the banking system, Financial Intermediaries, and Non-Banking companies' financial statements, all available on the Comisión de Mercados Financieros (CMF) website. In addition, we use data from December 2017 to match the information with the data used to calculate the shares of Hand-to-Mouth, which we obtain from household surveys, as describe below.

Appendix A contains a desegregated information of the aggregates. We define Revolving consumer debt as the Banking Credit Card Debt and the Banking Consumption Credits. The deposits correspond to what the banking system declared to have in their respective financial statements. Fixed Income include the Bond Holding and the amount of the Saving Accounts. Finally, equity is define as the shares and Mutual Funds Holding. Regarding the illiquid Assets we consider the Real Estate net of the present value debt and the motorized vehicles net of their respective debt.

Liquid		Illiquid		Total
	CMF		CMF+CB	
Revolving consumer debt	-0.12	Net housing	1.93	
Deposits	0.05	Net durables	0.13	
Fixed income	0.12			
Equity	0.12			
Total	0.17		2.06	2.23

Table 1: Values are expressed as a fraction of 2017 GDP.

Revolving debt corresponds to bank credit cards, lines of credit, bank or financial consumer loans, credit cards from non-banking institutions, consumer loans in commercial houses (cash advances), credits in savings banks compensation, cooperatives or other similar, educational loans, and other non-mortgage debts. Deposits are the total amount households keep in their checking or sight accounts. Fixed income is the total amount households have invested in different instruments such as time deposits, bonds, savings accounts, and insurance with savings. Equity is the sum of investments in shares, investments in mutual funds, participation in companies or investment funds, and investments in other equity instruments (options, futures, swaps, among others).

There are only two illiquid assets, net housing, defined as the value that households assign to their primary home or other real estate they own, discounting the present value of the mortgage loan debt. And net durables, which corresponds to the value of automotive assets such as cars or trucks, motorcycles, vans or utility vehicles, and other motorized vehicles (boats, planes, helicopters, etc.), as well as other assets such as agricultural or industrial machinery, animals, works of art, etc. discounted from the debt in auto loans.

Table 1 summarizes this as a fraction of the 2017 annual GDP. The total quantity of net liquid assets amounts to $7.57 billions (4 percent of annual GDP). The total amount of net illiquid assets amounts to $140 billions (0.78 times annual GDP).

3.2 Share of hand-to-mouth

According to Kaplan and Violante (2014) (see also Kaplan et al. (2014)), hand-to-mouth households are the ones that hold little or no liquid wealth relative to their income, whether in cash or in checking or savings accounts. Following their methodology, we estimate the share of hand-to-mouth households using data from the EFH of 2017. We restricted our sample to households in which the head is between 22 and 79 years, where income is positive, and drop households if all their income originates from self-employment. From an initial sample size of 4,549, we keep 2,777 households for our estimations, which represent approximately 45% of Chilean households.

We define income as household labor income, income from pensions, income from subsidies, and other sources of income except the income imputed to the main dwelling. Liquid assets are equity, fixed income, checking, and saving accounts. Liquid debt is the sum of bank credit card debt, lines of credit debt, bank consumer loans, educational loans, and other non-mortgage debt. The measure of liquid wealth is liquid assets minus liquid debt. Net illiquid wealth includes the value of housing, residential and nonresidential real estate net of mortgages and home equity loans, voluntary and mandatory pension savings, and automotive assets net of debt.

A household is hand-to-mouth if its liquid wealth holdings is equal to or less than five percent of their quarterly income. The difference between rich and poor hand-to-mouth is that the former owns more than zero illiquid wealth. Table 2 shows the results and Figure 1 the distribution of liquid and illiquid wealth.[3]

	Data
Frac. with b ≈ 0 and a = 0	0.08
Frac. with b ≈ 0 and a > 0	0.31

TABLE 2: Share of Hand to Mouth Households (Relative to the Total Population).

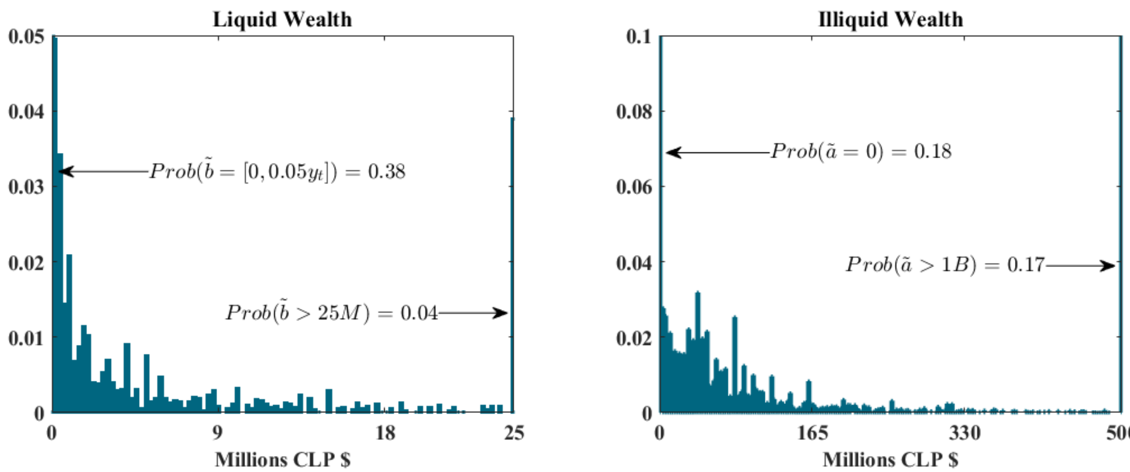

FIGURE 1: Distributions of Liquid and Illiquid Wealth

3.3 Labor Income Inequality and Risk

Labor income is a key ingredient of HANK models because it corresponds to most of low earners' income on the one hand and on the other because labor income risk plays a role in determining consumption. Most studies for the U.S. use Guvenen et al. (2019) estimates of income inequality and risk, which are available at a yearly frequency. However, in Chile, we have access to the population of monthly labor income of formal workers. This allows us to study the labor income distribution at a quarterly frequency, as we will calibrate the model below.

The database we use, which is called *Administradora de Fondos de Cesantía (AFC)*, covers all workers with an employment contract since October 2002. Each month we observe the income received by the worker, and hence, also his employment status. To focus on workers with a reasonably strong labor market and following Aldunate et al. (2023), we restrict our sample to males of age between 25 and 55, who are employed for at least seven months in the sample, and who earn at

[3] In Appendix B we discuss more extensively more definitions of the Hand-to-Mouth state considering different criteria. In general, our share of Hand-to-Mouth is consistent with the values found for other measures like the access to checking account of credit cards. We also find that the banking and non-banking rotative credit limits are low. We think these shares of HtM are an upper bound of the financial access. More analysis of these definitions and their implications are left for further research.

least more than half the minimum wage. For each worker included, we define the primary job as their highest-paying job each month. After these cleaning procedures, our sample contains about 358 million observations (about 44% of the initial database). Focusing on this subset of workers implies that we cover about 83% of the population with this database since the informality rates for males 25-55 year old is 17% (according to Gasparini and Tornarolli (2009)). Finally, we deflate income with headline CPI to obtain real measures.

As Guvenen et al. (2019), we distinguish between earnings growth over short and long horizons to account for the fact that workers receive short- and long-run shocks to their earnings. For this, we examine log income growth over one, four, and twenty quarters. Then we calculate the different moments for the quarterly income distribution, using a sample between 2003 and 2021 and a sub-sample between 2014 and 2019 (before the pandemics). Table 3 shows the moments of log earnings and one, four, and twenty-quarters growth. In Chile there is a high degree of labor income inequality, the variance of log earnings quarterly is about the one we observe in the U.S. with yearly data. The variance of income growth is large in comparison with what we observe for the U.S. amounting at a quarterly frequency to what the U.S. has at a yearly frequency (see Table 13 in the Appendix). In Chile, the third moment is close to zero on average, with the value being more negative in the 2014-2019 period. This is, it is equally likely to receive positive and negative shocks. However, we these values we observe on average because the skewness is highly procyclical. (see García et al. (2023))

Moments	Full sample	2014-2019
Var: log earns	0.70	0.72
Var: 1-qtr chg.	0.23	0.20
Var: 4-qtr chg.	0.33	0.30
Var: 20-qtr chg.	0.51	0.46
Skew: 1-qtr chg.	-0.02	-0.10
Skew: 4-qtr chg.	-0.01	-0.13
Skew: 20-qtr chg.	-0.02	-0.07
Kurt: 1-qtr chg.	9.91	11.18
Kurt: 4-qtr chg.	8.04	9.01
Kurt: 20-qtr chg.	5.55	6.21

TABLE 3: Empirical moments for earnings in Chile at quarterly frequency. Male workers.

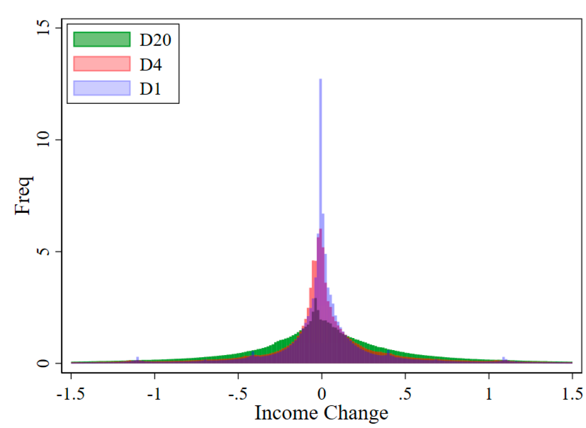

FIGURE 2: Distributions of Income Growth

The fourth moment is the one in the data for Chile departs the estimates from normality assumptions. As the table (and Figure 2) clearly show, labor income risk has a high kurtosis in Chile, similar to what the literature finds for the U.S. In Chile, we observe that the fourth moment is significantly larger than three (the value for a normal distribution). For the one-month change it is about ten, for four quarter change it is eight, and 5.5 for the 20 quarters change. These numbers imply that the probability of receiving a shock is lower than one, meaning that households do not necessarily receive shocks every quarter. This rules out a simple AR(1) as a model for income risk and we must follow a different approach to discretize and model the income risk process for Chile (as Kaplan et al. (2018)).

Finally, Table 13 in the Appendix compares the income risk moments between Chile and the U.S. at an annual frequency. In Chile, income inequality is 50% larger than in the U.S., measured as the variance of the log of earnings. Income volatility is higher as well as measured by the variance and the kurtosis of the changes of the log labor earnings. The variance of one and five-year growth in Chile are twice as large as the ones in the U.S., a similar phenomenon happens with the kurtosis which is larger for the U.S. than for Chile, meaning that the probability of receiving a shock in the U.S. is significantly lower than in Chile. These facts are consistent with previous evidence that the labor market in Chile is significantly more dynamic than in OECD countries (see Albagli et al. (2017)).

