Pontifícia Universidade Católica
do Rio de Janeiro

Bruno Alcântara Duarte

Monetary Policy and Housing in HANK

Dissertação de Mestrado

Masters dissertation presented to the Programa de Pós–graduação em Economia, do Departamento de Economia da PUC-Rio in partial fulfillment of the requirements for the degree of Mestre em Economia.

Advisor: Prof. Yvan Becard

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Abstract

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This research investigates how differences in housing market composition influence macroeconomic variables. It explores two main aspects: (i) the distributional effects of housing preferences and (ii) the economy's response to a monetary policy shock. Using a heterogeneous agent New Keynesian (HANK) model, we find that economies favoring home ownership exhibit more egalitarian wealth distributions. In this case, low-asset households hold relatively more assets. Having more wealth reduces their marginal propensity to consume, dampening the effects of monetary policy on economic variables.

Keywords

Housing; Heterogeneous agents; Monetary policy; Wealth distribution.

Resumo

Duarte, Bruno; Becard, Yvan. **Política monetária e setor imobiliário com agentes heterogêneos**. Rio de Janeiro, 2025. 38p. Dissertação de Mestrado – Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro.

Esta pesquisa investiga como as diferenças na composição do mercado imobiliário influenciam variáveis macroeconômicas. Ela explora dois aspectos principais: (i) os efeitos distributivos das preferências por moradia e (ii) a resposta da economia a um choque de política monetária. Usando um modelo HANK (heterogeneous agent New Keynesian), descobrimos que economias que favorecem a propriedade de imóveis apresentam distribuições de riqueza mais igualitárias. Nesse caso, famílias com poucos ativos possuem relativamente mais bens. Ter mais riqueza reduz a propensão marginal ao consumo dessas famílias, o que atenua os efeitos da política monetária sobre as variáveis econômicas.

Palavras-chave

Mercado imobiliário; Agentes heterogêneos; Política monetária; Distribuição de riqueza.

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List of Abbreviations

HANK – Heterogeneous Agent New Keynesian

MPC – Marginal Propensity to Consume

FOC – First-Order Condition

0.1 Introduction

Germany and Italy are two countries that have a sharp difference in home ownership. While most Italians are home owners, most Germans rent. They have a similar level of wealth per capita but great differences on how their wealth is distributed. The median wealth in Italy is significantly higher compared to Germany, and the inequality and the share of households with less than $10,000 in assets are much lower. Table 1 shows some key statistics comparing home ownership and wealth distribution between these two countries.

A key aspect in explaining the differences in wealth distribution between countries is the housing market. Housing represents the largest share of total wealth in most countries. Countries with a higher home-ownership rate generally have lower wealth inequality. This is because in an economy with mostly home owners, even lower-asset individuals own houses, giving them significant wealth. In an economy of mostly renters, low-asset individuals rent and have only financial assets as wealth. But they generally have much less in financial wealth than the value of real estate of low-asset home owners. This drastically reduces the total wealth of low-asset households in economies with a majority of renters.

Table 1: Wealth and Housing in Italy and Germany

	Italy	Germany
Home-ownership rate	75%	45%
Mean wealth	$234,139	$216,654
Median wealth	$91,889	$35,313
Share with less than $\$10,000$	5.8%	40.6%
Wealth Gini	0.669	0.816

Source: Global Wealth Databook 2019 by Credit Suisse

This research investigates (i) how a preference for home ownership affects the wealth distribution of an economy and (ii) how this preference impacts the transmission of monetary policy. We build a heterogeneous agent New Keynesian model (HANK) that incorporates housing preferences. In the baseline version of the model, households value both housing services and owning real estate. In the standard version, we calibrate the model so that households value only housing services, being indifferent to living in a house they own or renting a property.

Households can save in two assets: housing and bonds. There are two types of consumption, goods consumption and rent (housing services consumption). We incorporate frictions in buying and selling real estate through an adjustment cost that households pay if they change their amount of housing wealth. The rental market is frictionless, so agents can change the amount of housing services costlessly. We match the steady-state properties of both versions with the same output and total wealth. The calibration is the same, except for the preference for owning real estate.

We investigate how the preference for home ownership affects the wealth distribution of the economy. And we simulate the same monetary policy shock, a reduction in the interest rate, and compare the transmission between the versions. The comparison between Italy and Germany is convenient since monetary policy in both countries is the same, decided by the European Central Bank.

