Inequality, Home Production, and Monetary Policy

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Abstract

I study how home production alters the income channel through which monetary policy affects consumption inequality. Through the lens of a Two Agent New Keynesian model, I find that in response to a contractionary monetary policy shock, households living from hand to mouth (HtM) smooth total consumption, i.e., consumption of market and home-produced goods, with home production to a greater extent than savers do. First, because HtM households cannot smooth market consumption with financial markets, and second, because they have worse conditions on the labor market. The resulting income channel is smaller. The transmission to aggregate output is amplified, as home production yields a larger drop in labor supply, and furthermore, the effect is more pronounced for HtM households who have larger marginal propensities to consume. The model matches German data on time use and income of HtM households and savers.

Keywords: Heterogeneous Agents, Home Production, Consumption

JEL Codes: E21, E32, J22

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1 Introduction

Recent research in macroeconomics finds an interaction of monetary policy and inequality (see, e.g., Ahn et al. (2018) and Bayer et al. (2024)). Inequality usually refers to income, wealth, or consumption inequality. Consumption inequality is particularly interesting as consumption is directly related to households well-being (McKay and Wolf, 2023). While consumption usually refers to consumption goods bought on the market, households can also produce consumption goods at home (Becker, 1965).

The literature has identified various channels through which monetary policy affects inequality as outlined in McKay and Wolf (2023). One of these channels is the income channel, which refers to the finding that labor income of low-skilled households reacts more to business cycle fluctuations than labor income of high-skilled households (Guvenen et al., 2017), and it further refers to the finding that business income is affected less by a monetary policy shock than labor income (McKay and Wolf, 2023). The fact that households can also produce consumption goods at home can alter the income channel, because home production affects the market labor supply decision of households, since goods bought on the market and goods produced at home are substitutable (see, e.g., Benhabib et al. (1991) and Greenwood and Hercowitz (1991)). Particularly, households living from hand to mouth (hereafter "HtM households") could benefit form home production as a consumption smoothing device, since – according to the income channel – their income is most affected by a contractionary monetary policy shock. However, also households who have access to financial markets (hereafter "savers") can benefit from home production, as they can smooth market consumption with the financial market, nonetheless, reallocate hours worked from the market to the home sector, and thereby, keep a high level of both consumption types.

In this paper, I study whether home production alters the income channel through which monetary policy affects consumption inequality. Through the lens of a Two Agent New Keynesian (TANK) model, I find that HtM households substitute towards the home sector to a greater extent than savers do. Therefore, their total consumption then consists of less market consumption and much more consumption of home-produced goods, compared to savers. The two types of goods are sufficiently substitutable such that HtM households benefit more than savers from the additional smoothing possibility. Hence, inequality in total consumption, i.e., market and non-market consumption, increases only slightly. To be precise, the difference in the decrease of market consumption of savers and HtM households is 0.74 pp, while the difference in total consumption is only 0.15 pp. Thus, the resulting income channel is smaller, when taking consumption of home produced goods into account. The transmission from monetary policy to aggregate output is larger in a TANK model with home production for two reasons. First, home production in general yields a larger transmission to output, because the demand for goods bought on the market of all households decreases to a greater extent if they can also produce consumption goods at home. Second, the inequality dynamics amplify the effect on output, as HtM households substitutes towards home production more than savers do, and thus, their income decreases to a greater extent. Since HtM households have large marginal propensity to consume, a decrease in their income yields a larger drop in output compared to a decrease in the savers' income.

The model in this paper is based on the TANK model in Debortoli and Galí (2024). One type of household lives HtM, such that it does not have access to credit markets by assumption, and thus, consumes its entire income every period. The other type of household is called saver, since it can save and borrow, and thus, allocates consumption optimally across time. As in Gnocchi et al. (2016), I include home production into the model, so all households decide every period how to allocate their time across market work, leisure and non-market work. With the model, I can infer consumption of home produced goods from hours worked in the non-market sector, and thereby, study the effects on consumption inequality in the market and in the home sector. I further include wage stickiness via Rotemberg adjustment costs to avoid countercyclical profits, as it gives distributional effects that are not in line with empirical evidence (Broer et al., 2020). Prices are sticky to allow an adjustment of real wages, because the labor supply decision is key when analyzing the allocation of hours worked in the home and the market sector.

The model matches German data on time use and income of HtM households and savers. I follow Zeldes (1989) and define HtM households in the data as households whose wealth is less than twice their monthly labor income. I find in that savers and HtM households allocate their time similarly between market work, home work and leisure. Furthermore, HtM households do not have capital income, and their hourly wage is lower than of savers. I include a productivity wedge across savers and HtM households in the model to match the income differences. The share of HtM households is 24 %. This finding is in line with Aguiar et al. (2024), who find that 23 % of households are HtM based on net wealth in the US. On top of the productivity difference across savers and HtM households, the two types of households have also different degrees of wage stickiness as in Komatsu (2023). The intuition for this calibration choice is that HtM households are usually low-skilled workers whose wages are more often set by unions, and wages set by unions have a larger degree of wage stickiness (see, e.g., Franz and Pfeiffer (2006) and Babecký et al. (2010)). Therefore, the adjustment costs parameter is higher for HtM households than for savers.

The transmission mechanism in the model works as follows. In response to a contractionary monetary policy shock of 100 basis points (annualized), output drops by 0.64 %.

Since wages are sticky, inflation and real wages fall only slightly. The large drop in output combined with a small decrease in real wages yields a decrease in real profits, which translates into a decrease in capital income of savers. All households reduce market labor supply, and increase labor supply in the home sector. However, HtM households decrease market hours and increase home hours to a greater extent than savers do. There are two reasons for that: First, HtM households cannot smooth consumption with financial markets, and second, they have worse conditions on the labor market as their hourly wage is lower and their wages are stickier. This differential allocation of time yields an relatively large increase in market consumption inequality, but a relatively small increase in total consumption inequality. Thus, the importance of the income channel is reduced, when taking into account home production. The inequality dynamics shape macroeconomic aggregates, as HtM households decrease their market labor supply to a greater extent, which yields a larger drop in their income and since they have higher marginal propensities to consume, also their market consumption then drops to a greater extent. The findings in the model are in line with empirical evidence. Coibion et al. (2017) find an increase in market consumption inequality in response to a monetary policy shock. Cacciatore et al. (2024) find that households adjust their hours worked in home production due to cyclical variations, and Aguiar et al. (2024) find that hours worked of HtM households are more volatile than of savers.

To disentangle the two effects why income of HtM households decreases by more than of savers, I compare the baseline model to a model variation, where the effect on labor income of both types of households is similar. I obtain this model by muting the productivity wedge and the heterogeneity in wage stickiness. In the resulting model, the only income difference across the two types of households is their source of income. The impulse response functions (IRFs) of this model version show that the responses of both types of households to the contractionary monetary policy shock are alike if their labor income reacts similarly. Thus, the result that HtM households use the home sector for consumption smoothing to a greater extent than savers do is mainly due to differences in labor market conditions. Empirically, it is still an open question which effect dominates. While Lenza and Slacalek (2024) find support for relatively larger heterogeneity in labor earnings, Coibion et al. (2017) find relatively large differences in the sources of income.

When comparing the baseline model to a model without home production, I find that in the model without home production, market consumption inequality is smaller. The reason is that if households cannot produce consumption goods at home, HtM households keep a higher level of market hours. However, the effect on total consumption inequality is larger, if households cannot smooth consumption with the home sector. When households keep a higher level of market hours, also market consumption falls by less, and therefore, the difference between capital and labor income is larger in the model without home production. Hence, the sources of income are relatively more important for the size of the income channel in a model without home production.

Literature. This paper is related to the empirical literature on how home production can be used for consumption smoothing. Cacciatore et al. (2024) look at the effects of macroeconomic uncertainty on time use, and they find that higher uncertainty leads to more home production, and that home production lowers market labor supply and precautionary savings. Aguiar and Hurst (2005) show empirically that households smooth consumption with home production in response to negative income shocks that arise due to retirement or unemployment. Burda and Hamermesh (2010) show that when unemployment is cyclically high, households offset the reduced market work by home production. Aguiar et al. (2024) find that hours worked in the market fluctuate more for HtM households than for savers. The theoretical results in this paper are in line with the existing empirical evidence on the allocation of time. Also in my model, hours worked of HtM households fluctuate to a greater extent as in Aguiar et al. (2024), and thus, HtM households smooth consumption with home production, similar to the result in Aguiar and Hurst (2005). Furthermore, all households substitute towards the home sector in response to cyclical fluctuations as in Cacciatore et al. (2024) and Burda and Hamermesh (2010). To the best of my knowledge, there is no empirical evidence on how monetary policy (and business cycle fluctuations in general) affects the allocation of time of rich and poor households.

This paper builds on the literature on home production brought forward by Becker (1965), and on home production in business cycle analysis introduced by Benhabib et al. (1991), Greenwood and Hercowitz (1991), and McGrattan et al. (1997). These papers show that home production matters for business cycle fluctuations, and building on that, there is a strand of literature on economic policy at business cycle frequency in a model with home production. Olovsson (2015) looks at optimal taxation and Gnocchi et al. (2016) analyze the size of the fiscal multiplier in a New Keynesian model with home production. Similar to this paper, also Aruoba et al. (2016) look at the interaction of monetary policy and home production. However, the focus in Aruoba et al. (2016) is on housing as a form of home capital, while I focus on hours worked in the different sectors. Furthermore, I add to the literature on home production in business cycle models by looking at the interaction of monetary policy and consumption inequality. This paper is closely related to the paper by Boerma and Karabarbounis (2021), who find that including home production in an otherwise standard Heterogeneous Agent New Keynesian (HANK) model results in larger inequality in standards of living. Their focus is on inequality in standards of living in general, while I look at the interaction of consumption inequality and monetary policy. This important difference could also explain the different results: while households might be in general more unequal when taking into account home production (as in Boerma and Karabarbounis (2021)), nevertheless, poor households could use home production for consumption smoothing, and thus, the change in inequality is smaller when taking into account home production (as this paper shows).

This paper further builds on the large literature on household heterogeneity, inequality and how this interacts with the macroeconomy. Among many others, Kaplan et al. (2018) and Auclert (2019) look at the interaction of monetary policy and inequality. Komatsu (2023) shows three distributional channels in a TANK model. McKay and Wolf (2023) show that the different channels through which monetary policy affects inequality cancel each other out, while Bayer et al. (2024) and Bilbiie et al. (2023) highlight the relevance of business cycle fluctuations for inequality and vice versa. Broer et al. (2020) discuss the monetary transmission mechanism in a HANK model with King-Plosser-Rebelo preferences. I add to the literature by looking at the interaction of monetary policy and inequality when taking into account home production.

Finally, this paper builds on Campbell and Mankiw (1989), who outline the existence of two types of households, one that smooths consumption, and another one that is borrowing constrained, and on Zeldes (1989), who develops a classification of HtM households. It further builds on Aguiar et al. (2024), who do an empirical investigation about HtM households. This paper adds to that literature by discussing the allocation of time of HtM households and savers.

The rest of the paper is organized as follows. Section 2 outlines the model, section 3 presents the data used for the calibration and the calibration itself, section 4 contains the main results, and section 5 discusses two model variations. Section 6 concludes.

2 A TANK model with home production

The model is a new Keynesian two agent (TANK) model with sticky prices and sticky wages that includes home production. Home production is modeled as in Gnocchi et al. (2016) to include consumption of home-produced goods and labor supply in the home sector on top of market consumption and market labor supply. The model further includes two types of households (as in, e.g., Debortoli and Galí (2024)). One type of household is assumed to be constrained with respect to asset market participation. Constrained households cannot save or borrow, and thus, live HtM. The other type of household can save or borrow, and is, thus, called saver. Household heterogeneity allows to look at inequality and the respective channels through which monetary policy affects inequality. Wages are sticky to avoid countercyclical profits that would yield large distributional effects that are not found in the data (see Broer et al. (2020)). On top of wages, also prices are sticky in the model. Sticky prices allow real wages to adjust, and this adjustment of real wages is important, since one focus of the paper is on labor supply.

2.1 Households

There is a continuum of households j, and two types of households – HtM households and savers – denoted by $z \in (h, s)$. Both types of households maximize lifetime utility. I follow Gnocchi et al. (2016) and specify households' preferences as in King et al. (1988) (KPR preferences for short),

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_{jt}^z, L_{jt}^z) = E_0 \sum_{t=0}^{\infty} \beta^t \frac{[(C_{jt}^z)^b (L_{jt}^z)^{1-b}]^{1-\sigma} - 1}{1-\sigma}, \tag{1}$$

where C_{jt}^z denotes consumption and L_{jt}^z leisure of household type z. The parameter b stands for the total consumption share, σ is the inverse of the inter-temporal substitution elasticity and β is the discount factor. KPR preferences are used in macroeconomic models, because they are in line with a balanced growth path. Furthermore, they allow an interaction of hours worked and consumption that is crucial for this paper, since I looks at how consumption and hours worked are reallocated across sectors.

Consumption consists of market consumption, C_{mjt}^z, and non-market consumption, C_{njt}^z, and is aggregated via a constant elasticity of substitution (CES) aggregation,

$$C_{jt}^z = [\alpha_1 (C_{mjt}^z)^{b_1} + (1-\alpha_1)(C_{njt}^z)^{b_1}]^{(1/b_1)}, \tag{2}$$

where $(1-b_1)^{-1}$ is the substitution elasticity between market and home consumption and α_1 is the market consumption share. Households allocate their time to market work, H_{mjt}^z, non-market work, H_{njt}^z, and leisure, L_{jt}^z. Time is normalized to 1, thus,

$$L_{jt}^z = 1 - H_{njt}^z - H_{mjt}^z. \tag{3}$$

Non-market consumption is not storable and produced according to a linear production function,

$$C_{njt}^z = H_{njt}^z. \tag{4}$$

While all households have the same preferences, there is a productivity wedge, ω, between HtM households and savers to match the data on income.[1] Effective market hours, M_{jt}^z, are thus given by

$$M_{jt}^s = H_{mjt}^s, \tag{5}$$

and

$$M_{jt}^h = \omega H_{mjt}^h, \tag{6}$$

where $\omega \in (0, 1]$.