Income Risk in the Consumption Decomposition. Income risk appears in the decomposition we presented in equation 2 through the effects of income risk on the MPCs ($M_t(i)$) and the responses of consumption to the interest rate $\overline{\mathcal{Q}}_t$. A higher income risk generates more curvature in the consumption policy functions if there is a borrowing constraint. This means that higher labor income risk generates higher MPCs raising $\overline{M}_t$. Likewise, it will generate a higher dispersion on the MPCs, higher $VAR_i(M_t(i))$, which would also impact $COV_i(M_t(i), dy(i))$. Also, due to the larger $\overline{M}_t$, there would be a lower direct response to the interest rate $\overline{\mathcal{Q}}_t$

3.4 Heterogeneous Cyclicality of Labor Income

Another, and relevant, heterogeneity that we observe in Chile is that workers at the bottom quintiles see their labor fall by more than workers at the top of the distribution in response to recessionary shocks. Figure 3, borrowed from Aldunate et al. (2023) shows the response of labor income by quintile of the permanent income distribution of workers in response to a recessionary interest rate shock. They identify the shock as a shock to the Chilean interest rate due to an increase in the *Excess Bond Premium* (by Gilchrist and Zakrajšek (2012)). We show, in Figure 3 the responses by quintiles and the average response. In Chile, the response of labor income of the first permanent income quintile is 2.5 times larger than the response of the fifth quintile labor income in about the whole path of the response. This means that poorer workers (and with higher MPCs) suffer significantly the most in a recession.

Heterogeneous Cyclicality of Labor Income in the Consumption Decomposition. Different from income risk, these heterogeneous responses generate effects *given* a distribution of MPCs. This kind of heterogeneity will have an impact on the consumption decomposition through the term $COV_i(M_t(i), dy(i))$. This is, because of the pattern in the responses this covariance will be larger with respect to the case with homogeneous responses of labor income. This will generate an amplification of aggregate shocks.

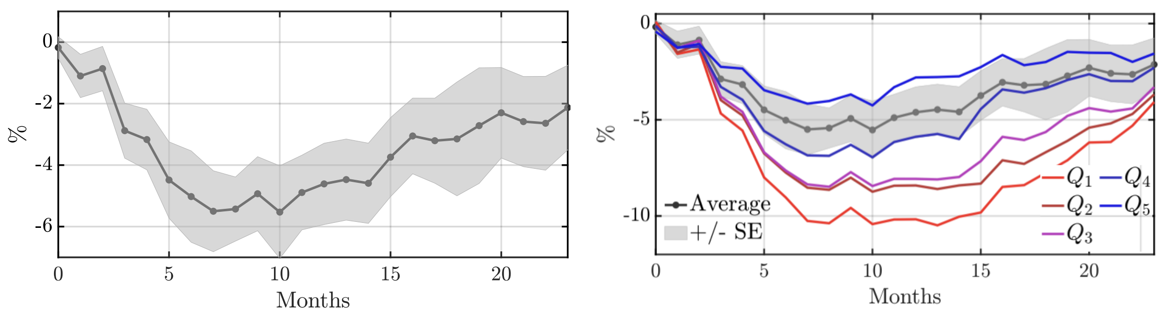

FIGURE 3: Responses of labor income in Chile to a credit spread shock along the permanent income distribution. Source: Aldunate et al. (2023)

3.5 Firms' Ownership and the Cyclicality of Markups

One of the main features of New Keynesian models is the cyclicality of markups. Due to price rigidities, the New Keynesian model predicts that markups are countercyclical if the main drivers of aggregate fluctuations are demand shocks. Bauducco et al. (2022) show that this is the case for Chile: markups are unconditionally countercyclical. This means that, at least theoretically, income from profits (dividends) are less cyclical than labor income. This fact implies that in models with inequality and market incompleteness, there is a distribution of income from firms' owners and workers, which (as Bilbiie (2008) and Debortoli and Galí (2017) show) may lead to amplification due to higher MPCs of workers.

In Chile, the ownership of firms is highly concentrated towards the top of the income distribution, meaning that markup countercyclicality not only reflects price rigidities but a redistribution of income between rich and poor households, or between low- and high-MPC individuals. According to the *Encuesta Financiera de Hogares* 88% of the equity is held by households in the ninth and tenth deciles as Figure 4 shows.

In the Consumption Decomposition. Due to the unequal holdings of equity, fluctuations in markups (which generates fluctuations both in labor income and firms' dividends (in the opposite directions).[4] This has an implication for the cross-section term in the decomposition, $COV_i(M_t(i), dy(i))$, because $dy(i)$ differs due to different sources of income of the different households. In particular, in this case, high-income households have a less cyclical $dy(i)$ due to countercyclical markups than low-income. That fact leads to a positive $COV_i(M_t(i), dy(i))$, and hence, amplification. This is the channel emphasized in Two-Agent New Keynesian models which is also present in HANK models.

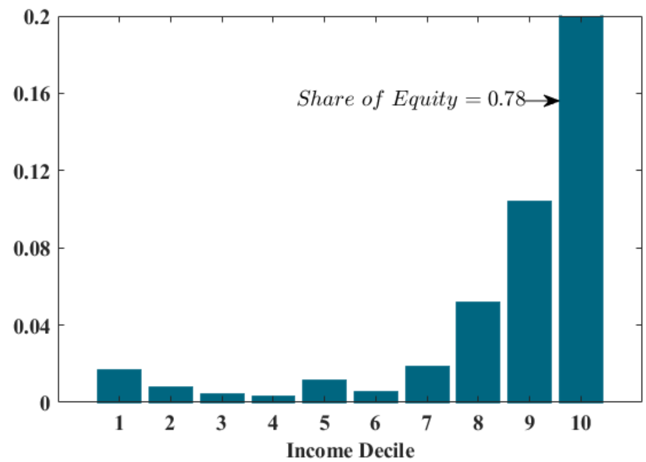

FIGURE 4: Equity holdings by decile of the income distribution as a share of total equity.

4 Models

To study to what extent heterogeneity impacts the aggregate response to shocks and the role of the empirical facts we presented above, we build a heterogeneous agent New Keynesian model calibrated for Chile. We follow closely the approach–and methods– presented by Auclert et al. (2021). We present three different versions of this model, depending on the labor market setup and the assets available to households. We study models with unemployment risk (as in Ravn and Sterk (2020)) with liquid and illiquid assets (as in Kaplan et al. (2018)) and with a fully illiquid asset with sticky wages (as in Auclert et al. (2018b)). We study the effects of fiscal and monetary policy and their transmission mechanisms. Motivated by recent events we study the effects of fiscal transfers (both

[4] The simple New Keynesian (Chapter 3 in Galí (2015)) shows that the labor income share goes down when markups go up while profits go up with markups.

progressive and non-progressive as in García et al. (2022)) and monetary policy shocks.

Since we use the methods developed by Auclert et al. (2021) to solve the model, that relies on economies with aggregate shocks but without uncertainty, we omit the expectation time-operator in the description of the model. In particular, the method applies a linearization of the sequence-space which relies on shocks that are unexpected but with a known future path.

4.1 Households

The economy is populated by a continuum of households of measure one. Households are heterogeneous in their assets, productivity, and employment state. Households receive utility from consumption and disutility from labor. They maximize the time-separable utility function $\mathbb{E}\left[\sum_{k=0}^{\infty}\beta^k u(c_{t+k}, h_{t+k})\right]$, where $u(c,h)$ is of the usual CRRA form $\frac{c^{1-1/\gamma}}{1-1/\gamma} - \psi\frac{h^{1+\varphi}}{1+\varphi}$. These households are subject to idiosyncratic productivity uncertainty. There are n_z possible idiosyncratic states where the probability of transitioning between states z and z' is given by $\Pi(z, z')$.

In the model with unemployment, agents have an additional source of uncertainty and, at each period of time, can be employed or unemployed. If employed, they supply an exogenous number of hours and earn $(1-\tau_t(z_t))w_t z_t h_t \mathcal{F}(z_t, Y_t)$, where w_t is the wage per efficient hour and $\tau_t(z_t)$ is a proportional income tax which can be type-dependent, and $\mathcal{F}(z_t, Y_t)$ an incidence function to account for the cross-sectional response of labor income we show in Section 3. If unemployed, they receive an unemployment benefit denoted by ω which is distributed in proportion to agents' productivity z_t. Following the Diamond-Mortesen-Pissarides framework, we denote the transition probabilities between unemployment and employment states by $s = [w, u]$. Hence, $\Pi(z, z', s, s')$ is the transition matrix considering both unemployment and income risk. Consequently, income becomes $y_t(z_t, s)$ with $y_t(z_t, .) = [(1-\tau_t(z_t))w_t z_t h_t \mathcal{F}(z_t, Y_t), z_t\omega]$.

Agents can trade in two assets, a liquid and an illiquid asset, which we denote by b and a respectively. These assets pay an interest rate r_t^b and r_t^a. Asset holdings are subject to a borrowing constraint. The value function of an agent in the state (z, b, a, s) at time t is, therefore[5]

$$V_t(z,b,a,s) = \max_{c,b,a}\ u(c) + \beta\sum_{z,s}\Pi(z,z',s,s')V_{t+1}(z',b',a',s'), \tag{4}$$

$$\text{s.t. } c + b' + a' = (1+r_t^a)a + (1+r_t^b)b + y(z,s) + d(z) + f_t(z) + \Phi_t(a', a), \tag{5}$$

$$b \geq 0 \text{ and } a \geq 0. \tag{6}$$

[5]In Appendix **??** we present the value functions and first-order conditions of this problem.

Households receive a fiscal transfer given by $f_t(z)$ and distributed firms' dividends $d_t(z)$.[6] These two quantities can also be distributed unevenly among the different households. Finally, the illiquid asset is subject to convex adjustment costs (as in Kaplan et al. (2018)), given by

$$\Phi_t(a', a) = \frac{\chi_1}{\chi_2} \left| \frac{a' - (1 + r_t^a)a}{(1 + r_t^a)a + \chi_0} \right|^{\chi_2} |(1 + r_t^a)a + \chi_0| \, . \tag{7}$$

Given optimal policies $c_t^\star(z, b, a, s)$, $a'^\star_t(z, b, a, s)$, $b'^\star_t(z, b, a, s)$, and denoting $\Psi(z, b, a, s) = Pr(z_t = z, b_{t-1} \in B, a_{t-1} \in A, s_t = s)$ the probability of that combination of states at the start of date t, the distribution Ψ_t has a law of motion

$$\Psi_{t+1}(z', b', a', s') = \sum_{z,s} \Psi_{t+1}(z', b'^{\star-1}, a'^{\star-1}, s')\Pi(z, z', s, s') \tag{8}$$

where $b'^{\star-1}$ is the inverse of the optimal policy b (and the same applies to $a'^{\star-1}$). For simplicity, we summarize in an index i, the combination of possible states, i.e. $i = (z, b, a, s)$. Therefore, in what follows, $\Psi(z, b, a, s) = \Psi(i)$, and the aggregate of a variable $x_t(i)$ is given by $\int x_t(i)\Psi(i)di = X_t$. However, we use the long notation when needed.

Nested Models. The model described above nests the three models we are going to use in the subsequent sections. First, we consider a model with a liquid and a fully illiquid asset without search and matching frictions. This means that $a' = a \ \forall \ t$, $\Pi(z, z', s, s')$ is reduced to $\Pi(z, z')$ and $y_t = (1 - \tau_t(z_t))w_t z_t h_t$. This model, on top of that, has wage rigidities in the definition of the labor market. We call this model *Sticky Wages One-Asset HANK* (SW-OA, henceforth). The second model is the one described above with a fully illiquid asset (with $a' = a \ \forall \ t$). We call this model *Search and Marching One-Asset HANK* (SAM-OA, henceforth). Finally, we consider a model with a partially illiquid asset and with sticky wages and name it *Sticky Wages Two Asset HANK* (SW-TA, henceforth). In the analysis of the models, we compare the effects of the labor market structure (SW-OA with SAM-OA) and the effects of the assets' structure (SW-OA with SW-TA). In the next subsections, we describe all the elements that are common to all of these models, clarifying the ones that are specific to one of these models.

[6] To set this function we follow a linear rule in z, following Kaplan et al. (2018).

4.2 Government

The government, in our setting, allocates its spending between government consumption G_t, fiscal transfers to households $f_t(z)$, and unemployment benefits. Transfers are heterogeneous across households and can be progressive $f_t'(z) < 0)$, $f_t'(z) > 0$, or flat $f_t'(z) = 0$. The way transfers are distributed across households satisfies $\int f_t(z)\Psi(i)di = T_t$, where T_t denotes the aggregate amount of transfers. The government finances its spending by issuing real-denominated debt B_t^g and by levying taxes on labor income, τ_t. Government debt is held by households in their liquid account and pays the return r_t^b. Transfers are lump-sum in the sense that households take these as given and do not enter the first-order conditions. However, they affect optimal decisions due to market incompleteness.

The government's budget constraint is then given by

$$B_{t+1}^g = T_t + G_t - \tau_t w_t N_t + (1 + r_t) B_t^g.$$

The evolution of the fiscal balance depends on a smoothing parameter ρ_x, which determines to what extent additional spending is financed with debt according to:

$$dB_t^g = \rho_x (dB_{t-1}^g + dX_t) \tag{9}$$

where X_t can be T_t or G_t, where the steady-state level of debt is determined in the market for bonds where households participate with their savings. The fiscal balance rule in equation 9 captures the fact that governments do not necessarily raise taxes to finance additional spending, as they can also issue more debt. Naturally, the government financing strategy is key for characterizing consumption dynamics as the Ricardian equivalence does not hold in these models.

4.3 Firms

There is a continuum of identical firms (indexed by $j \in [0, 1]$) which produce differentiated goods using capital and labor. They rent capital and hire labor, combining them with a Cobb-Douglas function $y_{jt} = Z_t k_{jt-1}^{\alpha} n_{jt}^{1-\alpha}$, with Z_t an aggregate productivity level. Although identical, these intermediate firms are in monopolistic competition and set prices taking into account the demand for their variety. Varieties are aggregated with a Dixit-Stiglitz aggregator with a price elasticity equal to $\frac{\mu_p}{\mu_p - 1}$, with μ_p the steady state markup charged by these firms. Price setting is subject to quadratic

Rotemberg adjustment costs, with the cost given by $\frac{\mu_p}{\mu_p-1}\frac{1}{2\kappa_p}\left[\log(1+\pi_{jt})\right]^2 y_{jt}$. Intermediate firms solve:

$$J_t(p_{jt-1}) = \max_{y_{jt},p_{jt},k_{jt},n_{jt}} \left\{ \frac{p_{jt}}{p_t} y_{jt} - h_t n_{jt} - r_t^k k_{jt-1} - \frac{\mu_p}{\mu_p - 1}\frac{1}{2\kappa_p}\left[\log(1+\pi_{jt})\right]^2 y_{jt} + \frac{J(p_{jt})}{1+r_{t+1}^a} \right\}$$

$$\begin{aligned}
&\text{s.t.}\\
&y_{jt} = Z_t k_{jt-1}^{\alpha} n_{jt}^{1-\alpha},\\
&y_{jt} = \left(\frac{p_{jt}}{p_t}\right)^{-\frac{\mu_p}{\mu_p-1}} Y_t.
\end{aligned}$$

The first-order conditions, after symmetry, read

$$\begin{aligned}
\log(1+\pi_t) &= \kappa_p\left(mc_t - \frac{1}{\mu_t}\right) + \frac{1}{1+r_{t+1}^a}\frac{Y_{t+1}}{Y_t}\log(1+\pi_{t+1})\\
h_t &= (1-\alpha)mc_t\frac{Y_t}{N_t}\\
r_t^k &= \alpha\, mc_t\frac{Y_t}{K_{t-1}}
\end{aligned}$$

where mc_t is the marginal cost. The aggregate amount of profits generated each period by intermediate firms is given by

$$D_t = (1-mc_t)\,Y_t - \frac{\theta}{2}\pi_t^2 Y_t.$$

4.4 Mutual Fund

Illiquid assets are equity claims on an investment fund. Thus, the fund's value equals the household's aggregate stock of illiquid assets $\mathcal{A}_t$. The investment fund owns the economy's capital stock K_t and shares in the intermediate producers X_t. The fund makes the economy's investment decision subject to an adjustment cost $\Gamma_t(K_{t+1}, K_t)$. The shares X_t represent a claim on a fraction ω of the entire future stream of monopoly profits net of price adjustment costs, Π_t. Let q_t^x denote the share price. The remaining fraction $1-\omega$ of profits flows directly into households' liquid assets account. The fund solves the problem:

$$A_0 := \sum_{s=0}^{\infty} \left(\frac{1}{1+r_s^a}\right) \left[r_t^k K_t - I_t - \Gamma(K_{s+1}, K_s) + \omega \Pi_s X_s - q_s^x((1+r_s^a)X_{s+1} - X_s)\right] \tag{10}$$

$$s.t. \tag{11}$$

$$K_{s+1} = (1-\delta)K_s + I_s \tag{12}$$

The first-order conditions with respect to capital, investment, and stocks are:

$$\begin{aligned}
(1+r_{t+1}^a)q_t^k &= r_t^k - \left[\frac{K_{t+1}}{K_t} - (1-\delta) + \frac{1}{\delta\epsilon_I}\left(\frac{K_{t+1}-K_t}{K_t}\right)^2\right] + \frac{K_{t+1}}{K_t}q_{t+1}^k \\
q_t^k &= 1 + \frac{1}{2\delta\epsilon_I}\left(\frac{K_{t+1}-K_t}{K_t}\right) \\
q_t^x &= \frac{(1-\omega)\Pi_{t+1} + q_{t+1}^x}{1+r_{t+1}^a}
\end{aligned}$$

In the absence of aggregate uncertainty, the returns from the mutual fund, capital, and equity must all be equal. This implies the following arbitrage conditions:

$$(1+r_{t+1}^a) = \frac{r_t^k - \left[\frac{K_{t+1}}{K_t} - (1-\delta) + \frac{1}{\delta\epsilon_I}\left(\frac{K_{t+1}-K_t}{K_t}\right)^2\right] + \frac{K_{t+1}}{K_t}q_{t+1}^k}{q_t^k} = \frac{(1-\omega)\Pi_{t+1} + q_{t+1}^x}{q_t^x}$$

As in Kaplan et al. (2018), we assume there is a share of profits owned by the fund, $(1-\omega)$, while the remainder is distributed directly to households with a distribution rule we discuss in the calibration.[7]

4.5 Labor Markets

To achieve realistic fluctuations in wages and wage inflation, different labor market setups are considered depending on the model. In all models, labor markets are subject to frictions. In the model without search frictions, wages are assumed to be subject to adjustment costs. However, in the SAM-HANK model, a full Diamond-Mortensen-Pissarides setup is assumed. These settings will be further described in what follows.

Sticky Wages. We assume households cannot decide their labor supply directly. Instead, there is a union that supplies aggregate labor. In each household i there is a continuum of tasks denoted by $g \in (0,1)$. A task-specific union decides nominal wages W_t^g for an amount of hours N_t^g. In this

[7] Kaplan et al. (2018) set $(1-\omega) = \alpha$ to isolate equity from fluctuations in countercyclical markups.

setting, unions have market power as workers' tasks are in monopolistic competition. The union aggregates individual labor such that $N_t^g = \int n_t^g(i)di$. Then, we assume there is a Dixit-Stiglitz aggregator that determines aggregate labor, given by:

$$N_t = \left(\int_0^1 (n_t^g)^{\frac{\varepsilon_w - 1}{\varepsilon_w}} \, dg \right)^{\frac{\varepsilon_w}{\varepsilon_w - 1}},$$

where ε_w is the elasticity of the demand for labor tasks, which is also a measure of the market power of the union. The Dixit-Stiglitz aggregator gives rise to the following demand for each task g:

$$n_t^g = \left(\frac{W_t^g}{W_t} \right)^{-\varepsilon_w} N_t. \tag{13}$$

We assume nominal wages are sticky and their changes are subject to Rotemberg adjustment costs in logs. The problem of the union is to the nominal wage and the wage inflation rate by solving:

$$U(w_{gt-1}) = \max_{n_{gt}, w_{gt}} \int (u(c_{it}) - v(n_{it})) \;\; d\Psi_t(i) - \frac{\mu_w}{\mu_w - 1} \frac{1}{2\kappa_w} \left[\log(1 + \pi_{gt}^w) \right]^2 N_t + \beta U_{t+1}(w_{gt}) \tag{14}$$

$$s.t. \tag{15}$$

$$n_{gt} = \left(\frac{w_{gt}}{w_t} \right)^{-\frac{\mu_w}{\mu_w - 1}} N_t \tag{16}$$

$$\pi_{gt}^w = (1 + \pi_t) \frac{w_{gt}}{w_{gt-1}} - 1. \tag{17}$$

This setup leads to a wage Phillips curve of the form

$$\log(1 + \pi_t^w) = \kappa_w \left[\varphi N_t^\nu - \mu_w (1 - \tau_t) w_t \mathcal{U}_t \right] + \beta \frac{N_{t+1}}{N_t} \log(1 + \pi_{t+1}^w), \tag{18}$$

with $\mathcal{U} = \int u'(c_t)$ and ν is the inverse Frisch elasticity. Equation (18) shows a New Keynesian Wage Phillips Curve(NKWPC) that relates wage inflation with hours worked and workers' preferences. As we show in the equation, due to labor market frictions–and symmetry, all workers supply N_t hours at a real wage w_t.

Search and Matching. In this version of the model we consider a labor market with search frictions as in Mortensen and Pissarides. We assume there is a Cobb-Douglas matching function $M(U_t, V_t) = m_t U_t^\gamma V_t^{1-\gamma}$, which leads to a job finding probability $f_t(\theta_t) = m_t \theta_t^{1-\gamma}$ and a job filling probability $q(\theta) = m_t \theta^{-\gamma}$, where $\theta_t = \frac{V_t}{U_t}$ is the market tightness. U_t is the measure of unemployed workers with $U_t = \int d\Psi(z_t, b, a, s = u)$, and the level of employment is given by $E_t = 1 - U_t$. The probability of becoming unemployed while working is given by an exogenous separation probability δ.

Households can not individually supply–and set– labor. Instead, there is an intermediary for each type who hires and sells labor services. This firm's value of a worker with productivity z_t is

$$J(z_t) = (h_t - w_t)z_t + (1-\delta)\frac{1}{1+r_{t+1}}\mathbb{E}_z[J(z_{t+1}|z_t)],$$

where h_t is the marginal product of labor. The free-entry condition for these intermediaries is

$$\frac{c_v}{q(\theta_t)} = \frac{1}{1+r_{t+1}}\int_{z_t}\mathbb{E}_z[J(z_{t+1}|z_t)]d\Phi(z_t, b, a, s = u).$$

Additionally, we use a Nash-inspired wage rule

$$w_t = (1-\eta)\omega + \eta(h_t + c\theta_t),$$

where η is workers' wage bargaining power.

Finally, the intermediary generates profits from the difference between the marginal productivity of labor and the real wage, given by

$$D_t^w = h_t - w_t.$$

These profits are delivered to households in the same way monopolistic profits are.