When working in the market, households earn a nominal wage, W_{jt}^n, such that real wage is given by $W_{jt} = W_{jt}^n / P_t$. Each household j can choose its nominal wage, W_{jt}^n, subject to the labor demand of firms. When adjusting the wage, households pay Rotemberg-type adjustment costs. The budget constraint of savers is thus given by

$$\begin{aligned} P_t C_{mjt}^s + B_{jt}^s = & B_{t-1}^s(1 + i_{t-1}) + W_{jt}^n M_{jt}^s - \frac{\xi^s}{2}\left(\frac{W_{jt}^n}{W_{jt-1}^n} - 1\right)^2 W_{jt}^n M_{jt}^s \\ & - T_{jt} + \frac{1 - \tau_D}{1 - \psi} P_t D_t, \end{aligned} \tag{7}$$

where T_t are lump-sum taxes and transfers, B_t^s are nominal bonds, and D_t denotes real profits. Savers are assumed to own the firm, and thus, receive all profits. However, there is a capital tax, τ_D, that can redistribute profits from savers to HtM households. The share of HtM households is denoted by ψ. The size of the wage adjustment costs is given by ξ^z. The budget constraint of HtM households is given by

$$P_t C_{mjt}^h = W_{jt}^n M_{jt}^h - \frac{\xi^h}{2}\left(\frac{W_{jt}^n}{W_{jt-1}^n} - 1\right)^2 W_{jt}^n M_{jt}^h - T_{jt} + \frac{\tau_D}{\psi} P_t D_t. \tag{8}$$

Households maximize their life-time utility in equation (1) subject to the consumption aggregation in equation (2), total time endowment in equation (3), the production of home goods in equation (4), effective market hours in equation (5) or (6) respectively, the budget constraint in equation (7) or (8) respectively, and labor demand of firms in equation (16).

Only savers have an Euler equation, which is given by

$$\beta E_t\left(\frac{\lambda_{t+1}^s}{\lambda_t^s} \frac{R_t^n}{\Pi_{t+1}}\right) = 1, \tag{9}$$

where λ^s is the marginal utility of market consumption, R_t^n denotes the nominal interest

[1]See, e.g., Kaplan et al. (2018), however, in this model, the productivity difference is not stochastic but deterministic. As in standard TANK models, households cannot switch between being HtM and savers.

rate and $\Pi_t \equiv P_t/P_{t-1}$ is price inflation. HtM households consume their entire income each period,

$$C^h_{m,t} = W_t M^h_t + \frac{\tau_D}{\psi} D_t - \frac{T_t}{P_t}. \tag{10}$$

Non-market labor supply is the same for both types of households, and is given by

$$\frac{1-b}{b(1-\alpha_1)} \left(\frac{C^z_t}{C^z_{nt}}\right)^{b_1} = \frac{L^z_t}{H^z_{nt}}. \tag{11}$$

Both types of households choose their optimal wage according to the following wage Phillips curves

$$\begin{aligned} &\epsilon_w MRS^z_t \frac{1}{W_t} + (1-\epsilon_w) - \xi^z \left(\Pi^w_t - 1\right)\left(\Pi^w_t + \frac{1-\epsilon_w}{2}\left(\Pi^w_t - 1\right)\right) \\ &+\beta \frac{U_{C^z_{t+1}}}{U_{C^z_t}} \left(\frac{\partial C^z_t}{\partial C^z_{mt}}\right)^{-1} \left(\frac{\partial C^z_{t+1}}{\partial C^z_{mt+1}}\right) \left(\Pi_{t+1}\right)^{-1} \xi^z \left(\Pi^w_{t+1} - 1\right)\left(\Pi^w_{t+1}\right)^2 \frac{M^z_{t+1}}{M^z_t} = 0, \end{aligned} \tag{12}$$

where W_t is the aggregate wage rate, $\Pi^w_t \equiv W_t/W_{t-1}$ is wage inflation, and MRS^z_t is the marginal rate of substitution between leisure and consumption.

The accounting identity of the different types of inflation is given by

$$\frac{W^n_t/P_t}{W^n_{t-1}/P_{t-1}} = \frac{W_t}{W_{t-1}} = \frac{\Pi^w_t}{\Pi_t}. \tag{13}$$

2.2 Firms

There is a continuum of monopolistically competitive firms denoted by i. Firm i produces output, $Y_t(i)$, according to a linear production function,

$$Y_t(i) = M_t(i), \tag{14}$$

where $M_t(i)$ is labor of firm i aggregated over households j, the labor aggregation index is given by

$$M_t(i) \equiv \left(\int_0^1 M_t(ij)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj\right)^{\frac{\epsilon_w}{\epsilon_w - 1}}, \tag{15}$$

where ϵ_w is the substitutability of differentiated labor. The firm takes wages as given, and thus, the labor demand equation of firm i is given by

$$M_{jt}(i) = \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w} M_t(i), \tag{16}$$

where the aggregate wage index is given by

$$W_t^n \equiv \left(\int_0^1 W_t^n(j)^{1-\epsilon_w} dj \right)^{\frac{1}{1-\epsilon_w}}. \tag{17}$$

I derive the labor demand equation in Appendix C.1.

There is monopolistic competition on the goods market and each firm sets its price as in Calvo (1983). Aggregate output, Y_t, the aggregate price level, P_t, and aggregate consumption of household j, $C_t(j)$, are defined as follows,

$$Y_t \equiv \left(\int_0^1 Y_t(i)^{\frac{\epsilon_p-1}{\epsilon_p}} di \right)^{\frac{\epsilon_p}{\epsilon_p-1}}, \tag{18}$$

$$P_t \equiv \left(\int_0^1 P_t(i)^{1-\epsilon_p} di \right)^{\frac{1}{1-\epsilon_p}}, \tag{19}$$

and

$$C_t(j) \equiv \left(\int_0^1 C_t(ij)^{\frac{\epsilon_p-1}{\epsilon_p}} di \right)^{\frac{\epsilon_p}{\epsilon_p-1}}, \tag{20}$$

where $\epsilon_p > 1$ is the elasticity of substitution between differentiated market consumption goods. The goods demand constraint of firm i is given by

$$Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\epsilon_p} Y_t^d, \tag{21}$$

where Y_t^d is aggregate demand.

Firm i's real marginal costs, $MC_t(i)$, are given by

$$MC_t(i) = \frac{W_t M_t(i)}{Y_t(i)}. \tag{22}$$

Optimal price setting is described by the ratio of the two auxiliary variables, $x_{t,1}$ and $x_{t,2}$,

$$\frac{P_t^*}{P_t} = \frac{x_{1,t}}{x_{2,t}}, \tag{23}$$

where P_t^* is the optimal price and the auxiliary variables are given by

$$x_{1,t} = [C_{m,t} + G_t] \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) MC_t + \beta\theta E_t \left(\frac{\lambda_{t+1}^s}{\lambda_t^s} (\Pi_{t+1})^{\epsilon_p} x_{1,t+1} \right), \tag{24}$$

and

$$x_{2,t} = [C_{m,t} + G_t] + \beta\theta E_t \left(\frac{\lambda^s_{t+1}}{\lambda^s_t} (\Pi_{t+1})^{\epsilon_p - 1} x_{2,t+1} \right), \tag{25}$$

where G_t denotes government spending, $C_{m,t}$ is aggregate market consumption and θ denotes the Calvo parameter. Savers own the firms, and thus, λ^s_t is the savers' marginal utility of market consumption. The relation between inflation and the relative price charged by re-optimizing firms is given by

$$\frac{P^*_t}{P_t} = \left(\frac{1 - \theta(\Pi_t)^{\epsilon_p - 1}}{1 - \theta} \right)^{\frac{1}{1-\epsilon_p}}. \tag{26}$$

2.3 Government

Fiscal spending, G_t, and net taxes, T_t, are zero,

$$G_t = T_t = 0. \tag{27}$$

The central bank sets the nominal interest rate according to a Taylor rule,

$$R^n_t = \beta^{-1} \Pi_t^{\phi_\pi} e^{\nu_t}, \tag{28}$$

where R^n_t denotes the nominal interest rate, $\phi_\pi > 1$ is the reaction of the central bank to inflation, and ν_t is a monetary policy shock. The shock process is given by

$$\nu_t = \rho_\nu \nu_{t-1} + \epsilon^\nu_t, \tag{29}$$

where ρ_ν denotes the persistence of the shock and ϵ^ν_t is white noise.

2.4 Aggregations

The different types of consumption and labor of households are aggregated as follows,

$$
\begin{aligned}
C_{m,t} &= (1-\psi)C^s_{m,t} + \psi C^h_{m,t} = \int_0^1 C_{m,t}(j)dj, \\
C_{n,t} &= (1-\psi)C^s_{n,t} + \psi C^h_{n,t} = \int_0^1 C_{n,t}(j)dj, \\
C_t &= (1-\psi)C^s_t + \psi C^h_t = \int_0^1 C_t(j)dj, \\
H_{m,t} &= (1-\psi)H^s_{m,t} + \psi H^h_{m,t} = \int_0^1 H_{m,t}(j)dj, \\
H_{n,t} &= (1-\psi)H^s_{n,t} + \psi H^h_{n,t} = \int_0^1 H_{n,t}(j)dj, \\
H_t &= (1-\psi)H^s_t + \psi H^h_t = \int_0^1 H_t(j)dj, \\
M_t &= (1-\psi)M^s_t + \psi M^h_t = \int_0^1 M_t(j)dj,
\end{aligned}
$$

where $C^s_{m,t}$ and $C^h_{m,t}$ are per capita market consumption of savers and HtM households. $C_{m,t}$ denotes total market consumption, which is the sum of market consumption of all savers and all HtM households, i.e., $(1-\psi)C^s_{m,t} + \psi C^h_{m,t}$. Total market consumption further is market consumption aggregated over all households j, and thus, it holds that $C_{m,t} = \int_0^1 C_{m,t}(j)dj$. The remaining variables for consumption and hours worked are aggregated in the same way.

2.5 Market clearing

For the goods market to clear, it must hold that

$$Y_t(i) = C_{m,t}(i) = \int_0^1 C_{m,t}(ij)dj. \tag{30}$$

The goods market clearing condition is given by

$$Y_t = Y^d_t = C_{m,t} + Y_t\psi\frac{\xi^s}{2}(\Pi^w_t - 1)^2 + Y_t(1-\psi)\frac{\xi^h}{2}(\Pi^w_t - 1)^2. \tag{31}$$

The labor market clears when

$$M_t = \int_0^1 M_t(i)di = \int_0^1 \left(\int_0^1 M_t(ij)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj\right)^{\frac{\epsilon_w}{\epsilon_w - 1}} di, \tag{32}$$

where $M_t(ji)$ is the demand from firm i for labor of type j, and $M_t(j)$ is labor supply of household j.

3 Data and calibration

I calibrate the model using data from the German Socioeconomic Panel (SOEP), and I find that HtM households and savers allocate their time similarly between leisure, market and non-market work. This is in line with Boerma and Karabarbounis (2021), who look at data from the American Time Use Survey, and do not find a negative correlation between wages and time spent on home production. In 2017, in Germany, 24% of households are HtM according to the definition by Zeldes (1989). This is in line with Aguiar et al. (2024), who find that 23 % of households between 1999 and 2019 in the US are HtM using the same definition. Furthermore, HtM households have no capital income and lower hourly wage. I calibrate the model such that in matches the allocation of time and the differences in income across the two groups of households.

3.1 Data

I use data from the SOEP, which is a yearly panel survey with around 20,000 households in Germany since 1984. The survey includes data on individuals and households, and it allows to match each individual to the corresponding household. Data on wealth is collected every 5 years.[2] In the context of my research question, the key variables are time use, income and wealth. With data on time use, I infer consumption of home produced goods, and wealth and income are necessary for the classification of HtM households and savers. The individual level data contains time allocation and wages, and the household level data contains capital income. Since the SOEP is a probability-based sample, I can calculate descriptive statistics of the entire population.

Construction of variables. There are nine categories of time use in the SOEP, I follow Aguiar and Hurst (2016) and classify them into six categories of time use as summarized in table 1. Some activities are not captured in the SOEP, thus, time use does not sum up to 24 hours. I calculate the average values for each individual in an entire week, and then I calculate the average at the household level.

[2] The first time was in 2002. After collecting the wealth data in 2017, it was collected again in 2019 for administrative reasons. The latest wealth data collection was in 2024, but this data is not yet available at the current point in time.

Table 1: Time use variables

Time use categories following Aguiar and Hurst (2016)	Corresponding variables in the SOEP
Market work	• Market work
Job search	• N/A
Childcare	• Childcare
Non-market work (core home production, activities related to home ownership, obtaining goods and services, and care of other adults)	• Errands (shopping, trips to government agencies, etc.) • Housework (washing, cooking, cleaning) • Care and support for persons in need of care • Repairs on and around the house, car repairs, garden work
Leisure	• Physical activities (sports, fitness, gymnastics) • Other leisure activities and hobbies
Other (such as education, health care, religion)	• Education or further training (also school, university)

I follow Zeldes (1989) for the classification of HtM households and savers. HtM households are households whose "net worth is less than two months of its labor earnings". Kaplan et al. (2014) find that there are also wealthy HtM households, i.e., households with low or negative liquid savings. I abstract from wealthy HtM households in the model, and therefore, I also do not identify them in the data. The empirically identified HtM households in this paper refer to HtM households based on low net worth. Including wealthy HtM households into a TANK model would yield a higher share of HtM households, and this would not affect the differences between HtM households and savers. However, the aggregate results would look a bit more like the results for HtM households if their population shares would be higher.

Capital income is the sum of interest income from securities and income from rents and lease net of maintenance costs and interest payments. To calculate hourly wage, I use actual working hours, since this gives the most accurate hourly wage. When it comes to time allocation, I use the variable for market work that also includes the commute (in line with Aguiar and Hurst (2016)).

Data clearance. I do the following four data selections to obtain a dataset that fits with my research question. First, I only include observations without missing entries wealth, income and time use. Second, wealth and wages are trimmed at the 1st and the 99th percentile (since especially survey data is prone to intentionally or unintentionally wrong answers). Third, I only look at the working age population, i.e., individuals aged between 25 and 60. Fourth, I exclude all individuals whose time spent on leisure, market work, non-market work and education and training exceeds 16 hours per day,[3] and I only include individuals who spend time on non-market work and leisure at all.

Table 2 summarizes the three different selections of households. The focus in this paper

Table 2: Processed selections of households (HH)

HH version no.	Market work	All adult HH members in the dataset?
1 (baseline)	all adult HH members	Yes
2	at least one adult HH member	Yes
3	at least one adult HH member	No

is on workers, and on how home production can offset or exacerbate differences in labor earnings. Thus, version one is the baseline selection. This selection includes working households, that is single households and dual earner households where both spouses are working in the market and the non-market sector to capture the trade-off between working at home and in the market. Furthermore, I look at households rather than individuals, since home produced goods and wealth is usually shared across all household members. To ensure that these criteria hold for all household, I exclude households where the partner is missing in the data. Reasons why the partner is missing in the data are for example because he or she is not of working age, or already retired.

I do a couple of robustness checks, and all yield similar results. To be precise, I do a

[3]E.g., see Ehrenberg and Smith (2012), who argue that individuals need at least 8 hours a day for "eating, sleeping and otherwise maintaining" herself/himself (page 170 in Edition 11).

second version of the household dataset where at least one household member works in the market, a third version that includes also incomplete households, and I analyze individuals.

Descriptive statistics. Table 3 presents the number of observations in the raw dataset and in the processed selections. Almost half of the excluded observations are due to missing

Table 3: Observations in the SOEP in 2017

	Raw	Processed selection
Households	19,763	Version 1: 3,727 Version 2: 4,170 Version 3: 7,121
Individuals	32,485	8,986

Source: SOEP, DOI: 10.5684/soep.v37.

values in wealth and time use, or due to an unrealistically high amount of total time. Furthermore, numerous individuals are not in the working age. Relatively few observations are excluded because individuals of working age do not work. In version one and two, numerous households are excluded because they are incomplete.

3.2 Empirical evidence

Table 4 presents the unconditional mean time allocation of HtM households and savers in Germany in 2017 of the baseline selection.[4] Net wage and net wealth is used to categorize the HtM households and savers. Thus, by construction, these two values differ across the two groups. HtM households have, on average, less labor income and are indebted. The share of HtM households in the working population is 24%. This number is in line with Aguiar et al. (2024), who find that 23 % are HtM based on net worth in the US between 1999 and 2019.

Non-market work is the sum of childcare and housework, as also in the model, there are only three categories of time use. This is a common simplification in the theoretical literature, since both fit to the definition of home production that one could pay somebody else to do it for him or her. Yet, Guryan et al. (2008) show that child care and non-market work differ substantially, since parents enjoy spending time with there children more than people generally enjoy doing housework. Furthermore, the authors argue that time spent on childcare rises with income, whereas time spent on housework falls. However, calibrating my

[4]In Appendix A, I present the results of individuals, different household selections, the median values and values from 2012. All versions yield similar results.

Table 4: Time allocation of savers and HtM households

	HtM	Savers
Net wealth (Euro)	-1,500	140,400
Net wage monthly (Euro)	1,500	2,000
Net wage hourly (Euro)	9	12
Population share	24 %	76 %
Market work (hours per day)	6.6	6.4
Leisure (hours per day)	2.5	2.3
Non-market work (hours per day)	2.5	2.9
Childcare (hours per day)	0.3	0.4
Housework (hours per day)	2.2	2.5
Market work (hours per *week*day)	8.5	8.5
Leisure (hours per *week*day)	2.1	1.9
Non-market work (hours per *week*day)	2.4	2.6
Childcare (hours per *week*day)	0.2	0.3
Housework (hours per *week*day)	2.2	2.3
Age	41	47
Share minor kids in household	15 %	21 %
No. of minor kids	0.2	0.3
Share cohabiting	17 %	41 %
Home help costs monthly (Euro)	2	7
Capital income monthly (Euro)	0	9
Share home owners	2 %	53 %
Share home paid	26 %	43 %
Home repayment (Euro)	430	500
Rent monthly (Euro)	460	490

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) German data from 2017.

model to the time use of HtM households and savers without taking into account childcare yields similar results, because only around 20 % of households have minor kids.

On weekdays, i.e., from Monday to Friday, the allocation of time of rich and poor across market work, homework, and leisure is almost identical. This finding is somewhat surprising, because savers have higher wages than HtM households, so one could expect that they specialize in market-work, while HtM households would spend more time on non-market work. The similar allocation of time across savers and HtM households is in line with Boerma and Karabarbounis (2021), who look at data from the American Time Use Survey, and conclude that there is no negative correlation between wages and time spent in home production. Home help costs are negligible for both types of households, thus, there is no large outsourcing of non-market work for neither of the two.

When including the weekend, rich households even spend slightly more time on non-market work than poor households, while they spend less time on leisure. The difference in non-market work is 24 minutes, and the difference in market work is 12 minutes. These differences persist even if I compare savers and HtM households without kids (see Appendix A table 11). It is puzzling that savers do overall more non-market and enjoy less leisure than HtM households. However, it is somewhat intuitive that these differences arise on the weekend, since there is less trade-off between market and non-market work during weekends. To understand these findings better, one would have to do a more profound conditional analysis of differences in time use across the two groups.

Monthly capital income as expelled in table 4 is negligible for both types of households. The capital income includes interest income from assets and income from renting and leasing less the interest and maintenance costs. However, savers have high wealth on average. The high share of home-owners among savers combined with low capital income despite a high amount of net wealth indicates that most of the wealth is owner-occupied housing. Therefore, I include owner-occupied housing into capital income when calibrating the model. To be precise, I add the saved rent to capital income, i.e., I multiply the share of home-owning savers with the rent paid by renting savers. On average, capital income of savers is then 270 Euro, which is 13 % of their labor income. The share of home-owners across HtM households is so small that capital income remains negligible. The difference in capital income between the two groups of households is then sizable. Adding the saved rent to capital income may seem problematic when a large share of households (57 %) still repays their house, and thus, has monthly home repayment costs (500 Euro). However, the home repayment costs lead to capital accumulation, whereas rent payment does not, so I treat rent payment and home repayment differently.

3.3 Calibration

Table 5 presents the calibration of the model. The discount factor is calibrated to 0.99, it gives a steady state interest rate of 1 %. The inverse elasticity of substitution is calibrated to match the wealth effect on private market consumption in the data. I follow Gnocchi et al. (2016) and set it to 2. For the elasticity of substitution between market and non-market consumption goods, I choose $b_1 = 0.5$ as it lies between estimates in the literature. Chang and Schorfheide (2003) estimate this parameter as 0.57, while McGrattan et al. (1997) find 0.429. This calibration yields a substitution elasticity of $(1 - b_1)^{-1} = 2$. I use the SOEP data presented in table 4 to calibrate the market consumption share, the total consumption share, the productivity wedge and the share of HtM households. The market consumption

Table 5: Calibration

Parameter	Description	Value
Households		
β	Discount factor	0.99
σ	Inverse of the elasticity of inter-temporal substitution	2
$(1-b_1)^{-1}$	Elasticity of substitution between market and non-market consumption goods	2
b	Total consumption share	0.82
α_1	Market consumption share	0.7
ω	Productivity wedge	0.75
τ_D	Redistribution of capital income	0
ψ	Share HtM households	0.24
Price and wage rigidities		
θ	Calvo parameter for prices	0.75
ϵ_p	Elasticity of substitution between different types of market consumption goods	9
ϵ_w	Elasticity of substitution between different types of labor	6
ξ^h	Stickiness of wages HtM households	1070
ξ^s	Stickiness of wages savers	430
Monetary policy		
ϕ_π	Inflation feedback Taylor Rule	1.5
ρ_ν	Persistence of monetary policy shock	0.5

share, α_1, is set to 0.7 to match the average market to non-market work ratio in the data. The total consumption share, b, is set to 0.82 to match the average work to leisure ratio in the data. I use the productivity wedge to match the labor income differences in the data. Hourly wage of savers is 12 Euro and of HtM households it is 9 Euro, yielding a productivity wedge, ω, of 75%. Capital income of HtM households is almost zero in the data. Thus, I set the capital tax to zero, such that all capital income goes to savers. The share of HtM households in the model and in the data is $\psi = 0.24$.

I follow Komatsu (2023) and choose different degrees of wage stickiness for savers and HtM households. As HtM households are usually low-skilled workers (in line with their lower hourly wage), their wages are more often negotiated through labor unions. These wages are typically stickier (see, e.g., Franz and Pfeiffer (2006), and Babecký et al. (2010)). As in Komatsu (2023), I calibrate the probability that wages are not renegotiated of savers to 3/4 and of HtM households to 5/6. This corresponds to Rotemberg adjustment costs of

$\xi^h = 1070$ for HtM households and $\xi^s = 430$ for savers.[5]

As in Galí (2015), I calibrate the Calvo parameter, θ, to 0.75, according to the average duration of a price of four quarters, the substitution elasticity of differentiated labor, ϵ_w, to 6 and the elasticity of substitution between market consumption goods, ϵ_p, to 9. The inflation feedback of the Taylor rule is calibrated to 1.5 and the persistence of the monetary policy shock calibrated to 0.5.

Steady state. Table 6 presents the steady state time allocation of HtM households and savers. It shows that the model matches the data well. However, in the data, savers work a

Table 6: Time allocation in the model and in the data

	HtM		Savers	
	data	model	data	model
market work	57%	56%	55%	55%
non-market work	22 %	24%	25%	22%
leisure	22 %	20%	20%	23%

Sources: own calculations and table 4.

bit more at home than HtM households do, while the model predicts that they work less at home than HtM households, because savers have a higher hourly wage. The time difference between the model and the data in non-market work of the two types of households is 14 minutes. Furthermore, savers have slightly less leisure time than HtM households in the data. The model predicts the opposite, because savers also have capital income, and thus, could enjoy more leisure compared to HtM households, while consuming the same amount of market consumption goods. The time difference between model and data in leisure of savers is 21 minutes, and of HtM households it is 14 minutes.

As discussed above, the empirical finding that savers spent less time on leisure and more time on non-market work compared to HtM households is somewhat puzzling. One would have to introduce heterogeneous preferences to rationalize this finding in a model. However, it does not seem important for the dynamic responses of the model, as leisure reacts relatively little to a contractionary monetary policy shock (as shown in section 4, panel 2c).

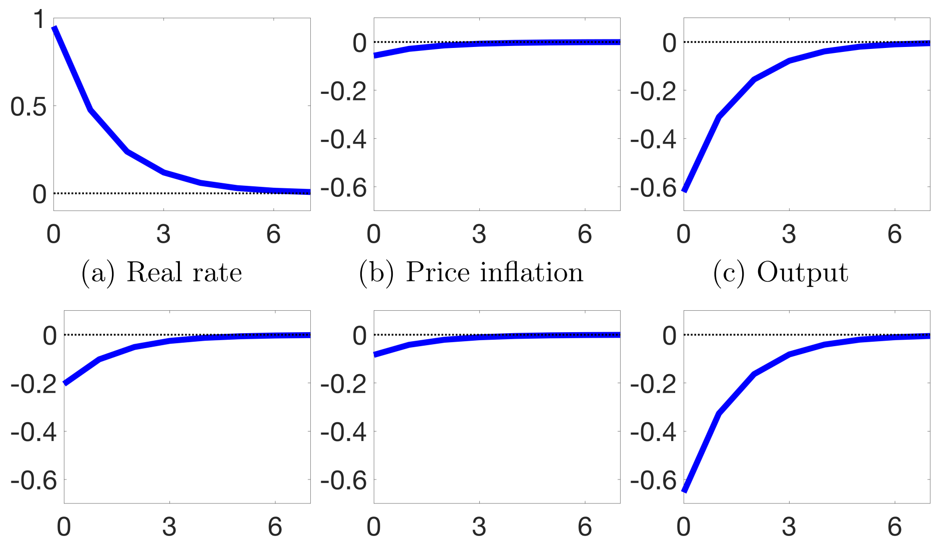
The steady-state labor income ratio, i.e., the income of HtM households relative to savers, is 0.76 in the model and 0.75 in the data. The total income ratio is 0.61 in the model and 0.66 in the data. Thus, the model predicts a larger total income ratio, because the capital income is slightly larger in the model than in the data.

[5] See Appendix B for details.

4 Results

Aggregate results. Figure 1 shows the IRFs to a contractionary monetary policy shock of 100 bp annualized. The monetary transmission mechanism in the model is in line with

Figure 1: Aggregate results



(a) Real rate (b) Price inflation (c) Output

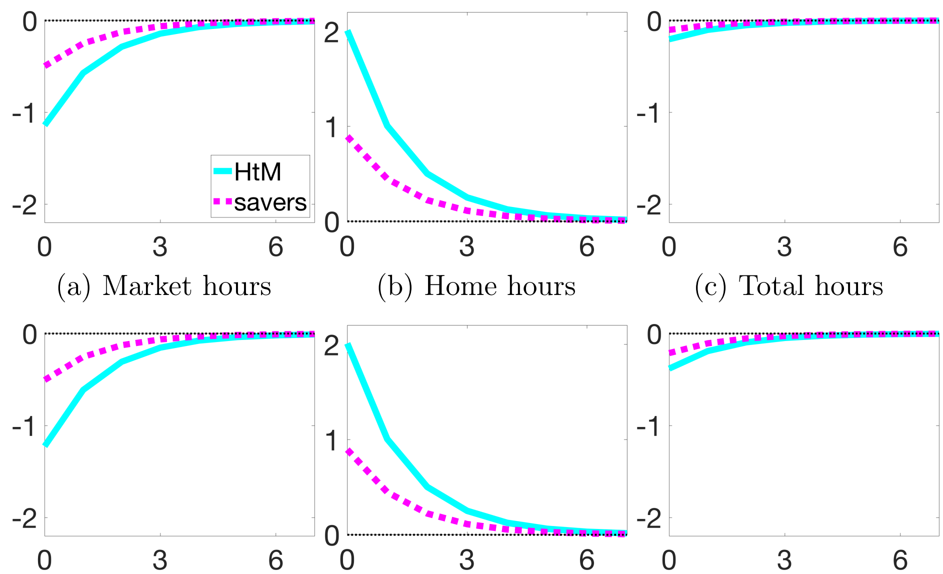
(d) Real profits (e) Real wage (f) Market hours

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly, rates are in pp deviations and all other variables in % deviations from the steady state, (iii) inflation and interest rates are annualized.

the empirical evidence (see, e.g., Christiano et al. (2005)). Output drops by 0.64% (see panel 1c). The possibility that households can produce consumption goods at home yields a larger decrease in output compared to a model without home production. The reason is that the decrease in wages leads to a large decrease in hours worked in the market and thus, to a large decrease in output. In section 5.2 I compare this model to a model without home production to illustrate the effect of home production on the results. A substitution away from the market and towards home production due to cyclical variation is also empirically documented by Cacciatore et al. (2024), who find that households increase housework when macroeconomic uncertainty increases. Annualized inflation decreases by 0.05% (see panel 1b). The wage stickiness in the model yield the relatively small response of inflation. Panel 1e shows that wages fall only slightly in response to the shock, while hours work drop substantially (see panel 1f), and therefore, profits decrease (see panel 1d). The contractionary monetary policy shocks yields an increase in the real interest rate (see panel 1a), which incentivizes savers to reduce market consumption and increase their savings. HtM households do not react to a change in the real interest rate, since they consume their entire income every period by assumption.

Distributional effects. Figure 2 shows the IRFs of the consumption and hours worked responses of savers and HtM households. Both types of households substitute away from

Figure 2: Distributional effects



(a) Market hours (b) Home hours (c) Total hours

(d) Market consumption (e) Home consumption (f) Total consumption

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly and in in % deviations from the steady state.