4.6 Monetary Authority

In the presence of nominal rigidities, the real interest rate r_t is determined by monetary policy, which sets the nominal interest rate i_t according to a Taylor rule:

$$i_t = i^* + \phi_\pi(\pi_t - \overline{\pi}) + \varepsilon_t^{mp}.$$

We denote by ϕ_π the preference parameter for inflation. ε_t^{mp} is a monetary policy shock that follows an AR(1) process given by:

$$\log(\varepsilon_t^{mp}) = \rho_{mp}\varepsilon_{t-1}^{mp} + u_t^{mp}.$$

Monetary authorities seek a nominal interest rate target in steady state given by i^* (where $i^* = r + \overline{\pi}$). Given the inflation level and the nominal interest rate, the real rate is determined by the Fisher equation $(1 + r_t) = \mathbb{E}_t \frac{(1+i_t)}{1+\pi_{t+1}}$.

4.7 Aggregation

Total consumption expenditures is given by

$$C_t = \int c(i) d\Psi(i). \tag{19}$$

Goods market clearing implies

$$Y_t = C_t + I_t + G_t + \Theta_t^{\pi} + \chi_t,$$

with $\chi_t = \int \chi_t(i) d\Psi_t(i)$ in SW-TA and zero otherwise. The financial markets close:

$$B_t^g = \int b \ \ d\Psi_t(i) \ \text{ and } \ K_t + q_t = \int a \ \ d\Psi_t(i).$$

5 Comparing SW-OA & SAM-OA HANK

Since there are several ways of modeling labor markets, and in particular, wage rigidities and search and matching are the two most popular, it is necessary to address the differences that arise from assuming one or the other. In this section, we explore that. We compare the differential responses of the two labor market setups embedded in a HANK environment. We first present the calibration; second, the responses of aggregate variables to fiscal transfer shocks (both progressive and non-progressive); and third the responses of aggregate variables to monetary policy shocks. In all the analysis we show the decompositions of consumption as presented in Section 2 to discuss the source of the differences between the different models.

5.1 Calibration

Income distribution and income risk. We embed the distribution of labor income inequality and risk in our model by estimating a stochastic process that is composed by two terms, a permanent and a transitory component. We estimate the parameters of the process and then discretize it to obtain a grid and a Markov chain.

We assume idiosyncratic income (in logs) is given by the sum of two processes z_{1t} and z_{2t}:

$$y_t = z_{1t} + z_{2t} \tag{20}$$

where z_{it} follows

$$\begin{aligned} z_{it} &= \rho_i z_{it-1} + \sigma_i \varepsilon_{it} \\ \varepsilon_{it} &= \begin{cases} \mu_{it} \geq p_i & \sim \mathcal{N}(0,1) \\ \mu_{it} < p_i & 0 \end{cases} \\ \mu_{it} &\sim U[0,1]. \end{aligned}$$

Therefore, we estimate parameters $\{\rho_1, \rho_2, \sigma_1, \sigma_2, p_1, p_2\}$. As noted by the previous literature, the combination of these two processes returns high kurtosis (given by a $p_i \neq 0$) and can match the moments of the growth in income at lower frequencies.

To match the moments of the empirical distribution with the income process in Equation (20), we approximate z_1 and z_2 using a discretization method first proposed by Farmer and Toda (2017) and Tanaka and Toda (2013, 2015). This method is based on matching conditional moments of the discrete approximation with the moments of the true continuous-state process. This is similar to the Rouwenhorst method proposed by Kopecky and Suen (2010), extended for non-linear, non-Gaussian Markovian processes. Therefore, our job is to pin down the parameters that describe the processes z_i, namely ρ_i, σ_i, p_i to match the moments observed in the data and then apply the method by Farmer and Toda (2017) to obtain the discretized version that we feed into the model. We find the parameters by minimizing a loss function that takes a proposed set of parameters and computes how far we are from the desired moments.

Table 4: Empirical and estimated moments of labor earnings in Chile at a quarterly frequency.

Moment	Data	Model
Var $\log(y_t)$	0.719	0.714
Var $\Delta\log(y_t)$	0.195	0.226
Var $\Delta_{20}\log(y_t)$	0.463	0.448
Kur $\Delta\log(y_t)$	11.18	11.617
Kur $\Delta_{20}\log(y_t)$	6.21	6.076

Notes: Source: Unemployment Fund Administration, Chile.

Table 4 shows the moments of quarterly labor income for one-quarter and twenty-quarters log-change in labor income and the variance of the log of income ($\log(y_t)$). We compare the empirical moments with the ones we obtain with our discretization method. What we observe here is that naturally, the variance increases with the lag of the difference, and these distributions have a high kurtosis, which decreases with the lag of the change. However decreasing, it is still higher than a normal distribution for the twenty-period change. Table 4 shows that our model matches the empirical moments well.

We show the estimated parameters of the process in Table 5. We estimate a permanent process with high persistence with a half-life of around 43 years (a career shock) and a low probability of occurrence: workers receive these shocks every 3.5 years. The other shock is less persistent but more likely. Households receive it almost every quarter, while its half-life is about 0.4 quarters. With these parameters, we build the transition matrix to discretize them, and we consider three points for the persistent component and eleven for the transitory component.[8]

Table 5: Parameter estimates for idiosyncratic income process.

ρ_1	ρ_2	σ_1	σ_2	p_1	p_2
0.996	0.145	0.511	0.382	0.071	0.958

The incidence function we assume is exponential and given by

$$\mathcal{F}(z, Y_t) = \frac{1}{f_0} \exp\left\{\xi \;\; z \;\; (Y_t - Y_{ss})\right\},$$

with $f_0 = \int \;\; z \;\; \exp\left\{\xi(Y_t - Y_{ss})\right\} dz$, which guarantees that $\int \mathcal{F}(Y_t) di = 1$ and we set ξ such that we obtain the response pattern we show in 3 in the baseline calibration.

[8]This process suggests that in Chile, income risk is higher than what we observe in the United States. A reason for this high risk is the high worker turnover in Chile. Albagli et al. (2017) conclude that turnover in Chile is higher than all of the OECD countries.

Labor Markets. For the SAM-OA we use the same targets as in the main quantitative DSGE model of the Central Bank of Chile (García et al., 2019): steady-state unemployment rate at 8%, the vacancy filling probability $q(\theta) = 0.8$, and the separation rate to $\delta = 0.04$. In the steady state, the job-finding probability is given by

$$u = \frac{\delta}{\delta + p(\theta)} \Rightarrow p(\theta) = \delta \cdot \frac{1-u}{u} = 0.46.$$

The Nash Bargaining parameter is set to $\eta = 0.5$ (as in García et al., 2019 and Mortensen and Pissarides, 1994). We set $\alpha = 0.5$ (Hosios condition). We calibrate the productivity of the matching function to satisfy the previous conditions, with $m = \frac{p(\theta)}{\theta^{1-\alpha}}$. Finally, we set the Frisch elasticity of labor supply $1/\varphi = 1$ equal to one and we calibrate the disutility of labor to match $H_t = 1$.

For the SW-OA model, we set the labor market markup, μ_w, at 1.085 and the slope of the New Keynesian Wage Phillips curve, κ_w, at 0.1.

Firms. We set the steady state level of capital, as a share of annual GDP, at 2.01 (8.04 quarterly) to match the value of illiquid assets, as a fraction of GDP, from Table 1. The capital share α_k is equal to 1/3. Steady-state productivity level Z is calibrated to obtain a steady-state GDP equal to one ($Y = 1$). The depreciation rate equals 0.01 (from García et al. (2019)) and, in the baseline calibration, the capital adjustment cost parameter, ϵ_I, is set to 2. Finally, we assume 10% markups ($\mu_p = 1.1$) and a slope of the Price Phillips curve of 0.1.

Government. We set the Taylor rule parameters to $\phi_\pi = 1.25$ and $\phi_U = -1$ in the baseline calibration. We set the level of government spending and fiscal transfers equal to ten percent of GDP each. Fiscal transfers have two components, a progressive and a non-progressive transfer. We set both to 5% of GDP. Individual transfers are defined by a non-linear function $f(z) = T_t z^{-\aleph_f} f_0$, where f_0 is a scalar which ensures $\int f(z)\Psi(i)di = T_t$ and $\aleph_f$ is the level of progressivity. We solve the model with two transfers which only differ in the progressivity level $\aleph_f$. In the next sections, we introduce two types of policies simultaneously, a progressive and a non-progressive one, to match the distribution of two selected policies delivered in 2020. These parameters are $\aleph_{\boldsymbol{p}} = -1.1$ $\aleph_{\boldsymbol{np}} = 0.4$ in the progressive and the non-progressive policies respectively. We explain how we set these parameters in the next section. Finally, we set the tax rate on dividends equal to 25%, and we show results for different ways of government financing, ρ_T.

Solution Method To solve this heterogeneous-agent model with borrowing constraints, we follow Auclert et al. (2021). The steady-state equilibrium is obtained by solving the model equilibrium. To solve the value function we use Carroll (2006) endogenous grid method, which is a fast and accurate algorithm to solve these kinds of problems. Then, we use a Newton method to solve the steady state of this economy. And finally, to solve the model with aggregate shocks we follow Auclert et al. (2021) as well, who propose to write the model in its Sequence-Space and linearize around that system of equations. The method relies on the fact that any model without aggregate uncertainty can be written as a sequence of equations in the transition. This is, if we assume shocks are one-time and unexpected, we can write the system as a sequence of equations in the transitional dynamics. This system of equations which is given by $T \times M$, with T the horizon of the transition and M the number of equations to solve, can be linearized around the steady state. This linearization leads to jacobians of all variables with respect to others, and the impulse-responses can be obtained by a composition of these jacobians. This method, based on Boppart et al. (2018), is faster, more accurate, and more robust than methods like the ones that follow Reiter (2009). We refer the reader to the paper for more details on the method.

	Description	SW-OA	SAM-OA	Source/Target
Preferences				
β	Discount factor	0.94	0.95	Share of HtM (0.42)
γ	EIS	1	1	
ψ	Disutility of labor	0.727	0.57	Hours worked (1)
φ	Frisch elasticity	1	1	
r	Eq. interest rate	2%	2%	
B	Agg. bonds	0.18	0.32	Bonds' mkt eq.
Labor Market and Wages				
η	Union's bargaining power		0.5	Mortensen & Pissarides (1994)
α	Elasticity matching fn.		0.5	Mortensen & Pissarides (1994)
s	Separation rate		0.04	Unemployment rate (0.08)
c_v	Vacancy cost		0.18	*Internally calibrated*
m	Matching efficiency		0.537	Job finding rate
μ_w	labor mkt mkup	1.085		
κ_w	Slope NKWPC	0.1		
Fiscal and Monetary Policy				
τ_w	Labor income tax	0.1	0.09	*Internally calibrated*
ϕ_π	Taylor rule (inflation)	1.25	1.25	
ϕ_U	Taylor rule (unemployment)		-1	
Production				
Z	TPF	0.49	0.52	Normalized agg output (1)
α_K	Capital share	0.33	0.33	
δ	Depreciation rate	0.01	0.01	
ε_I	Capital adjustment costs	2	2	
μ	goods mkup	1.07	1.07	
κ	Slope of P.C.	0.1	0.1	
K	Capital in SS.	2.01	2.01	

Table 6: Calibration of SW-OA and SAM-OA models.