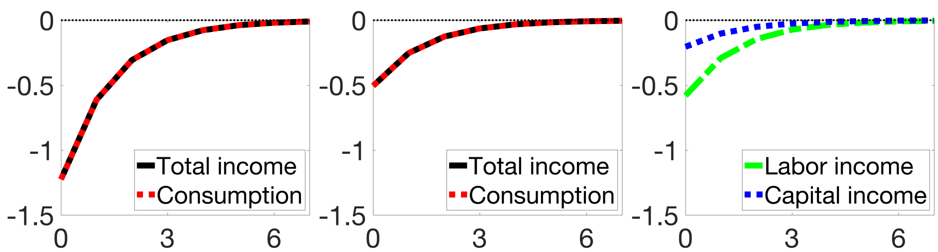
the market, i.e., market consumption decreases (see panel 2d), while home consumption increases (see panel 2e). For both types of households, market consumption goods become relatively more expensive, since wages fall and inflation falls only slightly. The decrease in market consumption combined with an increase in non-market consumption is more pronounced for HtM households. Home production gives an additional consumption smoothing possibility, and HtM households use it to a greater extent. When only looking at the market consumption response, one would conclude a relatively large drop in consumption for both types of households, and also a large increase in inequality in response to a monetary policy shock. However, panel 2f shows that the decrease in total consumption is much smaller for both types of households, i.e., total consumption of savers decreases by 0.2 % and of HtM households by 0.35 %. Thus, the difference between HtM households and savers is only 0.15 pp, while the difference in market consumption is 0.74 pp. The decrease in total hours is small (see panel 2c), and therefore, the effects on leisure are small.

The increase in market consumption inequality in response to a monetary policy shock (as indicated in panel 2d) is in line with empirical evidence (see, e.g., Coibion et al. (2017), Lenza and Slacalek (2024), and Mumtaz and Theophilopoulou (2017)). Also a larger decrease in market consumption of HtM households than of savers is in line with empirical evidence, as for example Aguiar et al. (2024) find that spending of HtM households is more volatile than of savers. The small effect on leisure matches the empirical evidence in Cacciatore et al. (2024), who find that the cyclical effects on leisure time are modest.

A key parameter in the model is the elasticity of substitution between goods bought on the market and produced at home. However, even if this elasticity is calibrated to a very low value, i.e., $b_1 = 0.1$, HtM households still reallocate hours towards the home sector to a greater extent than savers. Yet, there is then less reallocation of hours worked towards the home sector for both types of households and the differences across the two types of households are less pronounced.[6]

Labor income, capital income and total income. Figure 3 shows the changes in income and market consumption of HtM households and savers. The decrease in income of

Figure 3: Incomes and Market Consumption



(a) HtM households (b) Savers (c) Savers

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly and in in % deviations from the steady state.

HtM households is equivalent to the decrease in consumption (see panel 3a). The reason is that HtM households consume their entire income every period by assumption. Furthermore, they have only labor income, so their total income is the same as their labor income. Savers could save or borrow assets, and thus, their change in income could differ from their change in market consumption. However, in this model, also savers decrease their market consumption as much as their income decreases. Total income of savers decreases by much less than total income of HtM households, and this is due to two reasons: First, savers have capital and labor income, and capital income decreases by less than labor income (see panel 3c). Second, the change in labor income is different across savers and HtM households, because wages of HtM households have a higher degree of wage stickiness, and their hourly wage is lower. In section 5.1, I disentangle these two effects by comparing the baseline model to a model with

[6]See Appendix D.

homogeneous wage stickiness and without a productivity wedge. Hence, the effect on labor income is the same for both types of households in this model version.

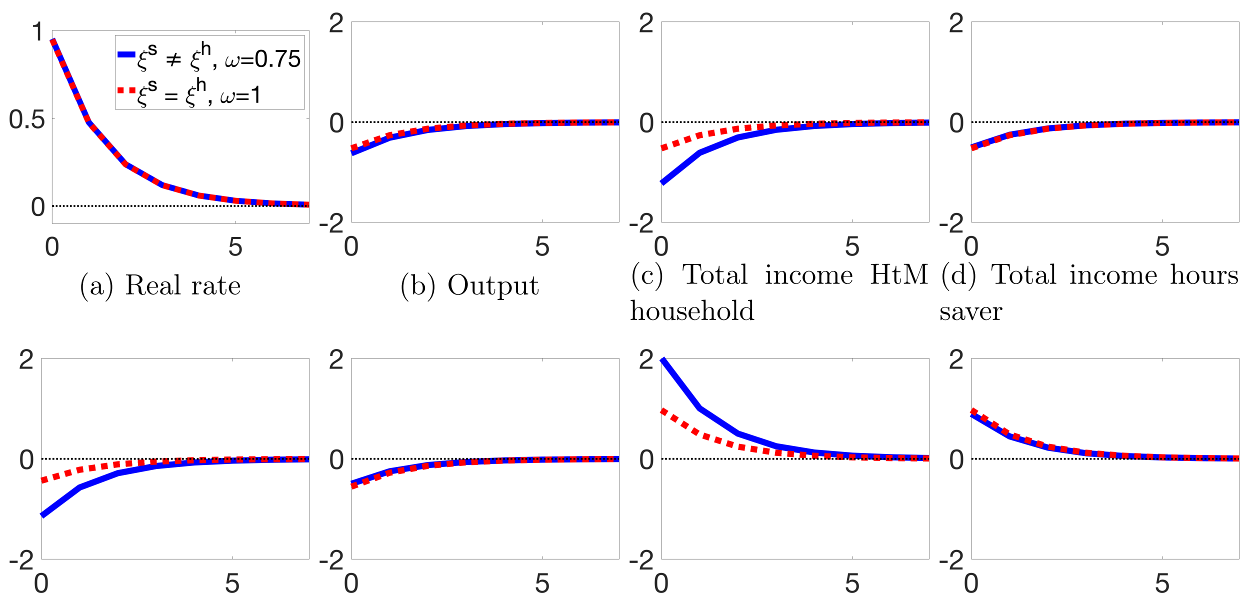
There is empirical evidence for both effects. Lenza and Slacalek (2024) find effects of monetary policy on inequality due to differences in labor earnings, while Coibion et al. (2017) find effects of monetary policy on inequality due to different income sources.

5 Model variations

5.1 A model with similar effects on both labor incomes

I now compare the results of the baseline model with a model where the effect on labor income of both types of households is similar. This comparison allows me to to disentangle the two effects of the income channel. In the baseline model, there are differences in the

Figure 4: Results with and without heterogeneous wage stickiness



(a) Real rate (b) Output (c) Total income HtM household (d) Total income hours saver

(e) Market hours HtM household (f) Market hours saver (g) Non-market hours HtM household (h) Non-market hours saver

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly, rates are in pp deviations and all other variables in % deviations from the steady state, (iii) inflation and interest rates are annualized.

change in income across the two types of households because they have different income sources and because their labor income reacts differently. I obtain a model where the effect on the labor income of both types of households is similar by muting the productivity wedge and the heterogeneity in wage stickiness. To be precise, I set the parameter of the adjustment costs of HtM households, ξ^h, to the same value as of savers, i.e., $\xi^h = \xi^s = 430$. The value corresponds to a probability of 1/4 that wages are renegotiated in one quarter. I further set the productivity wedge, ω, to one. The resulting difference in the responses of income is only due to different sources of income.

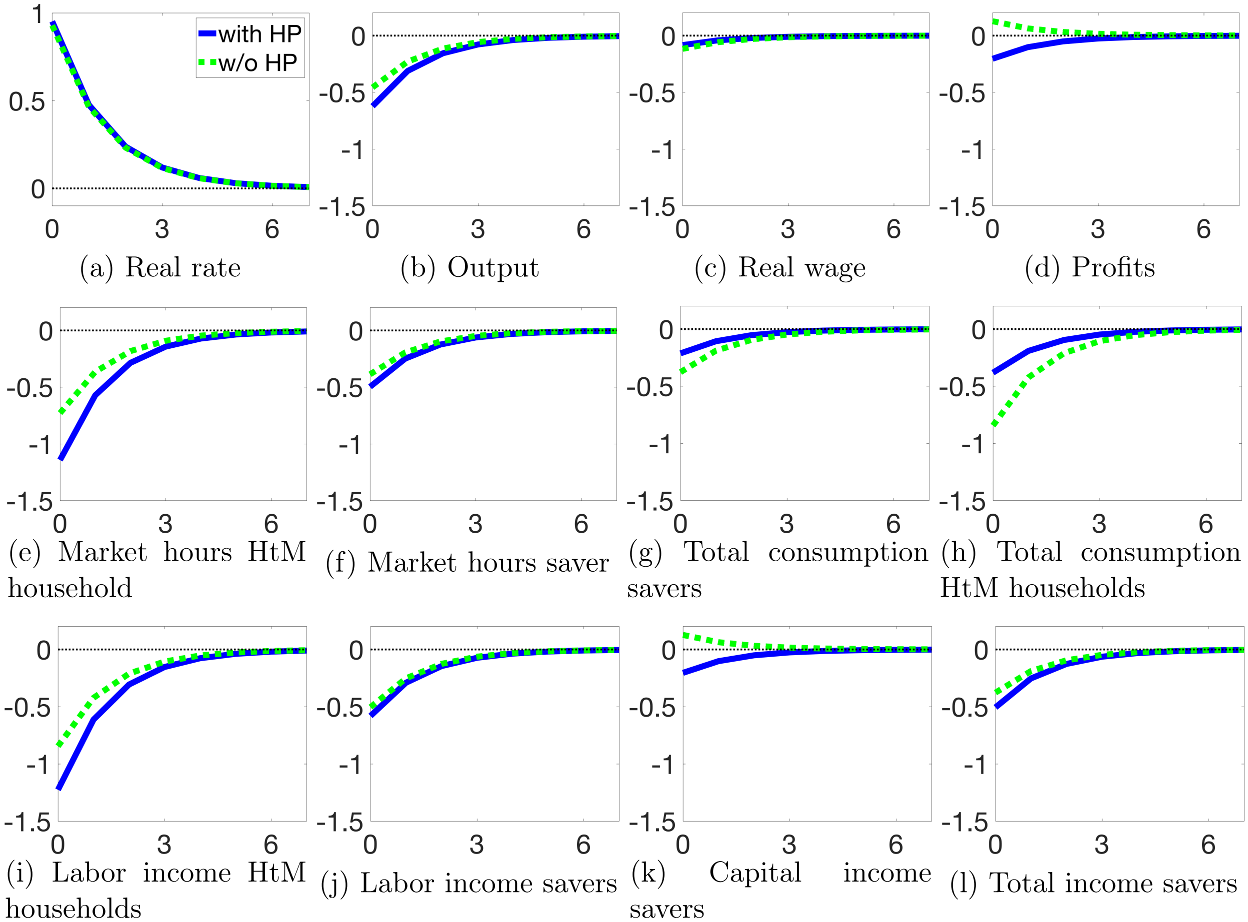
Figure 4 shows the results. The IRFs of savers are similar, since their degree of wage stickiness and their hourly wage did not change. Also the aggregate IRFs are similar, since savers represent 76 % of all households. HtM households decrease their market hours by much less, and analog to this, they also increase their non-market hours by much less in the model with similar effects on labor incomes. The resulting responses of HtM households are very similar to the responses of savers. This model comparison illustrates that the differences in labor income across the two types of households are more relevant for the size of income channel, and also for the result that HtM households use home production for consumption smoothing to a greater extent.

5.2 A model without home production

To illustrate the role of home production, I compare the model with home production to a model without it. I obtain a model without home production by setting the market consumption share and the elasticity of substitution between different types of consumption goods to one, i.e., $\alpha_1 = 1$ and $b_1 = 1$, which yields $C_t = C_{m,t}$. When households divide their time only between leisure and market work, the total consumption share, b, that matches the data decreases to 0.7 (cp. $b = 0.82$ in the model with home production).

Figure 5 shows the results of the model without home production (green dotted lines) compared to the model with home production (blue solid lines). The decrease in output is more pronounced in the model with home production, because households substitute away from the market and towards home production. Whereas in the model without home production, the decrease in market hours is similar to the decrease in total consumption, and therefore, households decrease market hours to a smaller extent. Real wages decrease slightly more in the model without home production, yielding a small increase in profits. Comparing the response of market hours of savers and HtM households underlines again that HtM households use home production as an additional smoothing opportunity to a greater extent than savers. Savers decrease market hours by 0.51 % in the model with home production and by 0.39 % in the model without home production. This difference is much more pronounced for HtM households, they decrease market hours by only 0.73 % in the model without home production, and by 1.18 % in the model with home production. Therefore, also total consumption (i.e., market and non-market consumption in the model with home production and market consumption in the model without home production) of

Figure 5: Results with and without home production



(a) Real rate (b) Output (c) Real wage (d) Profits

(e) Market hours HtM household (f) Market hours saver (g) Total consumption savers (h) Total consumption HtM households

(i) Labor income HtM households (j) Labor income savers (k) Capital income savers (l) Total income savers

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly, rates are in pp deviations and all other variables in % deviations from the steady state, (iii) inflation and interest rates are annualized.

HtM households decreases to a much greater extent in the model without home production.

In the model without home production, total income of savers decreases by less, which is due to the slightly smaller decrease in labor income of savers, but mostly due to the small increase in profits. Thus, the effect that households have different sources of income is more pronounced in the model without home production, yielding larger total consumption inequality. Whereas in the model with home production, the effect that households have differences in labor earnings drives the size of the income channel. Empirically, it is an open question which effect is more important. Lenza and Slacalek (2024) find that the effects of monetary policy on inequality are mainly due to differences in labor earnings, while Coibion et al. (2017) find that the different income sources are more important.

6 Conclusion

A large literature in macroeconomics looks at the effects of monetary policy on consumption inequality. To the best of my knowledge, this paper is the first one to look at the effects of monetary policy on consumption inequality when taking into account home production. Similar to precautionary savings and the financial market, also home production can work as a consumption smoothing device. Home production is relevant for the analysis of inequality and macroeconomics, because it is large for all households, it affects total consumption and it affects key macroeconomic variables such as hours worked, and thereby, output.

I built a TANK model with home production that matches German data on time allocation and income. Through the lens of the model, I find that in response to a contractionary monetary policy shock, inequality in total consumption increases to a smaller extent than inequality in market consumption. The reason is that mainly HtM households reallocate hours worked towards the home sector, and thus, smooth total consumption with home-produced goods. The resulting income channel is smaller when taking into account consumption of home-produced goods. To take a stand on the overall effect of monetary policy on consumption inequality when taking into account home production, one would have to carefully study how all other channels are affected by home production.

In future research, I aim to analyze empirically, how savers and HtM households reallocate their time in response to a monetary policy shock. There is empirical evidence that supports the plausibility of the results in this paper, yet, to the best of my knowledge, there is no empirical work that explicitly focuses on the allocation of time across the income distribution in response to macroeconomic shocks. A second avenue for future research is to look at the state-dependency of monetary policy that is related to the size of the home sector. The size of the home sector differs a lot across countries, and a larger home sector could lead to larger fluctuations in market variables. Furthermore, the size of the home sector might affect the substitutability of home produced goods and goods bought on the market might differ. In turn, also this substitutability is crucial for the size of the fluctuations in market labor supply, and thereby, output.

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A Robustness of empirical results

Table 7: Robustness of time allocation of savers

	Savers			
	V1	V2	V3	IND
Net wealth (Euro)	140,400	138,400	132,000	130,400
Net wage monthly (Euro)	2,000	2,000	2,100	2,100
Net wage hourly (Euro)	12	12	12	13
Population share	76 %	73 %	78 %	74 %
Market work (hours per day)	6.4	6.3	6.3	6.4
Leisure (hours per day)	2.3	2.4	2.2	2.2
Non-market work (hours per day)	2.9	2.9	3.3	3.1
Childcare (hours per day)	0.4	0.4	0.7	0.7
Housework (hours per day)	2.5	2.5	2.6	2.5
Market work (hours per weekday)	8,5	8.4	8.4	8.5
Leisure (hours per weekday)	1.9	2.0	1.8	1.8
Non-market work (hours per weekday)	2.6	2.6	2.9	2.8
Childcare (hours per weekday)	0.3	0.3	0.5	0.5
Housework (hours per weekday)	2.3	2.3	2.4	2.3
Age	47	46	47	46
Share minor kids in household	21 %	21 %	31 %	31 %
No. of minor kids	0.3	0.3	0.5	0.5
Share cohabiting	41%	41%	67 %	74 %
Home help costs monthly (Euro)	7	6	6	N/A
Capital income monthly (Euro)	9	9	-4	N/A
Share home owners	53 %	52 %	60 %	N/A
Share home paid	43 %	43 %	39 %	N/A
Home repayment (Euro)	500	430	480	N/A
Rent monthly (Euro)	490	490	450	N/A

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) German data from 2017, (iv) the variables home help costs, capital income, share home-owners and rent is only available at the household level.

Table 8: Robustness of time allocation of HtM households

	HtM households			
	V1	V2	V3	IND
Net wealth (Euro)	- 1,500	-1,500	- 1,900	-2,200
Net wage monthly (Euro)	1,500	1,400	1,600	1,600
Net wage hourly (Euro)	9	9	10	10
Population share	24 %	27 %	22 %	26%
Market work (hours per day)	6.6	6.2	6.5	6.5
Leisure (hours per day)	2.5	2.5	2.3	2.3
Non-market work (hours per day)	2.5	2.6	2.8	2.8
Childcare (hours per day)	0.3	0.3	0.6	0.6
Housework (hours per day)	2.2	2.6	2.2	2.2
Market work (hours per weekday)	8.5	8.1	8.4	8.5
Leisure (hours per weekday)	2.1	2.1	1.9	1.9
Non-market work (hours per weekday)	2.4	2.5	2.5	2.5
Childcare (hours per weekday)	0.2	0.3	0.4	0.4
Housework (hours per weekday)	2.2	2.2	2.1	2.1
Age	41	40	42	41
Share minor kids in household	15 %	15 %	26%	27 %
No. of minor kids	0.2	0.2	0.4	0.4
Share cohabiting	17 %	17 %	46 %	58 %
Home help costs monthly (Euro)	2	2	2	N/A
Capital income monthly (Euro)	0	0	0	N/A
Share home owners	2 %	2 %	4 %	N/A
Share home paid	26 %	23 %	16 %	N/A
Home repayment (Euro)	440	500	560	N/A
Rent monthly (Euro)	460	450	410	N/A

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) German data from 2017, (iv) the variables home help costs, capital income, share home-owners and rent is only available at the household level.

Table 9: Mean and median time allocation of savers and HtM households

	HtM		Savers	
	Mean	Median	Mean	Median
Net wealth (Euro)	-1,500	0	140,400	83,200
Net wage monthly (Euro)	1,500	1,500	2,000	1,900
Net wage hourly (Euro)	9	9	12	12
Market work (hours per day)	6.6	6.4	6.4	6.4
Leisure (hours per day)	2.5	2.1	2.3	2.0
Non-market work (hours per day)	2.5	2.1	2.9	2.6
Childcare (hours per day)	0.3	0	0.4	0
Housework (hours per day)	2.2	2.0	2.5	2.3
Market work (hours per *week*day)	8.5	9	8.5	9
Leisure (hours per *week*day)	2.1	2	1.9	2
Non-market work (hours per *week*day)	2.4	2	2.6	2
Childcare (hours per *week*day)	0.2	0	0.3	0
Housework (hours per *week*day)	2.2	2	2.3	2
Age	41	42	47	49
Minor kids	0.2	0	0.3	0
Home help costs monthly (Euro)	2	0	7	0
Capital income monthly (Euro)	0	0	9	0
Home repayment (Euro)	430	400	500	350
Rent monthly (Euro)	460	420	490	450

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) German data from 2017.

Table 10: Time allocation of savers and HtM households 2012 and 2017

	HtM		Savers	
	2012	2017	2012	2017
Net wealth (Euro)	- 3,000	-1,500	110,200	140,400
Net wage monthly (Euro)	1,400	1,500	1,800	2,000
Net wage hourly (Euro)	9	9	11	12
Population share	24 %	24 %	76 %	76 %
Market work (hours per *week*day)	8.5	8.5	8.4	8.5
Leisure (hours per *week*day)	2.0	2.1	1.9	1.9
Non-market work (hours per *week*day)	3.0	2.4	3.1	2.6
Childcare (hours per *week*day)	0.3	0.2	0.4	0.3
Housework (hours per *week*day)	2.7	2.2	2.8	2.3
Age	43	41	45	47
Share minor kids in household	16 %	15 %	23 %	21 %
Minor kids	0.2	0.2	0.3	0.3
Share cohabiting	16 %	17 %	41 %	41 %
Home help costs monthly (Euro)	0	2	6	7
Capital income monthly (Euro)	0	0	2	9
Share home owners	3 %	2 %	55 %	53 %
Share home paid	8 %	26 %	28 %	43 %
Home repayment (Euro)	740	430	415	500
Rent monthly (Euro)	410	460	450	490

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) in 2012, there is no data on time use on the weekend, (iv) German data.

Table 11: Time allocation of savers and HtM households with and without kids

	HtM		Savers	
	baseline	without kids	baseline	without kids
Market work (hours per day)	6.6	6.7	6.4	6.5
Leisure (hours per day)	2.5	2.6	2.3	2.4
Non-market work (hours per day)	2.5	2.2	2.9	2.5
Market work (hours per *week*day)	8.5	8.6	8.5	8.7
Leisure (hours per *week*day)	2.1	2.1	1.9	2
Non-market work (hours per *week*day)	2.4	2.1	2.6	2.3

Notes: (i) source: SOEP, DOI: 10.5684/soep.v37, (ii) except shares, all values are per capita, (iii) German data from 2017.

B Details on the calibration of wage stickiness

I follow Born and Pfeifer (2020) to calculate the Rotemberg adjustment parameter from the Calvo probabilities of resetting the wage. Following Born and Pfeifer (2020) section 2.4., it holds that

$$\frac{(1-\theta_w)(1-\beta\theta_w)}{\theta_w(1+\epsilon_w\epsilon_{tot}^{mrs})} = \frac{(\epsilon_w - 1)(1-\tau^n)\chi}{\xi}$$

$$\leftrightarrow \xi = (\epsilon_w - 1)(1-\tau^n)\chi\frac{\theta_w(1+\epsilon_w\epsilon_{tot}^{mrs})}{(1-\theta_w)(1-\beta\theta_w)}$$

In case of multiplicatively separable preferences, the total elasticity is given by

$$\epsilon_{tot}^{mrs} = \left[1 - \frac{(1-b)(\sigma-1)}{b(1-\sigma)-1}\right] \times \frac{N}{1-N},$$

with $N/(1-N)$ being the ratio of hours worked to leisure. The steady-state labor share χ without fixed costs is given by

$$\chi = \frac{WN}{\Xi} = \frac{\epsilon_p - 1}{\epsilon_p}(1-\alpha),$$

where Ξ are the nominal adjustment cost base.

The baseline calibration in this model is given by $\alpha = 0$, $\epsilon_p = 9$, $\epsilon_w = 6$, $\beta = 0.99$, $\sigma = 2$, $b = 0.82$ and $\tau^n = 0$. It follows that $\chi = \frac{\epsilon_p - 1}{\epsilon_p}(1-\alpha) = 0.89$. The ratio of market work to leisure of HtM households is given by 0.53/0.2=2.65 and of savers 0.52/0.23=2.26. For HtM households, the total elasticity of substitution is then given by $\epsilon_{tot,h}^{mrs} = \left[1 - \frac{(1-0.82)(2-1)}{0.82(1-2)-1}\right] \times 2.65 = 1.26$, and for savers, it is given by $\epsilon_{tot,s}^{mrs} = \left[1 - \frac{(1-0.82)(2-1)}{0.82(1-2)-1}\right] \times 2.26 = 1.22$. Born and Pfeifer (2020) report that plausible values of ϵ_{tot}^{mrs} lie in the range between 0.25 and 1.5, so the value in this paper is plausible.

For savers, I target a Calvo parameter for wage stickiness of 3/4, which yields the following Rotemberg adjustment costs parameter,

$$\xi^s = (6-1) \times 0.89 \times \frac{0.75(1 + 6 \times 1.22)}{(1-0.75)(1-0.99 \times 0.75)} = 431.35 \approx 430,$$

and for HtM households I target a Calvo parameter for wage stickiness of 5/6, and this yields the following Rotemberg adjustment costs parameter,

$$\xi^h = (6-1) \times 0.89 \times \frac{5/6(1 + 6 \times 1.24)}{(1-5/6)(1-0.99 \times 5/6)} = 1071.86 \approx 1070.$$

C Model derivations

In terms of the derivation of the home sector, I follow the online appendix of Gnocchi et al. (2016), and for the derivation of the wage stickiness, I follow Broer et al. (2020) (henceforth BHKÖ).[7]

C.1 Derivation of the firms' problem

A continuum of firms produces a differentiated output good $Y_t(i)$, using aggregate effective labor, $M_t(i)$. The production function is given by

$$Y_t(i) = M_t(i).$$

Prices and wages are sticky. Firm i maximizes profits,

$$\max_{M_t(i),Y_t(i),P_t(i)} P_t(i)Y_t(i) - W_t^n M_t(i),$$

subject to the production function,

$$Y_t(i) = M_t(i),$$

the demand constraint,

$$Y_t(i) = \left[\frac{P_t(i)}{P_t}\right]^{-\epsilon_p} Y_t^d,$$

where aggregate demand, Y_t^d, is taken as given, and subject to a Calvo price-setting scheme,

$$P_{t+j+1}(i) = \begin{cases} P^*_{t+j+1}(i) & \text{with probability } (1-\theta), \\ P_{t+j}(i) & \text{with probability } \theta. \end{cases}$$

The discounted sum of current and future profits is given by

$$E_t\left(\sum_{j=0}^{\infty}\theta^j Q_{t,t+j}[P_t(i)Y_{t+j}(i) - W_{t+j}^n M_{t+j}(i)]\right),$$

[7] While BHKÖ have a model with full heterogeneity, and labor productivity is stochastic, I have only two agents, and as in the flexible wage model, the productivity difference across these two types is deterministic. Thus, for simplicity, nominal wage is paid for effective hours worked, $M_{jt}^z = M_{jt}$, so both types of agents receive the same hourly effective wage, $W_{jt}^z = W_{jt}$, and less productive households work more time for one effective hour. In contrast, in BHKÖ nominal wage is paid per hour, and differs across agents according to their productivity.

where $Q_{t,t+j}$ denotes the stochastic discount factor given by

$$Q_{t,t+j} = \beta^j E_t \left(\frac{\lambda^s_{t+j}}{\lambda^s_t} (\Pi_{t,t+j})^{-1} \right).$$

The Lagrangian in then given by

$$\begin{aligned}\mathcal{L} \equiv & E_t \left(\sum_{j=0}^{\infty} \theta^j Q_{t,t+j} \{ [P^*_t(i) Y_{t+j}(i) - W^n_{t+j} M_{t+j}(i)] \right) \\ & - \lambda_{t+j}(i) \left(Y_{t+j}(i) - \left[\frac{P^*_t(i)}{P_{t+j}} \right]^{-\epsilon_p} Y^d_{t+j} \right) - \mu_{t+j}(i)(Y_{t+j}(i) - M_{t+j}(i)) \},\end{aligned}$$

where Lagrange multipliers are re-parametrized. The first order conditions are given by

$$\frac{\partial \mathcal{L}}{\partial M_{t+j}(i)} = -W^n_{t+j} + \mu_{t+j}(i) = 0 \leftrightarrow MC^n_{t+j} \equiv \mu_{i,t+j} = W^n_{t+j} \leftrightarrow MC_{t+j} = W_{t+j},$$

$$\frac{\partial \mathcal{L}}{\partial Y_{t+j}(i)} = P^*_t - \lambda_{t+j}(i) - \mu_{t+j}(i) = 0 \leftrightarrow \lambda_{t+j}(i) = P^*_t - \mu_{t+j}(i) = P^*_t - MC^n_{t+j},$$

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial P^*_t(i)} = & E_t \left(\sum_{j=0}^{\infty} \theta^j Q_{t,t+j} [Y_{t+j}(i) - \lambda_{t+j}(i) \epsilon_p \left[\frac{P^*_t}{P_{t+j}} \right]^{-\epsilon_p - 1} \frac{1}{P_{t+j}} Y^d_{t+j} \right) = 0 \\ & \leftrightarrow E_t \left(\sum_{j=0}^{\infty} \theta^j Q_{t,t+j} [Y_{t+j}(i) - \lambda_{t+j}(i) \epsilon_p \frac{Y_{t+j}(i)}{P^*_t}] \right) = 0 \\ & \leftrightarrow E_t \left(\sum_{j=0}^{\infty} \theta^j Q_{t,t+j} Y_{t+j}(i) [1 - \epsilon_p + MC^n_{t+j} \epsilon_p \frac{1}{P^*_t}] \right) = 0\end{aligned}$$

multiply by $\frac{1}{1-\epsilon_p}$ and by $\frac{P^*_t}{P_t}$ to obtain

$$\leftrightarrow E_t \left(\sum_{j=0}^{\infty} \theta^j Q_{t,t+j} Y_{t+j}(i) \left[\frac{P^*_t}{P_t} - MC_{t+j} \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) \right] \right) = 0.$$