Steady State Calibration. To solve the steady state we leave free the disutility of labor (ψ), the discount factor (β), the level of labor income taxes (τ_w), aggregate bonds holdings (B or B^g), and the vacancy cost (c_v) in the SAM-OA case. The targets we set are an interest rate of 5% yearly, the share of hand-to-mouth 0.42, hours normalized to one, and the unemployment rate implicitly by satisfying the free-entry condition in the labor market in the SAM-OA case. Additionally, τ^w is determined to satisfy the government budget constraint. Table 6 shows that after this calibration procedure, we obtain in the SAM-OA model: $\beta = 0.95$, $\psi = 0.57$, $c_v = 0.18$ which leads to 0.8 percent of GDP in vacancy costs, a tax rate equal to $\tau^w = 0.09$, and aggregate bond holdings equal to 0.18 as a share of annual GDP (very close to the values in Table 1 of 0.19). On the other hand, in the SW-OA model, we obtain: $\beta = 0.94$, $\psi = 0.73$, $\tau_w = 0.1$, and bond holdings equal to 0.32.

Additionally, Table 7 shows the MPCs implied by the two models we compare in steady state. We argue that this is the main source of differences between the SAM-OA and the SW-OA. Because the SAM-OA has an additional layer of risk due to unemployment, and unemployment would affect workers of all income levels, SAM frictions generate higher MPCs along the distribution of income. In Table 7 we observe two additional facts: first, that MPCs are decreasing in income (because wealth correlates with income); second that the difference between models, i.e., the effect of unemployment on MPCs, is also decreasing in income. That is because labor income is more important at the bottom of the distribution than at the top of the distribution. As we will see below, these facts have important effects on consumption dynamics, driving the differences between SW-OA and SAM-OA models both on the size and the transmission mechanisms of the effects.

	Q1	Q2	Q3	Q4	Q5
SW-OA HANK	0.592	0.532	0.277	0.278	0.122
SAM-OA HANK	0.891	0.634	0.331	0.288	0.159

Table 7: MPCs by quintile of the income distribution in SW-OA and SAM-OA.

5.2 Response to a Fiscal shock

In this section, we study the role of labor markets' frictions in the transmission of fiscal transfers. We follow García et al. (2022) by comparing the role of progressive and non-progressive transfers when monetary policy is loose or tight; i.e. it responds to inflation loosely or strongly.[9]. Next, we show the impulse responses and the decomposition of each case comparing SW-OA with SAM-OA.

Loose Monetary Policy. Figures 5 and 6 show the responses of macroeconomic variables to a fiscal transfer shock in the SW-OA and the SAM-OA models, calibrated to generate the same impact response of the ratio $\frac{w_t}{n_t}$. With a loose monetary policy, fiscal transfers have a big expansionary effect on consumption, with impact multipliers larger than one in the case of the progressive policy in both models. The reason is that due to the unresponsive monetary policy, the increase in inflation generates a fall in the real rate in the short run which stimulates the economy further. Quantitatively, and due to the calibration we use, the responses in both SW-OA and SAM-OA are similar (this can

[9] García et al. (2022) define progressivity of transfers which match fiscal transfer schemes in times of COVID in Chile.

be observed in the responses of the macroeconomic aggregates), but the transmission mechanisms change, as can be seen in the responses of labor market variables and prices.

To understand the differences between both models it is better to use the decomposition we propose in Section 2, which separates the response of consumption into the effect of the real rate and the impact of marginal propensities to consume (and their distribution). Figure 7 shows that decomposition for SW-OA and SAM-OA, and also progressive and non-progressive policies with their respective differences. The first to note is that in our calibration, the impact of policies not only depends on the progressivity of the policy but depends on the model assumptions. The effect of progressive policies is larger in SAM-OA while the effect of non-progressive policies is larger in SW-OA. This implies that SAM/SW are not always amplification devices and depend on the type of shock (and how it distributes among the income distribution).

The first to note is the effect of the larger MPCs. This is represented by the dark-green bar. In both cases, the dark green bars are larger in SAM, which means that the direct-average effect of these policies is larger in SAM. While this is true on average, the SW-OA has (on impact) a larger cross-sectional effect from transfers, that becomes lower from the second quarter. All of this implies that the initial impulse in SAM-OA is larger than in SW-OA due to higher MPCs (which we describe in Table 7).

Recall that a feature we include in the model is the cross-sectional unequal responses of labor income to the shocks (see section 3) that in addition to the countercyclical markups and unemployment in SAM-OA, generates cross-sectional responses of income ($dy_t(i)$). These facts generate responses in the component $COV(M_t(i), dy_t(i))$. We find that the cross-section term jumps in both policies; however, in the SW-OA that term is more responsive and drives most of the effects of fiscal transfers. This means that to generate amplification, SW-OA needs features that generate redistribution between MPCs to a larger extent than SAM-OA, in which the action is mainly given by the average effects of shocks. This could be due to the effects of having higher MPCs, but also to the effect of unemployment, which is about similar for all households.

Tight Monetary Policy. Figure 8 and 9 show the responses of macroeconomic variables to a fiscal transfer shock in the SW-OA and the SAM-OA models respectively. With a tight monetary policy, fiscal transfers have a low expansionary effect on consumption, with impact multipliers slightly positive but with a dynamic response negative from the second quarter. This implies that to have a strong response of aggregates to fiscal policy, monetary policy should not react in the opposite direction.

Figure 10 displays the decomposition in this case. It shows a similar result we had before. In this case, we also find that cross-sectional effects are stronger in SW-OA than in SAM-OA, while the average effects are stronger in the SW-OA. Finally, the effect of the interest rate is very similar in both settings, with again, the SAM-OA being stronger than in SW-OA.

5.3 Response to a Monetary shock

It is also useful for us to compare the different settings analyzing monetary policy shocks. Figure 11 shows the response of aggregate variables to a monetary policy shock in the calibration we used before. However, we calibrate the size of the monetary policy shock to generate the same response of consumption on impact we observe in both models. We do that to study the transmission mechanism of the shock more closely. The first we find is that due to the nature of the frictions we have in both models, inflation is more responsive in SW-OA than in SAM-OA. This is because of the stronger price rigidity wage rigidities generate. Also, we have that investment responds more strongly in the SAM-OA than in the SW-OA. That is due most likely to the stronger response of marginal costs that is positively related in this model to the return to capital.

Figure 15 shows the decomposition of consumption to the monetary policy shock in two terms, the direct response to the interest rate given by the dark-green bar, the average-indirect in dark-red and the cross-sectional indirect in light-red. We can mention several results from this plot. First, that the direct effects are very similar, accounting for a small portion of the total effect on impact. Second, from all of the indirect effects, the cross-sectional term is what drives the expansion in consumption. We observe that the average responses of income (labor income and income from dividends) go down, whereas the cross-sectional effect counteracts that. This is, monetary policy operates in this case in both models through the cross-sectional effect. The third result relates to the difference between SW-OA and SAM-OA, where the former has a more persistent response, which is mainly due to the persistence of employment this model has.

Overall, we find that, unlike the case of a fiscal transfer, a monetary policy shock has a similar transmission mechanism in both models. This means that properly calibrated, we can use both of them for the analysis of the transmission of monetary policy shocks.

6 Comparing SW-OA with SW-TA HANK

Recent literature emphasizes the importance of the asset structure for monetary policy (see Kaplan et al. (2018) and Luetticke (2019)), in particular on the role of assets liquidity for the transmission of monetary policy shocks and the generation of high marginal propensities to consume. They argue that having only a liquid asset does not generate the MPCs we observe in empirical analyses, and a way to generate them is to split total household wealth into liquid and illiquid assets.

In particular, Kaplan et al. (2018) conclude that when considering two assets, the transmission of monetary policy substantially changes; this is, there is a more prominent role of the indirect effects from monetary policy shocks (those unrelated to the interest rate). However, in the previous section, we showed that a one-asset model with a fully illiquid asset works similarly to what is exposed by Kaplan et al. (2018). Therefore, in this section, we compare our OA-SW model described previously and a two-asset sticky wages model. We compare the response of consumption to monetary policy shocks, focusing on the transmission mechanisms. The idea is to establish the need to incorporate more complexity (a second asset) into an already complex model. First, we show the calibration of the SW-TA model and then compare this with the SW-OA model we analyzed above.

6.1 Calibration

Most of the calibration of the Two-Asset model is the same as the one-asset models described above. Nevertheless, in the SW-TA model, as the illiquid asset holdings are a choice, we must calibrate it accordingly. Therefore, two dimensions are left to calibrate in the SW-TA model. First, we must calibrate the liquidity adjustment cost function defined by the parameters χ_0, χ_1, and χ_2. And second, the parameter of the profits' distribution ω. Recall the adjustment cost function:

$$\Phi_t(a', a) = \frac{\chi_1}{\chi_2} \left| \frac{a' - (1 + r_t^a)a}{(1 + r_t^a)a + \chi_0} \right|^{\chi_2} |(1 + r_t^a)a + \chi_0| , \tag{21}$$

with χ_0 representing the absolute value of changing the portfolio, which generates an inaction zone for the deposits to the illiquid account, χ_1 controls the level of the cost of changing the portfolio which controls the marginal decision between investing in the two assets, and hence, determines the spread between the liquid and illiquid assets, and χ_2 which is the curvature of the cost. We set $\chi_2 = 1.25$ (as in Auclert et al. (2018b)), and calibrate χ_0 to match the share of wealthy hand-to-mouth according to Table 2. We obtain $\chi_0 = 1.26$. Then, we calibrate χ_1 to match the level of total illiquid assets according to Table ??. We obtain $\chi_1 = 2.71$. Finally, and similar to the previous section, we calibrate β, φ, and B to close the liquid assets market, the labor supply in $N = 1$, and the share of poor hand-to-mouth according to Table ??. We obtain $\beta = 0.97$, $\varphi = 0.7$ $B = 0.76$. The remaining parameter is ω, which we set (similar to Kaplan et al. (2018)) equal to α.

6.2 Monetary Policy Shocks

Figures 14 and ?? show the impulse responses of the main macroeconomic variables to a monetary policy shock and the decomposition of the consumption response to a monetary policy shock. In this exercise, we calibrate the shock to have the same consumption response on impact in both models and the same remainder parameters. Figure 14 shows that the output response is stronger in the SW-TA model than in the SW-OA. The reason is the investment behavior because a fall in the nominal interest rate generates a boom in consumption and investment in both models, and the incentives to accumulate capital rise. The difference between the SW-TA and the SW-OA is that due to the liquidity cost, we are introducing an additional cost to accumulate capital, represented by the muted response in investment. That implies that having liquidity costs is not innocuous for aggregate dynamics.

Figure ?? shows the decomposition for both the SW-OA and SW-TA. We decompose the consumption response into the effects of the interest rates in both models; this is, in the SW-TA we combine both the effects from the liquid and the illiquid interest rates, that we dubbed the interest rate effect. As above, we show the effects from the other income sources split into the average and the cross-sectional effects. We find that the effect of a monetary policy shock is more persistent in the SW-TA, due to the sluggish response of capital in that model (because the liquidity cost generates sluggish illiquid assets accumulation). Also, the effect is driven by the sluggish response of the cross-sectional effect in the SW-TA. We interpret this result as a distributional effect from the rise in capital that tilts income from capital owners to workers due to lower returns to capital and higher wages. Finally, the more negative response of the interest rate effect in SW-TA is due to the same reason: as capital remains high for longer, the return to the illiquid asset remains lower for longer, impacting consumption more negatively.

7 Conclusion

In this paper, we build–and calibrate– different Heterogeneous Agents New Keynesian models (HANK) for Chile. We show that in the data, there is substantial heterogeneity in assets holdings, income sources, levels, and cyclicality along the distribution of Chilean households. In particular, we show that Chilean households have higher shares of hand-to-mouth than in the US (thus, they have lower access to financial markets), they face higher income (and unemployment) risk, and the income of low quintiles households are more responsive to shocks than those of the high quintiles.