Rewrite the condition as

$$\frac{P^*_t}{P_t} = \frac{x_{1,t}}{x_{2,t}}$$

with

$$x_{1,t} = [C_{m,t} + G_t] \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) MC_t + \beta \theta E_t \left(\frac{\lambda^s_{t+1}}{\lambda^s_t} (\Pi_{t+1})^{\epsilon_p} x_{1,t+1} \right)$$

and

$$x_{2,t} = [C_{m,t} + G_t] + \beta\theta E_t \left(\frac{\lambda^s_{t+1}}{\lambda^s_t} (\Pi_{t+1})^{\epsilon_p - 1} x_{2,t+1} \right).$$

From Calvo pricing it follows that

$$\frac{P^*_t}{P_t} = \left(\frac{1 - \theta \Pi_t^{\epsilon_p - 1}}{1 - \theta} \right)^{\frac{1}{1-\epsilon_p}}.$$

Labor and wages are aggregated through the Dixit–Stiglitz aggregator:

$$M_t(i) = \left(\int_0^1 M_{jt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj \right)^{\frac{\epsilon_w}{\epsilon_w - 1}},$$

where ϵ_w denotes the elasticity of substitution between the different types of labor,

$$W^n_t = \left(\int_0^1 \left(W^n_{jt}\right)^{1-\epsilon_w} \right)^{\frac{1}{1-\epsilon_w}}.$$

The demand curve for labor is derived as follows. Optimizing behavior of firm i implies the following maximization problem

$$\max_{M_{jt}(i)} M_t(i) = \left(\int_0^1 M_{jt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj \right)^{\frac{\epsilon_w}{\epsilon_w - 1}} \quad \text{subject to} \quad \int_0^1 W^n_{jt} M_{jt}(i) dj = Z_t(i),$$

where $Z_t(i)$ is any given level of labor costs of firm i. The corresponding Lagrangian is then given by

$$\mathcal{L} \equiv \left(\int_0^1 M_{jt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj \right)^{\frac{\epsilon_w}{\epsilon_w - 1}} - \lambda_t \left(\int_0^1 W^n_{jt} M_{jt}(i) dj - Z_t(i) \right)$$

The first order condition with respect to a particular labor unit k is then given by

$$\frac{\epsilon_w}{\epsilon_w - 1} \left(\int_0^1 M_{jt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj \right)^{\frac{\epsilon_w}{\epsilon_w - 1} - 1} \frac{\epsilon_w - 1}{\epsilon_w} M_{kt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w} - 1} - \lambda_t W^n_{kt} = 0,$$

and with respect to a particular labor unit n is given by

$$\frac{\epsilon_w}{\epsilon_w - 1} \left(\int_0^1 M_{jt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w}} dj \right)^{\frac{\epsilon_w}{\epsilon_w - 1} - 1} \frac{\epsilon_w - 1}{\epsilon_w} M_{nt}(i)^{\frac{\epsilon_w - 1}{\epsilon_w} - 1} - \lambda_t W^n_{it} = 0.$$

Dividing the two first order conditions by each other yields

$$\left(\frac{M_{kt}(i)}{M_{nt}(i)}\right)^{\frac{\epsilon_w-1}{\epsilon_w}-1} = \frac{W^n_{kt}}{W^n_{it}}$$
$$\leftrightarrow M_{kt}(i) = (W^n_{kt})^{-\epsilon_w}(W^n_{nt})^{\epsilon_w}M_{nt}(i)$$
$$\leftrightarrow M_{jt}(i) = (W^n_{jt})^{-\epsilon_w}(W^n_{nt})^{\epsilon_w}M_{nt}(i)$$

When plugging the optimality condition into the constraint one obtains

$$Z_t(i) = \int_0^1 W^n_{jt}(W^n_{jt})^{-\epsilon_w}(W^n_{nt})^{\epsilon_w}M_{nt}(i)dj$$
$$= (W^n_{nt})^{\epsilon_w}M_{nt}(i)\int_0^1 (W^n_{jt})^{1-\epsilon_w}dj = (W^n_{it})^{\epsilon_w}M_{it}(i)(W^n_t)^{1-\epsilon_w}$$
$$\leftrightarrow M_{it}(i) = \left(\frac{W^n_{it}}{W^n_t}\right)^{-\epsilon_w}\frac{Z_t(i)}{W_t} \leftrightarrow M_{jt}(i) = \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w}\frac{Z_t(i)}{W_t}$$

In a last step, it is shown that $\int_0^1 W^n_{jt}M_{jt}(i)dj = W^n_t M_t(i)$, and therefore, $\frac{Z_t(i)}{W^n_t} = M_t(i)$.

$$M_t(i) = \left(\int_0^1\left(\left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w}\frac{Z_t(i)}{W^n_t}\right)^{\frac{\epsilon_w-1}{\epsilon_w}}dj\right)^{\frac{\epsilon_w}{\epsilon_w-1}}$$
$$= \frac{Z_t(i)}{W_t}(W^n_t)^{\epsilon_w}\left(\int_0^1((W^n_{jt})^{1-\epsilon_w})dj\right)^{\frac{\epsilon_w}{\epsilon_w-1}} = \frac{Z_t(i)}{W^n_t}(W^n_t)^{\epsilon_w}(W^n_t)^{-\epsilon_w} = \frac{Z_t(i)}{W^n_t}$$

Thus, since $\frac{Z_t(i)}{W^n_t} = M_t(i)$, the demand curve for labor is given by

$$M_{jt}(i) = \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w}M_t(i). \tag{33}$$

The firm's marginal costs are equal to the real wage (due to the linear production function), because the aggregated wage of households is equal to the firm's demand for labor.[8]

C.2 Derivation of the households' problem

Household j of type $z \in (h, s)$ maximizes lifetime utility given by

$$E_0\sum_{t=0}^{\infty}\beta^t U(C^z_{jt}, L_{jt}) = E_0\sum_{t=0}^{\infty}\beta^t\frac{[(C^z_{jt})^b(L^z_{jt})^{1-b}]^{1-\sigma}-1}{1-\sigma} \tag{34}$$

[8] See Erceg et al. 2000, section 2.1, equation (5).

subject to the following four constraints that are the same for each type of households.

$$C^z_{jt} = [\alpha_1 \left(C^z_{mjt}\right)^{b_1} + (1-\alpha_1)\left(C^z_{njt}\right)^{b_1}]^{1/b_1} \tag{35}$$

$$L^z_{jt} = 1 - H^z_{mjt} - H^z_{njt} \tag{36}$$

$$C^z_{njt} = H^z_{njt} \tag{37}$$

$$M^z_{jt}(i) = \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w} M^z_t(i) \tag{38}$$

and subject to the the firm's labor demand equation (33).

HtM households have the two following additional constraints:

$$M^h_{jt} = \omega H^h_{mjt} \tag{39}$$

$$W^n_{jt}M^h_{jt} - \frac{\xi^h}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2 W^n_{jt}M^h_{jt} - T_t + \frac{\tau_D}{\psi}P_tD_t \leq P_tC^h_{mjt} \tag{40}$$

Savers have the two following additional constraints:

$$M^s_{jt} = H^s_{mjt} \tag{41}$$

$$W^n_{jt}M^s_{jt} - \frac{\xi^s}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2 W^n_{jt}M^s_{jt} + B^s_t - T_t + \frac{1-\tau_D}{1-\psi}P_tD_t \leq E_t\{Q_{t,t+1}B^s_{t+1}\} + P_tC^s_{mjt} \tag{42}$$

The Lagrange function of savers is given by:

$$\mathcal{L} \equiv E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{\left[\left([\alpha_1 \left(C^s_{mjt}\right)^{b_1} + (1-\alpha_1)\left(C^s_{njt}\right)^{b_1}]^{1/b_1}\right)^b (1 - M^s_{jt} - H^s_{njt})^{1-b}\right]^{1-\sigma} - 1}{1-\sigma} \right)$$
$$+ \lambda^s_{jt}\left[W^n_{jt}M^s_{jt} - \frac{\xi^s}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2 W^n_{jt}M^s_{jt} + B^s_t - T_t + \frac{1-\tau_D}{1-\psi}P_tD_t - E_t\{Q_{t,t+1}B^s_{t+1}\} - P_tC^s_{mjt}\right]$$
$$+ \mu^s_{jt}\left[M^s_{jt}(i) - \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w} M^s_t(i),\right]$$
$$+ \chi^s_{jt}\left[H^s_{njt} - C^s_{njt}\right]$$

The first order conditions are derived as follows.

$$\frac{\partial \mathcal{L}}{\partial C^s_{mjt}} : U_{C^s_{jt}} \frac{\partial C^s_{jt}}{\partial C^s_{mjt}} - P_t \lambda^s_{jt} = 0 \leftrightarrow \lambda^s_{jt} = \frac{U_{C^s_{jt}}}{P_t} \frac{\partial C^s_{jt}}{\partial C^s_{mjt}},$$

$$\frac{\partial \mathcal{L}}{\partial M^s_{jt}} : U_{M^s_{jt}} + \lambda^s_{jt}(W^n_{jt} - \frac{\xi^s}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2 W^n_{jt}) + \mu^s_{jt} = 0$$

$$\leftrightarrow \mu^s_{jt} = -U_{M^s_{jt}} - \frac{U_{C^s_{mjt}}}{P_t}\frac{\partial C_{jt}}{\partial C_{mjt}}(W^n_{jt} - \frac{\xi^s}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2 W^n_{jt})$$

$$\frac{\partial \mathcal{L}}{\partial H_{n,t}} : \frac{U_{L^s_{jt}}(C^s_t, L^s_t)}{(1-\alpha_1)U_{C^s_{jt}}(C^s_t, L^s_t)} \left(\frac{C^s_{n,t}}{C^s_t}\right)^{1-b_1} = \frac{C^s_{n,t}}{H^s_{n,t}}$$

$$\leftrightarrow \frac{\left[(C^s_t)^b (L^s_t)^{1-b}\right]^{-\sigma} (C^s_t)^b (1-b)(L^s_t)^{-b}}{(1-\alpha_1)\left[(C^s_t)^b (L^s_t)^{1-b}\right]^{-\sigma} b(C^s_t)^{b-1}(L^s_t)^{1-b}} \left(\frac{C^s_{n,t}}{C^s_t}\right)^{1-b_1} = \frac{C^s_{n,t}}{H^s_{n,t}}$$

$$\leftrightarrow \frac{1-b}{b(1-\alpha_1)} \frac{(C^s_t)^b (L^s_t)^{-b}}{(C^s_t)^{b-1}(L^s_t)^{1-b}(C^s_t)^{1-b_1}} (C^s_{n,t})^{1-b_1} = \frac{C^s_{n,t}}{H^s_{n,t}}$$

$$\leftrightarrow \frac{1-b}{b(1-\alpha_1)} \frac{1}{L^s_t (C^s_t)^{-b_1}} (C^s_{n,t})^{-b_1} = \frac{1}{H^s_{n,t}}$$

$$\leftrightarrow \frac{1-b}{b(1-\alpha_1)} \left(\frac{C^s_t}{C^s_{n,t}}\right)^{b_1} = \frac{L^s_t}{H^s_{n,t}}$$

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial W^n_{jt}} : &\lambda^s_{jt}\left(M^s_{jt} - \frac{\xi^s}{2} M^s_{jt}\left[2\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)\frac{1}{W^n_{jt-1}} W^n_{jt} + \left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2\right]\right) \\
&+ \mu^s_{jt}\left[-\epsilon_w \left(\frac{W^n_{jt}}{W^n_t}\right)^{-\epsilon_w - 1} \frac{1}{W^n_t} M^s_t(i)\right] \\
&+ \beta \lambda^s_{jt+1}\left[-\xi^s \left(\frac{W^n_{jt+1}}{W^n_{jt}} - 1\right) W^n_{jt+1} M_{jt+1} \frac{W^n_{jt+1}}{(W^n_{jt})^2}(-1)\right] = 0 \\
\leftrightarrow &\frac{U_{C^s_{jt}} M^s_{jt}}{P_t} \frac{\partial C^s_{jt}}{\partial C^s_{mjt}} \{\epsilon_w MRS^s_{jt} \frac{1}{\frac{W^n_{jt}}{P_t}} + (1-\epsilon_w) \\
&- \xi^s \left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)\left(\frac{W^n_{jt}}{W^n_{jt-1}} + \frac{1-\epsilon_w}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)\right) \\
&+ \beta \frac{U_{C^s_{jt+1}}}{U_{C^s_{jt}}} \left(\frac{\partial C^s_{jt}}{\partial C^s_{mjt}}\right)^{-1} \left(\frac{\partial C^s_{jt+1}}{\partial C^s_{mjt+1}}\right) \frac{P_t}{P_{t+1}} \xi^s \left(\frac{W^n_{jt+1}}{W^n_{jt}} - 1\right) \frac{W^n_{jt+1}}{W^n_{jt}} \frac{W^n_{jt+1} M^s_{jt+1}}{W^n_{jt} M^s_{jt}}\} = 0
\end{aligned}$$

$$
\begin{aligned}
\frac{\partial \mathcal{L}}{\partial B^s_{t+1}} &: -\lambda^s_{jt} Q_{t,t+1} + E_t \beta \left(\lambda^s_{jt+1}\right) = 0 \\
&\leftrightarrow \lambda^s_{jt} Q_{t,t+1} = \beta E_t \left(\lambda^s_{jt+1}\right) \\
&\leftrightarrow Q_{t,t+1} = \beta E_t \left(\frac{\lambda^s_{jt+1}}{\lambda^s_{jt}}\right) \\
&= \beta E_t \left(\frac{U_{C^s_{jt+1}}}{U_{C^s_{jt}}} \left(\frac{\partial C^s_{jt}}{\partial C^s_{mjt}}\right)^{-1} \left(\frac{\partial C^s_{jt+1}}{\partial C^s_{mjt+1}}\right) \frac{P_t}{P_{t+1}} \right) \\
&= \beta E_t \left(\frac{U_{C^s_{jt+1}}}{U_{C^s_{jt}}} \left(\frac{\partial C^s_{jt}}{\partial C^s_{mjt}}\right)^{-1} \left(\frac{\partial C^s_{jt+1}}{\partial C^s_{mjt+1}}\right) \Pi^{-1}_{t+1} \right)
\end{aligned}
$$

Assuming that the no arbitrage condition holds (i.e., $Q_{t,t+1} \equiv (1+R_t)^{-1}$), the Euler equation simplifies to:

$$
\beta \left(\frac{U_{C^s_{jt+1}}}{U_{C^s_{jt}}} \left(\frac{\partial C^s_{jt}}{\partial C^s_{mjt}}\right)^{-1} \left(\frac{\partial C^s_{jt+1}}{\partial C^s_{mjt+1}}\right) (1+R_t)\Pi^{-1}_{t+1} \right) = 1.
$$

HtM households cannot save or borrow in bonds, but they consume their entire income each period that is given by

$$
C^h_{jt} = \left(1 - \frac{\xi^h}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2\right) W_{jt} M_{jt} - T_t + \frac{\tau_D}{\psi} P_t D_t.
$$

The optimality condition with respect to non-market hours is the same for both types of households.