Considering those facts, we calibrate three models to study the transmission mechanisms of fiscal and monetary policy shocks through consumption. First, we compare labor market setups. We compare a model with search and matching frictions (SAM) with a model with sticky wages frictions. We show that with SAM, there are larger MPCs; hence, the direct effect of fiscal policies is more significant than in the sticky wages model. Since SAM has a higher average MPC, the response of transfers is higher, while the average response dominates the cross-sectional effect of the transfer. We also compare these two models in how monetary policy transmits to consumption. We show that the cumulative response in SAM is larger for a shock that generates the same consumption response on impact. This is because of a cross-sectional effect of the monetary policy shock that operates through unemployment, which is persistent in SAM and is absent in the sticky wages model.

Finally, we study the role of assets liquidity. We find that for our calibration, the differences between the SW-TA and the SW-OA are given by the role of the accumulation of illiquid assets. In the SW-TA we find there is an additional source of persistence of capital due to the cost of illiquidity that propagates into labor income and return to capital that generates a redistribution between capital and labor. When capital goes up, there is amplification of shocks.

This paper is part of the effort to understand consumption dynamics and what elements of the HANK toolkit matter the most. Further research points towards questions about the role of open economy considerations in these kinds of models, the role of richer elements of the labor markets (since it seems to be a key determinant of consumption fluctuations in HANK), and the role of heterogeneity in expenditures of different goods in the business cycles, among other phenomena.

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A Assets decomposition, different Data Sources

B Obtaining the Shares of Hand-to-Mouth and robustness analysis

In the current appendix we discuss the construction of the share of Hand-to-Mouth using the *Encuesta Financiera de Hogares 2017 (EFH 2017).* There is a newer version of this survey (EFH 2021),

Liquid				Illiquid				Total
		EFH	CMF			EFH	CMF+CBC	
	Banking Credit Cards	-0.011	-0.0322	Net housing	Net Primary House	0.898	1.93 (-0.251)	
	Banking Credit Lines	-0.003			Net Other House	0.384		
	Banking Consumption Credits	-0.027	-0.0795					
Revolving consumer debt	Non-Banking Credit Cards	-0.005						
	Non-Banking Consumption Credits	-0.003						
	Cooperative Credits	-0.005						
	Other Loans	-0.003	-0.008					
		-0.06	-0.12			1.282	1.93	
Deposits		0.01	0.05					
	Bonds	-	0.012					
Fixed income	Saving Accounts	-	0.105					
	Saving Insurance	-		Net durables	Net Cars	0.106		
	Other	-			Other Real Assets	0.022		
		0.056	0.12			0.128	0.128	
	Shares	-	0.003					
Equity	Mutual Funds	-	0.07					
	Other	-						
	Investment Funds	-	0.044	AFP		0.187	0.722	
		0.083	0.114					
APV		-	0.019					
Education Loans		-0.014	-0.0368					
Total		0.08	0.164			1.597	2.06	2.23

TABLE 8: Values are expressed as a fraction of 2017 GDP.

however, we stick to 2017 wave due to the allowance of the pension funds withdrawals taken during 2020 and 2021 to face the impact of the COVID-19 pandemic. As consequence of the aforementioned measures at that point in time Households kept an unusual amount of liquid Assets compared to any other time analyzed.

The EFH 2021 contains question regarding the Household's Asset stock, income, present valued debt, access to the financial market, among others. All Assets and debt is aggregated in the head of the Household answers. Table 10 is constructed using three common assumptions to construct the share of HtM.

First of all, we kept only the self-identified Head of the Household. The second common assumption is to eliminate all Households, where the Head of it is younger than 22 years old and the ones older than 79 years old. Finally, we drop all IDs where it is reported to have received a negative income.

There is a last assumption on the Entrepreneurs population on the survey (it makes to vary the remaining total Households in tha sample). There are Households who report to been entrepreneurs as their primary source of income. The first option we made is to drop them out of the sample, as their reported income may be not representative of the gross annual income due to the volatile

Table 9: Shares of HtM

Asset def.	Illiquid Assets def.	Share of HtM Poor	Rich	Total	Asset def.	Illiquid Assets def.	Share of HtM Poor	Rich	Total
	Principal Home	0.14	0.29			Principal Home	0.12	0.27	
SR wo. E	All Real Estates	0.12	0.31	0.43	12m Saving wo. E	All Real Estates	0.11	0.28	0.39
	Real Estates & Durables	0.08	0.35			Real Estates & Durables	0.08	0.31	
	Principal Home	0.14	0.30			Principal Home	0.12	0.28	
SR w. E	All Real Estates	0.12	0.32	0.44	12m Saving w. E	All Real Estates	0.11	0.29	0.40
	Real Estates & Durables	0.08	0.36			Real Estates & Durables	0.07	0.33	

nature of some entrepreneurs. The definition under this assumption is presented in the top panel of table 9 (expressed as wo. E). The bottom panel of the table shows the shares of HtM Households made under a softer measure of the dropped Entrepreneurs, we only drop a Household, that do not report the income (presented as w. E).

Focusing on the Asset holding, we added up all self-reported net values of the Asset, such as, Deposits, Fixed Income Assets[10], the Equity Assets[11], net of the reported debt[12]. This way to sum up the net liquid Asset holding is presented in the left hand panel in table 9 under the label of self-reported (SR). There is an additional check it can be made. The EFH 2017 contains an additional question regarding the saves made by the Household during the 12 months to the survey. Thus, it is possible to correct one last time the possible misreporting of the liquid Asset holding described above. The aforementioned replacement is presented in the right-hand side of table 9 under the *12 m Saving* label.

Finally, there are three different ways in which the illiquid Assets can be grouped. The first definition used in the analysis was to considered only the net valuation of th principal Home as the illiquid Asset holding - presented in the top panel of each subcategory -, then we used the possession of all real estates net valuation (the middle panel of each subcategory). Finally, we considered all real estates plus the reported durables Assets net of their debt as the illiquid Asset holding (the bottom panel in each subcategory explained before).

The preferred subcategory to Measure the HtM Households of the chilean economy is the 12m Saving wo. Entrepreneurs, take as the illiquid Assets all Real Estates plus Durables. It allows to

[10] Correspond to the total amount households have invested in different instruments such as time deposits, bonds, savings accounts, and insurance with savings.

[11] The sum of investments in shares, investments in mutual funds, participation in companies or investment funds, and investments in other equity instruments (options, futures, swaps, among others).

[12] Bank credit cards, lines of credit, bank or financial consumer loans, credit cards from non-banking institutions, consumer loans in commercial houses (cash advances), credits in savings banks compensation, cooperatives or other similar, educational loans, and other non-mortgage debts.

correct the possibility of misreporting and takes into account all material Assets outside of the finacial markets.

B.1 Robustness Analysis

Table 10: Dichotomic Share of HtM

	No Sav. last 12m	No CC possession	No Checking Acc.	No Cred Line Acc.	No CLA, CC nor NBCC
wo. E	0.3646	0.3677	0.0835	0.3502	0.1791
w. E	0.3744	0.3792	0.0854	0.3614	0.1846

As discussed above the measure of HtM Households may vary depending in the assumptions one follows when constructing the ratio. We created some dichotomic based shares of HtM to have a bottom (soft) estimate of the ratio. The EFH 2017 contains questions about the availability of some financial instruments and if the people in it were able to save any amount during the last 12 months. We looked at the ratio of the Households under both Entrepreneurs assumption, whether it possess some financial instruments, such as Banking Credit Card, Checking Account, Credit Line Account and any of the aforementioned instruments. Additionally, we obtained the ratio of Households that reported to have save any amount during the last 12 months prior to the survey. The results are presented in table 10.

Table 10 shows some interesting facts. First of all the ratio of Checking Account availability in the chilean economy is much wider than any other ratio considered in the analysis is due to Government policy of managing via Banco Estado - a Commercial Bank with Government ownership - to have available to any 18 years old citizen a Checking Account with a limit to have in it. Thus, there should be no friction in the accessibility to this specific financial instrument.

Table 11 presents the average of the ratio between the instrument limit given by the financial system and the quarterly income of the entire Household. The three analyzed instruments show that the amount given to the Households does not cover them for a large period of time. The available level of credit covers less than two months of income in case of losing a job on average terms. This ratio is considering the ideal case, where the limit is at full disposal. A better way to get the constrained Household that have a financial instrument to their disposal is presented in table 12.

Table 11: Financial instrument limit as quarterly income (ratio)

	Credit Cards	Credit Lines	No banking CC
wo. E	0.6819	0.4604	0.5808
w. E	0.6795	0.4857	0.5678

Table 12 shows two different measure of a soft HtM ratio. The first measure are those Households that have all their available credit used (in the respective financial instrument). If we take the Total column this share of HtM Households is around 0.25, to obtain the amount of HtM in the aggregate level it is necessary to add the 0.18 of those Households that do not have any financial instrument (presented in the last column of table 10), what give us that this soft HtM measure is around 0.43. Once again near the shares obtained in the principal analysis.

Table 12: Spare amount in Credit Cards as HtM Measures

	Banking CC	Non-Banking CC	Total
No amount available to be used	0.258	0.282	0.25
Less than 15% of quarterly income to spare	0.441	0.598	0.476

C Tables and Figures

C.1 Empirical

Moments	United States	Chile (Full sample)	Chile (Sub-sample)
Variance: log earns	0.70	1.14	1.12
Variance: 1-year change	0.23	0.53	0.48
Variance: 5-year change	0.46	0.88	0.82
Skewness: 1-year change		0.00	-0.14
Skewness: 5-year change		-0.02	-0.14
Kurtosis: 1-year change	17.8	6.80	7.47
Kurtosis: 5-year change	11.6	5.15	5.68

Table 13: Empirical moments for earnings in United States and Chile at annual frequency.

Moments	Full sample	2014-2019
Variance: log earns	0.70	0.69
Variance: 1-qtr chg.	0.21	0.18
Variance: 1-year chg.	0.30	0.26
Variance: 5-year chg.	0.49	0.43
Skewness: 1-qtr chg.	0	-0.07
Skewness: 1-year chg.	0	-0.11
Skewness: 5-year chg.	0	-0.06
Kurtosis: 1-qtr chg.	10.15	11..69
Kurtosis: 1-year chg.	8.47	9.63
Kurtosis: 5-year chg.	5.69	6.45

Table 14: Empirical moments for earnings in Chile at quarterly frequency. All workers.

C.2 Figures of Section 5

Figure 5: IRFs of Macroeconomic Variables to a progressive/non-progressive Fiscal Transfer Shock in SW-OA model, loose Monetary Policy.