The marginal utilities of consumption and leisure differ across households due to the productivity wedge. They are given by the following equations.

$$\begin{aligned}
U_{C^s_{jt}} &= \left[(C^s_{jt})^b \left(1 - M^s_{jt} - H^s_{njt}\right)^{(1-b)}\right]^{-\sigma} b(C^s_{jt})^{b-1} \left(1 - M^s_{jt} - H^s_{njt}\right)^{(1-b)} \\
&= b(C^s_{jt})^{b(1-\sigma)-1} \left(1 - M^s_{jt} - H^s_{njt}\right)^{(1-b)(1-\sigma)} \\
U_{M^s_{jt}} &= \left[(C^s_{jt})^b \left(1 - M^s_{jt} - H^s_{njt}\right)^{(1-b)}\right]^{-\sigma} (C^s_{jt})^b (1-b) \left(1 - M^s_{jt} - H^s_{njt}\right)^{-b} \\
&= (b-1)(C^s_{jt})^{b(1-\sigma)} \left(1 - M^s_{jt} - H^s_{njt}\right)^{\sigma(b-1)-b} \\
U_{L^s_{jt}} &= -U_{M^s_{jt}} = (1-b)(C^s_{jt})^{b(1-\sigma)} \left(1 - M^s_{jt} - H^s_{njt}\right)^{\sigma(b-1)-b} \\
\frac{\partial C^s_{jt}}{\partial C^s_{mjt}} &= \alpha_1 \left(\frac{C^s_{mjt}}{C^s_{jt}}\right)^{b_1-1} \\
\left(\frac{\partial C^s_{jt}}{\partial C^s_{mjt}}\right)^{-1} \left(\frac{\partial C^s_{jt+1}}{\partial C^s_{mjt+1}}\right) &= \left(\alpha_1 \left(\frac{C^s_{mjt}}{C^s_{jt}}\right)^{b_1-1}\right)^{-1} \left(\alpha_1 \left(\frac{C^s_{mjt+1}}{C^s_{jt+1}}\right)^{b_1-1}\right) = \left(\frac{C^s_{mjt+1}}{C^s_{jt+1}} \frac{C^s_{jt}}{C^s_{mjt}}\right)^{b_1-1} \\
MRS^s_t &= \frac{-U_{M^s_{jt}}}{U^s_{C_{jt}}} = -\frac{b-1}{b} \frac{C^s_{jt}}{1 - M^s_{jt} - H^s_{njt}}
\end{aligned}$$

$$\begin{aligned}
U_{C^h_{jt}} &= \left[(C^h_{jt})^b \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{(1-b)}\right]^{-\sigma} b(C^h_{jt})^{b-1} \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{(1-b)} \\
&= b(C^h_{jt})^{b(1-\sigma)-1} \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{(1-b)(1-\sigma)} \\
U_{M^h_{jt}} &= \left[(C^h_{jt})^b \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{(1-b)}\right]^{-\sigma} (C^h_{jt})^b (1-b) \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{-b} \left(-\frac{1}{\omega}\right) \\
&= \frac{b-1}{\omega} (C^h_{jt})^{b(1-\sigma)} \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{\sigma(b-1)-b} \\
U_{L^h_{jt}} &= -\omega U_{M^h_{jt}} = (1-b)(C^h_{jt})^{b(1-\sigma)} \left(1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}\right)^{\sigma(b-1)-b} \\
\frac{\partial C^h_{jt}}{\partial C^h_{mjt}} &= \alpha_1 \left(\frac{C^h_{mjt}}{C^h_{jt}}\right)^{b_1-1} \\
\left(\frac{\partial C^h_{jt}}{\partial C^h_{mjt}}\right)^{-1} \left(\frac{\partial C^h_{jt+1}}{\partial C^h_{mjt+1}}\right) &= \left(\alpha_1 \left(\frac{C^h_{mjt}}{C^h_{jt}}\right)^{b_1-1}\right)^{-1} \left(\alpha_1 \left(\frac{C^h_{mjt+1}}{C^h_{jt+1}}\right)^{b_1-1}\right) = \left(\frac{C^h_{mjt+1}}{C^h_{jt+1}} \frac{C^h_{jt}}{C^h_{mjt}}\right)^{b_1-1} \\
MRS^h_t &= \frac{-U_{M^h_j}}{U_{C^h_{jt}}} = -\frac{b-1}{b\omega} \frac{C^h_{jt}}{1 - \frac{1}{\omega} M^h_{jt} - H^h_{njt}}
\end{aligned}$$

In a last step, the optimality conditions with respect to market work, market consumption and wages are used to derive the wage Phillips curve for both types of households. As in BHKÖ, I look for a symmetric solution in which $W^n_{jt} = W^n_{it} = (W^n_t)^*$ for all i, j. The labor demand equation shows that if $W^n_{jt} = W^n_{it}$ then also $M_{jt} = M_{it}$. Wage inflation is defined as follows

$$\Pi^w_{t+1} \equiv \frac{W^n_{jt+1}}{W^n_{jt}} = \frac{W^n_{t+1}}{W^n_t}, \tag{43}$$

and price inflation is defined as

$$\Pi_{t+1} = \frac{P_{t+1}}{P_t}. \tag{44}$$

The accounting identity for the evolution of the average real wage is given by

$$\begin{aligned} \frac{W^n_t/P_t}{W^n_{t-1}/P_{t-1}} &= \frac{W^n_t}{W^n_{t-1}}\left(\frac{P_t}{P_{t-1}}\right)^{-1} = \frac{\Pi^w_t}{\Pi^p_t} \\ \leftrightarrow \frac{W^n_t}{P_t} &= \frac{W^n_{t-1}}{P_{t-1}}\frac{\Pi^w_t}{\Pi^p_t} \\ \leftrightarrow W_t &= W_{t-1}\frac{\Pi^w_t}{\Pi^p_t} \end{aligned} \tag{45}$$

Since $\frac{U_{C^z_{jt}} M^z_{jt}}{P_t}\left(\frac{\partial C^z_{jt}}{\partial C^z_{mjt}}\right)$ is not stochastic, it can be shortened out. Hence, the first order condition with respect to wages is given by

$$\begin{aligned} &\epsilon_w MRS^z_{jt}\frac{1}{W_t} + (1-\epsilon_w) \\ &- \xi^z\left(\Pi^w_t - 1\right)\left(\Pi^w_t + \frac{1-\epsilon_w}{2}\left(\Pi^w_t - 1\right)\right) \\ +&\beta\frac{U_{C^z_{jt+1}}}{U_{C^z_{jt}}}\left(\frac{\partial C^z_{jt}}{\partial C^z_{mjt}}\right)^{-1}\left(\frac{\partial C^z_{jt+1}}{\partial C^z_{mjt+1}}\right)\left(\Pi^p_{t+1}\right)^{-1}\xi^z\left(\Pi^w_{t+1}-1\right)\left(\Pi^w_{t+1}\right)^2\frac{M^z_{jt+1}}{M^z_{jt}} = 0 \end{aligned}$$

HtM households consume their per period income, so their consumption is given by

$$\begin{aligned} C^h_{mjt} &= \left(1 - \frac{\xi^h}{2}\left(\frac{W^n_{jt}}{W^n_{jt-1}} - 1\right)^2\right) W_{jt}M^h_{jt} - T_t + \frac{\tau_D}{\psi}P_t D_t \\ \leftrightarrow C^h_{mjt} &= \left(1 - \frac{\xi^h}{2}\left(\Pi^w_t - 1\right)^2\right) W_t M^h_t - T_t + \frac{\tau_D}{\psi}P_t D_t \end{aligned}$$

Recall that $W^n_{it} = W^n_{jt} = W^n_t$ due to symmetry, thus, also $M^h_{it} = M^h_{jt} = M^h_t$, and therefore $C^h_{mit} = C^h_{mjt} = C^h_{mt}$ and $MRS^h_{it} = MRS^h_{jt} = MRS^h_t$. The wage inflation Phillips curve of

HtM households is thus given by

$$\epsilon_w MRS_t^h \frac{1}{W_t} + (1-\epsilon_w) - \xi^h \left(\Pi_t^w - 1\right) \left(\Pi_t^w + \frac{1-\epsilon_w}{2} \left(\Pi_t^w - 1\right)\right)$$
$$+\beta \frac{U_{C_{t+1}^h}}{U_{C_t^h}} \left(\frac{\partial C_t^h}{\partial C_{mt}^h}\right)^{-1} \left(\frac{\partial C_{t+1}^h}{\partial C_{mt+1}^h}\right) \left(\Pi_{t+1}^p\right)^{-1} \xi^h \left(\Pi_{t+1}^w - 1\right) \left(\Pi_{t+1}^w\right)^2 \frac{M_{t+1}^h}{M_t^h} = 0$$

Also optimizing households all have the same level of consumption (Erceg et al., 2000), such that $C_{mit}^s = C_{mjt}^s = C_{mt}^s$, and hence also $U_{C_{it}^s} = U_{C_{jt}^s} = U_{C^s t}$, and $MRS_{it} = MRS_{jt} = MRS_t^s$. The wage inflation Phillips curve of savers is hence given by

$$\begin{aligned} &\epsilon_w MRS_t^s \frac{1}{W_t} + (1-\epsilon_w) - \xi^s \left(\Pi_t^w - 1\right) \left(\Pi_t^w + \frac{1-\epsilon_w}{2} \left(\Pi_t^w - 1\right)\right) \\ &+\beta \frac{U_{C_{t+1}^s}}{U_{C_t^s}} \left(\frac{\partial C_t^s}{\partial C_{mt}^s}\right)^{-1} \left(\frac{\partial C_{t+1}^s}{\partial C_{mt+1}^s}\right) \left(\Pi_{t+1}^p\right)^{-1} \xi^s \left(\Pi_{t+1}^w - 1\right) \left(\Pi_{t+1}^w\right)^2 \frac{M_{t+1}^s}{M_t^s} = 0 \end{aligned} \tag{46}$$

C.3 Equilibrium conditions

$$C_t^s = \left(\alpha_1 \left(C_{m,t}^s\right)^{b_1} + (1-\alpha_1) \left(C_{n,t}^s\right)^{b_1}\right)^{\frac{1}{b_1}} \tag{47}$$

$$C_{n,t}^s = H_{n,t}^s \tag{48}$$

$$H_t^s = H_{n,t}^s + H_{m,t}^s \tag{49}$$

$$\frac{1-b}{(1-\alpha_1)\, b} \left(\frac{C^s{}_t}{C_{n,t}^s}\right)^{b_1} = \frac{\left(1 - H_{m,t}^s - H_{n,t}^s\right)}{H_{n,t}^s} \tag{50}$$

$$\begin{aligned} &\frac{\epsilon_w}{\alpha_1} \frac{-U_{M^s t}}{U_{C^s t}} \left(\frac{C_{mt}^s}{C_t^s}\right)^{-(b_1-1)} \frac{1}{W_t} + (1-\epsilon_w) - \xi^s \left(\Pi_t^w - 1\right) \left(\Pi_t^w + \frac{1-\epsilon_w}{2} \left(\Pi_t^w - 1\right)\right) \\ &+\beta \frac{U_{C^s t+1}}{U_{C^s t}} \left(\frac{C_{mt+1}^s}{C_{t+1}^s} \frac{C_t^s}{C_{mt}^s}\right)^{b_1-1} \left(\Pi_{t+1}\right)^{-1} \xi^s \left(\Pi_{t+1}^w - 1\right) \left(\Pi_{t+1}^w\right)^2 \frac{M_{t+1}^s}{M_t^s} = 0 \end{aligned} \tag{51}$$

$$\lambda_t^s = \alpha_1\, b \left(1 - H_{m,t}^s - H_{n,t}^s\right)^{(1-b)\,(1-\sigma)} \left(C_{m,t}^s\right)^{b_1-1} \left(C_t^s\right)^{b\,(1-\sigma)-b_1} \tag{52}$$

$$Q_{t,t+1} = \frac{\beta \frac{\lambda^s{}_{t+1}}{\lambda^s{}_t}}{\Pi_{t+1}} \tag{53}$$

$$C_t^h = \left(\alpha_1 \left(C_{m,t}^h\right)^{b_1} + (1-\alpha_1) \left(C_{n,t}^h\right)^{b_1}\right)^{\frac{1}{b_1}} \tag{54}$$

$$C_{n,t}^h = H_{n,t}^h \tag{55}$$

$$H_t^h = H_{n,t}^h + H_{m,t}^h \tag{56}$$

$$\frac{1-b}{(1-\alpha_1)\, b} \left(\frac{C_t^h}{C_{n,t}^h}\right)^{b_1} = \frac{\left(1 - H_{m,t}^h - H_{n,t}^h\right)}{H_{n,t}^h} \tag{57}$$

$$
\begin{aligned}
&\frac{\epsilon_w}{\alpha_1}\frac{-U_{M^ht}}{U_{C^ht}}\left(\frac{C^h_{mt}}{C^h_t}\right)^{-(b_1-1)}\frac{1}{W_t}+(1-\epsilon_w)-\xi^h\left(\Pi^w_t-1\right)\left(\Pi^w_t+\frac{1-\epsilon_w}{2}\left(\Pi^w_t-1\right)\right)\\
&+\beta\frac{U_{C^ht+1}}{U_{C^ht}}\left(\frac{C^h_{mt+1}}{C^h_{t+1}}\frac{C^h_t}{C^h_{mt}}\right)^{b_1-1}\left(\Pi_{t+1}\right)^{-1}\xi^h\left(\Pi^w_{t+1}-1\right)\left(\Pi^w_{t+1}\right)^2\frac{M^h_{t+1}}{M^h_t}=0
\end{aligned}
\tag{58}
$$

$$C^h_t=\left(1-\frac{\xi^h}{2}\left(\Pi^w_t-1\right)^2\right)W_tM^h_t-T_t+\frac{\tau_D}{\psi}P_tD_t. \tag{59}$$

$$U_{C^s_t}=b\left(C^s_t\right)^{b(1-\sigma)-1}\left(1-M^s_t-H^s_{nt}\right)^{(1-b)(1-\sigma)} \tag{60}$$

$$U_{C^h_t}=b\left(C^h_t\right)^{b(1-\sigma)-1}\left(1-\frac{1}{\omega}M^h_t-H^h_{nt}\right)^{(1-b)(1-\sigma)} \tag{61}$$