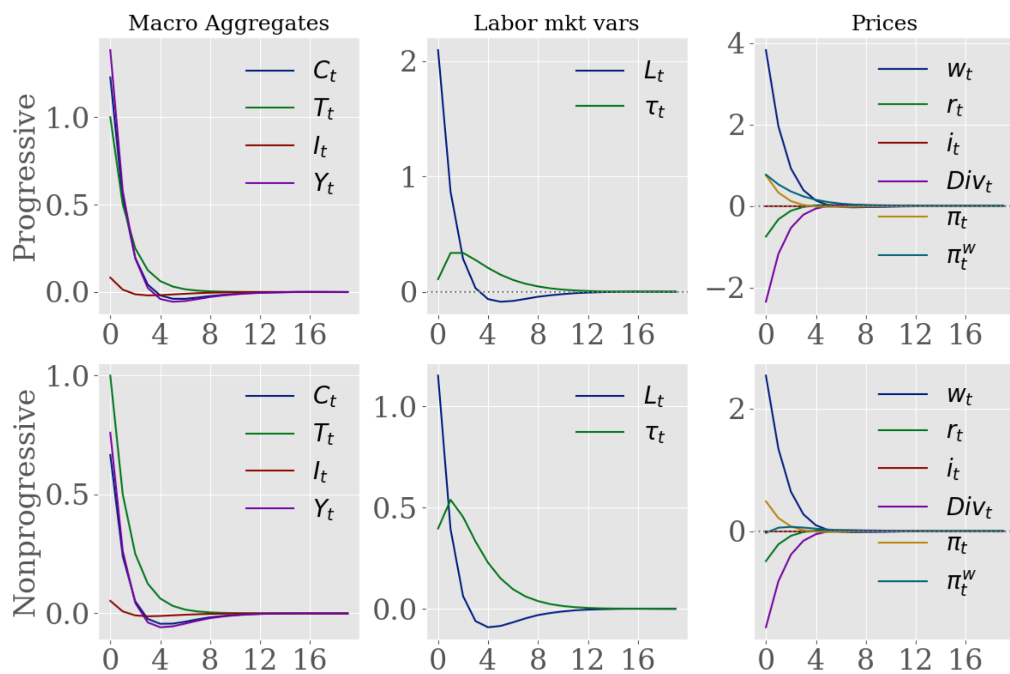

Figure 6: IRFs of Macroeconomic Variables to a progressive/non-progressive Fiscal Transfer Shock in SAM-OA model, loose Monetary Policy.

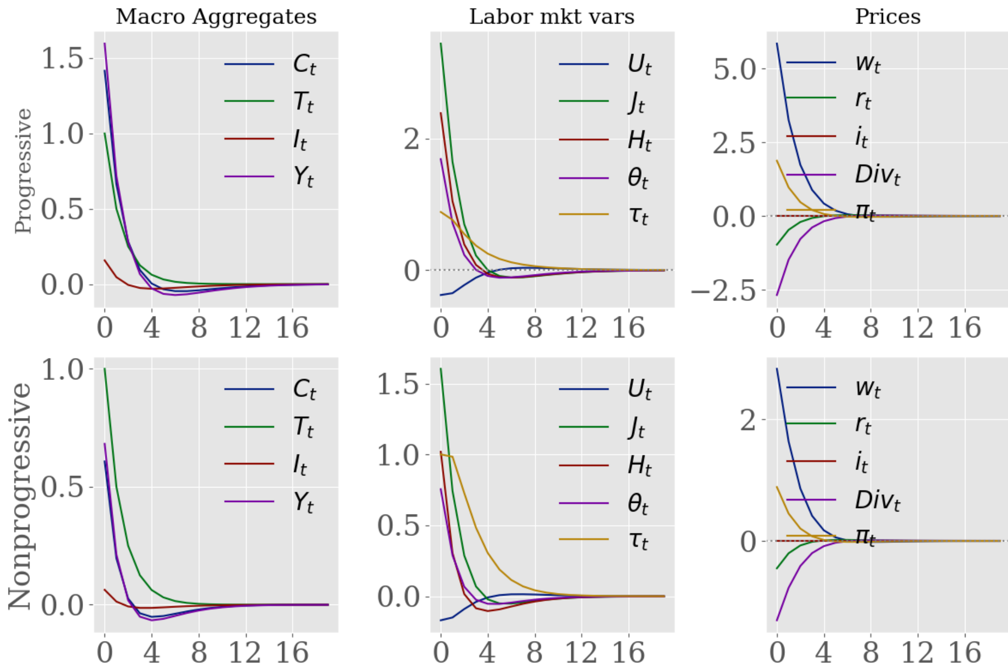

FIGURE 7: Consumption Decomposition, SW and SAM Model with a loose Monetary Policy.

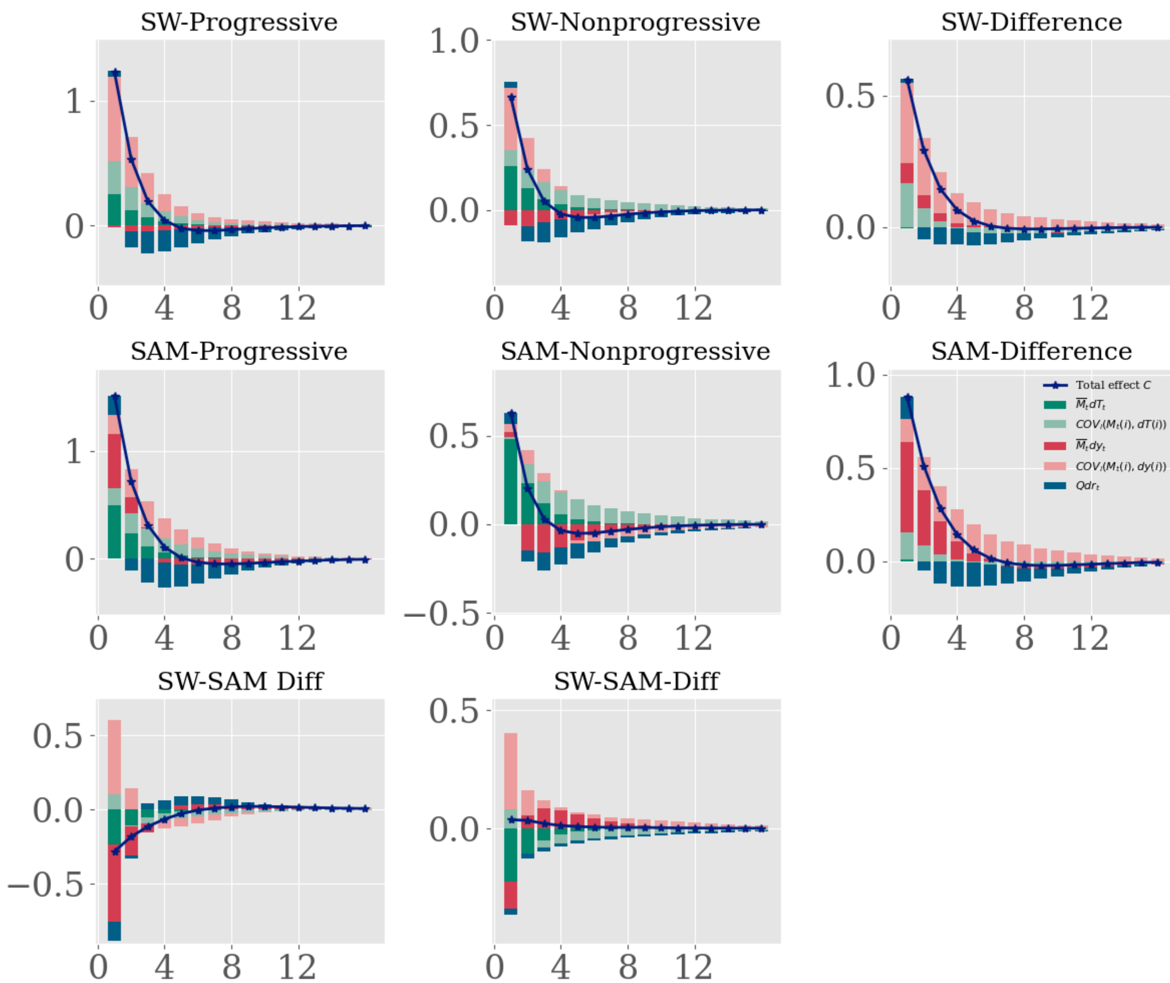

Figure 8: IRFs of Macroeconomic Variables to a progressive/non-progressive Fiscal Transfer Shock in SW-OA model, tight Monetary Policy.

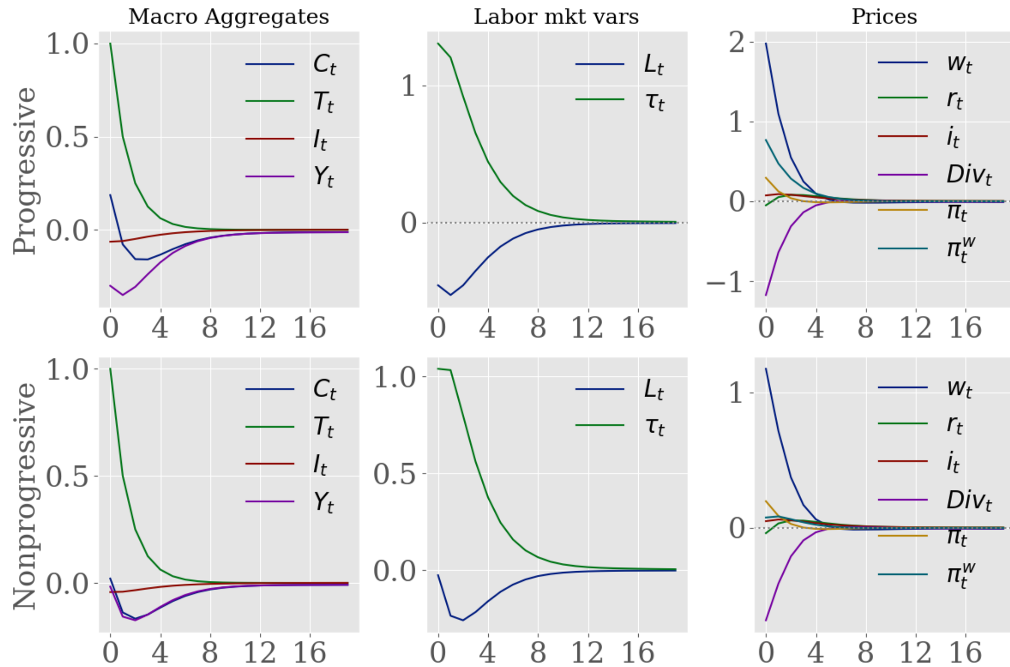

Figure 9: IRFs of Macroeconomic Variables to a progressive/non-progressive Fiscal Transfer Shock in SAM-OA model, tight Monetary Policy.

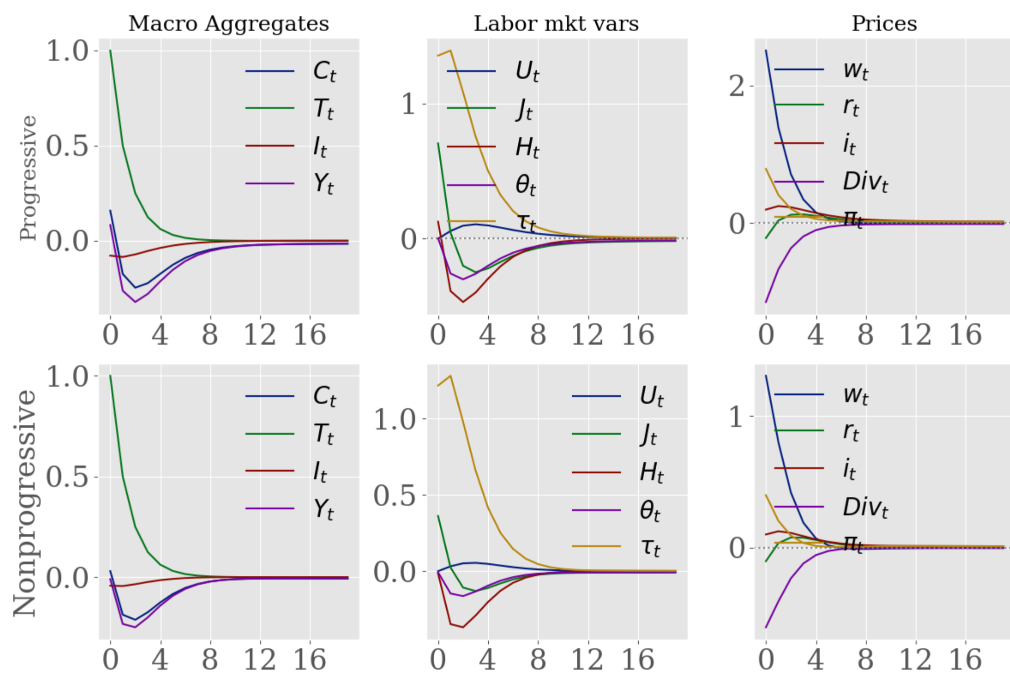

Figure 10: Consumption Decomposition, SW and SAM Model

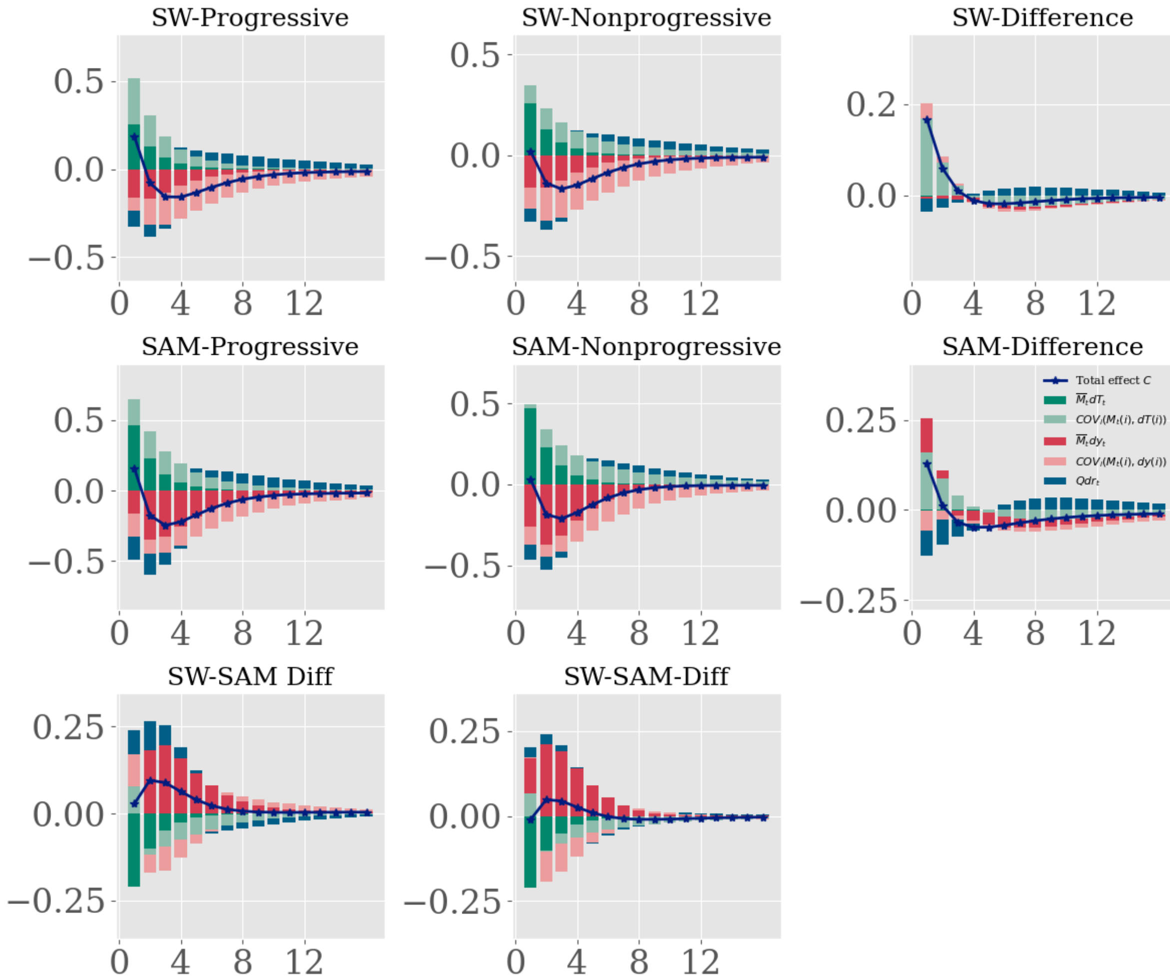

Figure 11: IRF Monetary Policy Shock

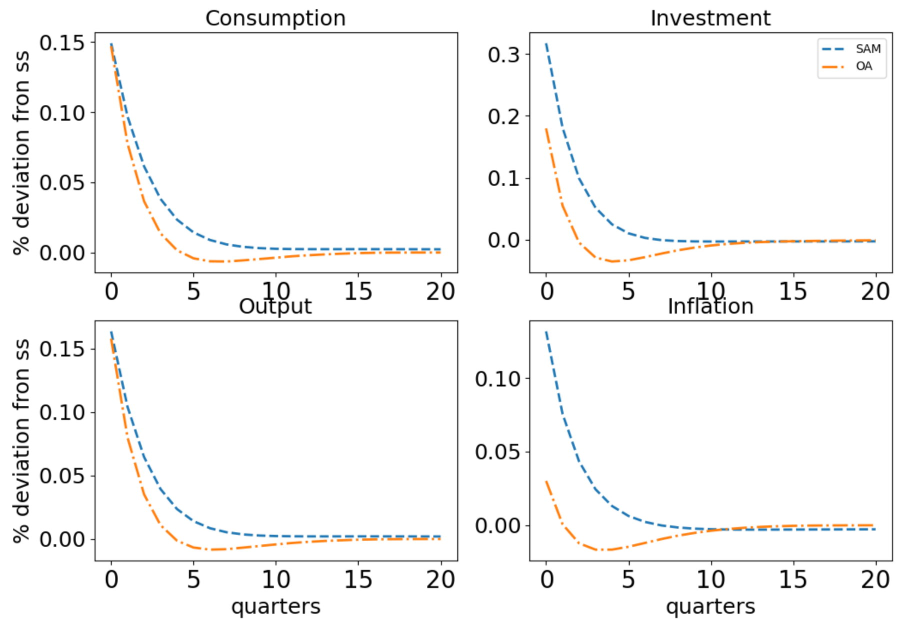

Figure 12: IRF Monetary Policy Shock Decomposition

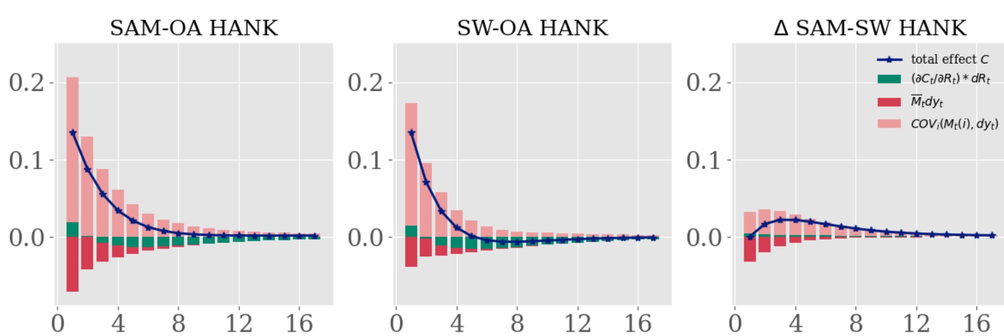

FIGURE 13: MPCs Comparison

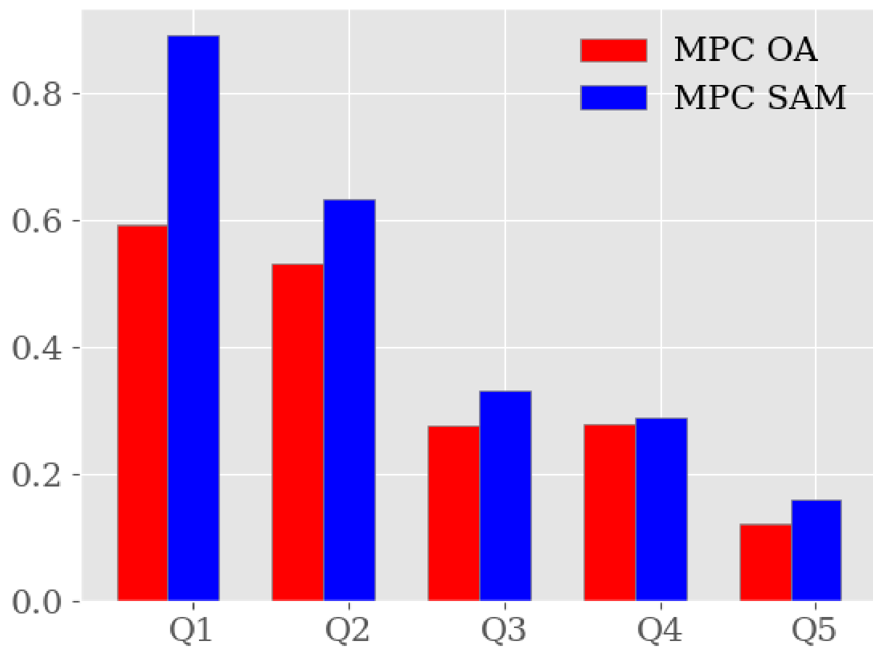

FIGURE 14: IRF Monetary Policy Shock 2A v SW

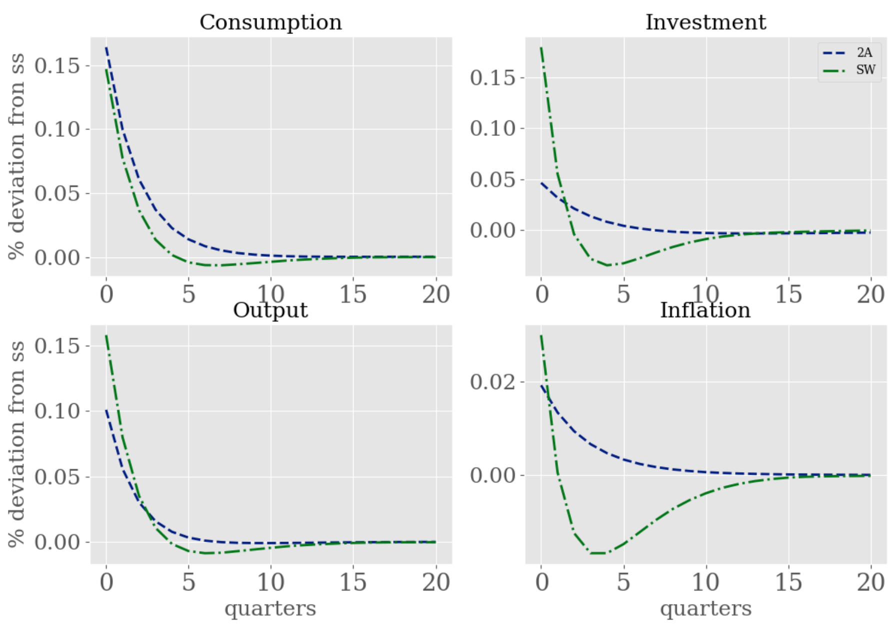

Figure 15: IRF Monetary Policy Shock Decomposition