$$U_{M^s_t}=(b-1)\left(C^s_t\right)^{b(1-\sigma)}\left(1-M^s_t-H^s_{nt}\right)^{\sigma(b-1)-b} \tag{62}$$

$$U_{M^h_t}=\frac{b-1}{\omega}\left(C^h_t\right)^{b(1-\sigma)}\left(1-\frac{1}{\omega}M^h_t-H^h_{nt}\right)^{\sigma(b-1)-b} \tag{63}$$

$$MRS^h_t=\frac{1}{\alpha_1}\frac{-U_{M^h_t}}{U_{C^h_t}}\left(\frac{C^h_{mt}}{C^h_t}\right)^{-(b_1-1)} \tag{64}$$

$$MRS^s_t=\frac{1}{\alpha_1}\frac{-U_{M^st}}{U_{C^s_mt}}\left(\frac{C^s_{mt}}{C^s_t}\right)^{-(b_1-1)} \tag{65}$$

$$W_t=W_{t-1}\frac{\Pi^w_t}{\Pi_t} \tag{66}$$

$$C_{m,t}=\psi C^h_{m,t}+(1-\psi)\,C^s_{m,t} \tag{67}$$

$$C_{n,t}=\psi C^h_{n,t}+(1-\psi)\,C^s_{n,t} \tag{68}$$

$$C_t=\psi C^h_t+(1-\psi)\,C^s_t \tag{69}$$

$$H_{m,t}=\psi H^h_{m,t}+(1-\psi)\,H^s_{m,t} \tag{70}$$

$$H_{n,t}=\psi H^h_{n,t}+(1-\psi)\,H^s_{n,t} \tag{71}$$

$$H_t=\psi H^h_t+(1-\psi)\,H^s_t \tag{72}$$

$$M_t=\psi\omega H^h_{m,t}+(1-\psi)\,H^s_{m,t} \tag{73}$$

$$Y_t=M_t \tag{74}$$

$$MC_t=\frac{W_tM_t}{Y_t} \tag{75}$$

$$D_t=Y_t-W_t\,M_t \tag{76}$$

$$\Pi_t = \frac{P_t}{P_{t-1}} \tag{77}$$

$$\frac{P_t^*}{P_t} = \frac{x_{1,t}}{x_{2,t}} \tag{78}$$

$$x_{1,t} = [C_{m,t} + G_t] \left(\frac{\epsilon_p}{\epsilon_p - 1}\right) MC_t + \beta\theta E_t \left(\frac{\lambda_{t+1}^s}{\lambda_t^s} (\Pi_{t+1})^{\epsilon_p} x_{1,t+1}\right) \tag{79}$$

$$x_{2,t} = [C_{m,t} + G_t] + \beta\theta E_t \left(\frac{\lambda_{t+1}^s}{\lambda_t^s} (\Pi_{t+1})^{\epsilon_p - 1} x_{2,t+1}\right) \tag{80}$$

$$\frac{P_t^*}{P_t} = \left(\frac{1 - \theta \Pi_t^{\epsilon_p - 1}}{1 - \theta}\right)^{\frac{1}{1-\epsilon_p}} \tag{81}$$

$$R_t^n = \frac{1}{Q_t} \tag{82}$$

$$R_t^n = \Pi_{t+1} \, R_t^r \tag{83}$$

$$R_t^n = \frac{1}{\beta} \, \Pi_t^{\phi_\pi} \, \exp\left(\nu_t\right) \tag{84}$$

$$\nu_t = \rho_\nu \, \nu_{t-1} + \epsilon_t^\nu \tag{85}$$

$$T_t^h = 0 \tag{86}$$

$$G_t = 0 \tag{87}$$

$$C_{mt} + G_t = Y_t \tag{88}$$

C.4 Steady state

I assume a zero inflation steady state,

$$\bar{\Pi} = 1. \tag{89}$$

The monetary policy shock is zero, $\bar{\epsilon}^\nu = 0$, so

$$\bar{\nu} = 0. \tag{90}$$

The Taylor rule gives

$$\bar{R}^n = \frac{1}{\beta}, \tag{91}$$

which gives

$$\bar{Q} = \frac{1}{\bar{R}^n}. \tag{92}$$

The two auxiliary equation give the steady state of the real marginal costs, $\bar{MC}$,

$$\bar{x}_1 = [\bar{C}_m + \bar{G}] \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) \bar{MC} + \beta\theta \frac{\bar{\lambda}^s}{\bar{\lambda}^s} \bar{\Pi}^{\epsilon_p} \bar{x}_1 \tag{93}$$

$$\leftrightarrow \bar{x}_1 (1 - \beta\theta\bar{\Pi}^{\epsilon_p}) = [\bar{C}_m + \bar{G}] \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) \bar{MC} \tag{94}$$

$$\bar{x}_2 = [\bar{C}_m + \bar{G}] + \beta\theta \frac{\bar{\lambda}^s}{\bar{\lambda}^s} \bar{\Pi}^{\epsilon_p - 1} \bar{x}_2 \tag{95}$$

$$\leftrightarrow \bar{x}_2 (1 - \beta\theta\bar{\Pi}^{\epsilon_p - 1}) = \bar{C}_m + \bar{G} \tag{96}$$

since $\bar{\Pi} = 1$, $\bar{\Pi}^{\epsilon_p - 1} = \bar{\Pi}^{\epsilon_p} = 1$ and $\bar{P} = \bar{P}^*$, and because $\frac{\bar{x}_1}{\bar{x}_2} = \frac{\bar{P}^*}{\bar{P}} = 1$, it follows that $\bar{x}_1 = \bar{x}_2$. This gives

$$[\bar{C}_m + \bar{G}] \left(\frac{\epsilon_p}{\epsilon_p - 1} \right) \bar{MC} = \bar{C}_m + \bar{G} \leftrightarrow \bar{MC} = \frac{\epsilon_p - 1}{\epsilon_p} \tag{97}$$

Using the production function, the real wage in steady state is given by

$$\bar{W} = \bar{MC} \left(\frac{\bar{Y}}{\bar{M}} \right) = \bar{MC}.$$

The wage setting decision of both types of households in steady state is given by

$$\begin{aligned} \frac{\epsilon_w}{\alpha_1} \left(\frac{-\bar{U}_{M^z}}{\bar{U}_{C^z}} \right) \left(\frac{\bar{C}^z_m}{\bar{C}^z} \right)^{-(b_1 - 1)} \frac{1}{\bar{W}} + (1 - \epsilon_w) - \xi^z \left(\bar{\Pi}^w - 1 \right) \left(\bar{\Pi}^w + \frac{1 - \epsilon_w}{2} \left(\bar{\Pi}^w - 1 \right) \right) \\ + \beta \frac{\bar{U}_{C^z}}{\bar{U}_{C^z}} \left(\frac{\bar{C}^z_m}{\bar{C}^z} \frac{\bar{C}^z}{\bar{C}^z_m} \right)^{b_1 - 1} \left(\bar{\Pi} \right)^{-1} \xi^z \left(\bar{\Pi}^w - 1 \right) \left(\bar{\Pi}^w \right)^2 \frac{\bar{M}^z}{\bar{M}^z} = 0 \\ \leftrightarrow \frac{\epsilon_w}{\alpha_1} \left(\frac{-\bar{U}_{M^z}}{\bar{U}_{C^z}} \right) \left(\frac{\bar{C}^z_m}{\bar{C}^z} \right)^{-(b_1 - 1)} \frac{1}{\bar{W}} + (1 - \epsilon_w) = 0 \\ \leftrightarrow \frac{\epsilon_w}{\alpha_1 (\epsilon_w - 1)} \left(\frac{-\bar{U}_{M^z}}{\bar{U}_{C^z}} \right) \left(\frac{\bar{C}^z_m}{\bar{C}^z} \right)^{-(b_1 - 1)} = \bar{W} \end{aligned}$$

Note that due to sticky wage model, the MRS is only up to a fraction equal to the real wage (whereas if wages were flexible, the MRS is exactly equal to the real wage).

The utility trade-off of savers is given by

$$\frac{-\bar{U}_{M^s}}{\bar{U}_{C^s}} = \frac{-(b - 1) \left(\bar{C}^s \right)^{b(1 - \sigma)} \left(1 - \bar{M}^s - \bar{H}^s_n \right)^{\sigma(b - 1) - b}}{b \left(\bar{C}^s \right)^{b(1 - \sigma) - 1} \left(1 - \bar{M}^s - \bar{H}^s_n \right)^{(1 - b)(1 - \sigma)}} = \frac{1 - b}{b} \frac{\bar{C}^s}{(1 - \bar{M}^s - \bar{H}^s_n)},$$

and when plugging in the previous equation, this yields

$$\frac{\epsilon_w}{\alpha_1(\epsilon_w - 1)}\left(\frac{1-b}{b}\frac{\bar{C}^s}{(1-\bar{M}^s-\bar{H}_n^s)}\right)\left(\frac{\bar{C}_m^s}{\bar{C}^s}\right)^{-(b_1-1)} = \bar{W}$$

$$\leftrightarrow \bar{W}(1-\bar{M}^s-\bar{H}_n^s) = \frac{(1-b)\epsilon_w}{b\alpha_1(\epsilon_w-1)}\bar{C}^s\left(\frac{\bar{C}_m^s}{\bar{C}^s}\right)^{-(b_1-1)},$$

When plugging in for the MRS of HtM households, it yields

$$\frac{\epsilon_w}{\alpha_1(\epsilon_w - 1)}\left(\frac{1-b}{\omega b}\frac{\bar{C}^h}{(1-\frac{1}{\omega}\bar{M}^h)} - \bar{H}_n^h\right) = \bar{W}$$

$$\leftrightarrow \bar{W}(1-\frac{1}{\omega}\bar{M}^h-\bar{H}_n^h) = \frac{(1-b)\epsilon_w}{\omega b\alpha_1(\epsilon_w-1)}\bar{C}^h\left(\frac{\bar{C}_m^h}{\bar{C}^h}\right)^{-(b_1-1)}.$$

I use the function *fsolve* in Matlab to solve for output, and hours worked and consumption of savers and HtM at home, in market, and in total.

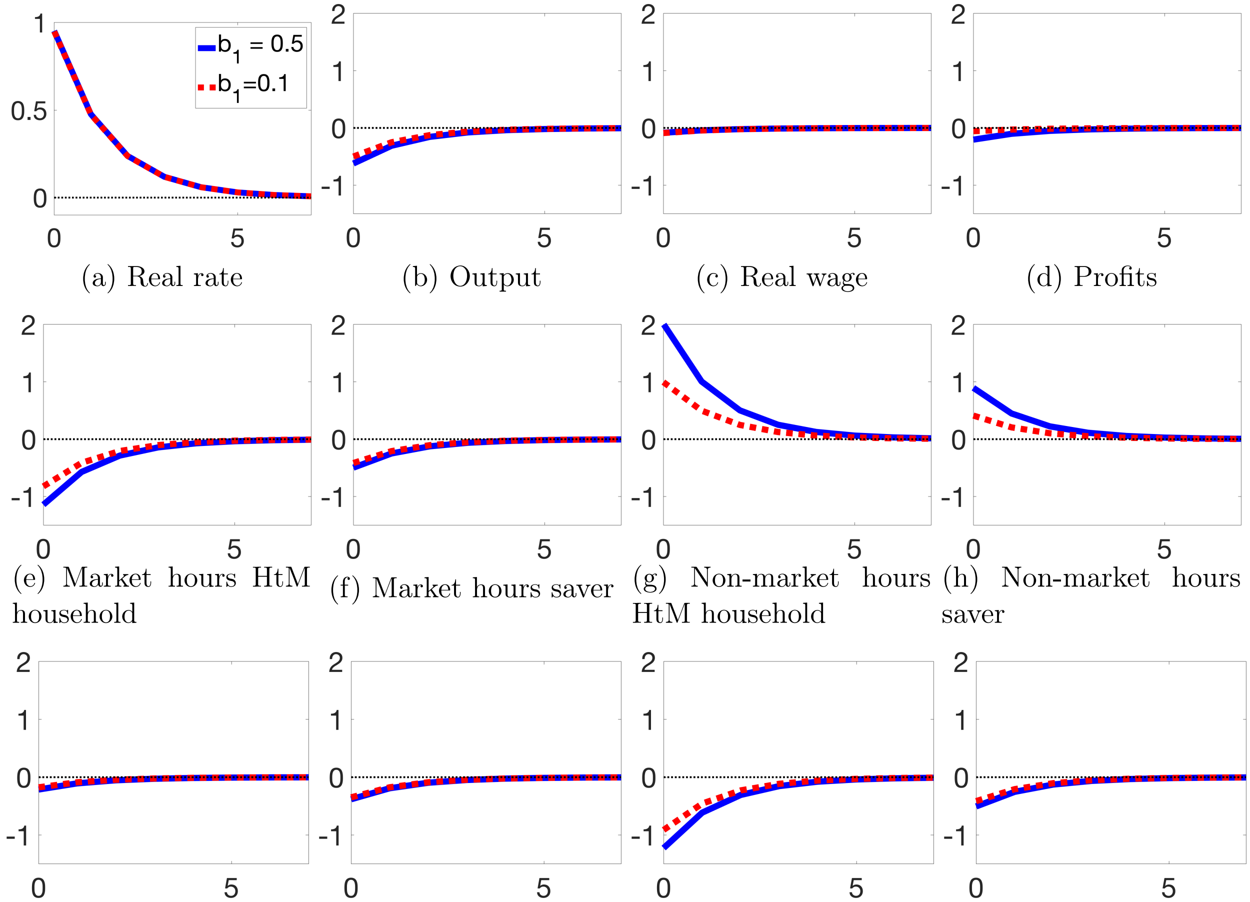
C.5 Model solution

I solve the model using Dynare 5.0 in Matlab R2024b. My code is based on two replication codes. The replication code of Galí (2015) by Johannes Pfeifer,[9] and the replication code of Gnocchi et al. (2016) from the Macroeconomic Model Data Base.

[9] Pfeifer, Johannes (2017): "DSGE_mod: A collection of Dynare models," orcid: 0000-0002-6756-6418.

D Results with a lower substitutability of goods bought on the market and produced at home

Figure 6: Results with a lower and the baseline value of the substitutability of goods bought on the market and produced at home compared



(a) Real rate (b) Output (c) Real wage (d) Profits

(e) Market hours HtM household (f) Market hours saver (g) Non-market hours HtM household (h) Non-market hours saver

(i) Total consumption savers (j) Total consumption HtM households (k) Labor income HtM households (l) Total income savers

Notes: (i) shock size: 100 bp annualized, (ii) responses: quarterly, rates are in pp deviations and all other variables in % deviations from the steady state, (iii) inflation and interest rates are annualized.