The first main takeaway is that the preference for home ownership generates much less wealth inequality. That is, low-asset households have more assets. This is in line with what we see in Italy and Germany. For low-asset households, the preference for home ownership makes them want to hold more housing wealth. On the other hand, for high-asset households, the marginal propensity for more housing ownership is low since their holdings are already at the high end of the distribution. This makes low-asset households hold

relatively more housing and high-asset households hold relatively less, making the distribution of housing wealth more egalitarian.

The second main takeaway is that an economy with preference for home ownership is less sensitive to monetary policy. This is in line with evidence presented in Scharnagl, Mandler, and Volz (2016) and Ampudia, Georgarakos, Slacalek, Tristiani, Vermeulen, and Violante (2018). A result in standard HANK models is that households in the lower end of the wealth distribution, who have a higher marginal propensity to consume, drive an important share of the reaction to deviations from the steady state. An economy with a preference for ownership implies that low-asset households have relatively more assets, and, consequently, a relatively lower marginal propensity to consume. This results in a dampened effect of monetary policy.

This research contributes to the literature in macroeconomics, housing and monetary policy in three ways. This first contribution is the addition of housing to the recent literature on HANK models. We build upon the literature by extending the canonical HANK model proposed in Auclert, Rognlie and Straub (2024) to include housing preferences. Currently the only paper that includes housing preferences in a heterogeneous-agent framework is an unpublished paper by Hedlund, Karahan, Mitman and Ozkan (2017) that focuses on mortgage debt.

The second contribution is to include a framework with heterogeneous agents into the literature that already looks at housing preferences. Our model includes household heterogeneity and frictions to the literature of housing in macroeconomics, important aspects pointed out by Piazzesi and Schneider (2016). Iacoviello (2005), Iacoviello (2015), Iacoviello and Neri (2010), Becard and Gauthier (2022), Ferrante (2019) and Agénor, Jackson and da Silva (2024), among others, introduce housing to the utility function of agents. However, these papers cannot speak about wealth distribution since they do not include heterogeneity.

The third contribution is the new way we model the housing market. First is to allow for a rental market. Owners can rent out their property to other households and households that do not hold real estate can rent housing to live in. An important aspect of housing is that it serves as both a consumption good and a collateralizable asset. This is related to the literature that includes a durable good in the utility function such as Auclert, Rognlie and Straub (2018) and Partsch, Petrella and Santoro (2024). Housing in existing models plays a role very similar to what a durable good plays in the papers cited. However, in our research, it is key that agents can rent out the housing owned and earn income from it. In current models, if agents did not have consumption for durable goods in the utility function, no agent would own them, since they depreciate and do not generate returns like bonds. For the housing model proposed, it is the opposite, even without utility for housing ownership, some households still have housing ownership to get income from renting.

Second is to include a preference for ownership of housing. In some countries, there is an explicit preference for owning real estate, which is reflected in the home-ownership rate. Therefore, one of the key aspects of this paper is to incorporate this preference for not only housing consumption but also to housing wealth in the agents' behavior. This captures the preference for owning real estate. Kaplan, Mitman, and Violante (2020) argue that there may be additional utility for households from home ownership. Michaillat and Saez (2021) apply this principle to total wealth proposing a New Keynesian model in which agents value both consumption and wealth in their preferences.

This research is organized as follows. Section 2 proposes a model that includes a preference for housing ownership. Section 3 proposes a calibration. Section 4 examines how a preference for ownership changes steady-state properties of an economy. Section 5 shows how differently the economy responds to a monetary policy shock given a difference in this preference. Section 6 concludes.

0.2
A Model with Housing Wealth in the Utility

In this section we propose a model that builds upon the existing literature to include housing wealth to the utility function. First, we explain the household problem and how it is different from existing models. Then, we detail the key blocks of the model as well as go into the conditions that provide how general equilibrium obtains. Finally, we set a calibration that make the new model similar to existing models in the literature.

0.2.1
Households

The economy is populated by a unit mass of households indexed by $i \in [0, 1]$. They have preferences over consumption, housing services and housing wealth, respectively c_{it}, h^s_{it} and h^w_{it}. Households are subject to idiosyncratic productivity shocks. At the beginning of each period, household i draws idiosyncratic productivity e_{it} from a stochastic process described by a positive and recurrent finite-state Markov chain; e_{it} is iid across households, with a mean normalized to 1. A union aggregates the labor of households and supplies the total labor of the economy to a firm. The firm hires labor from the union to produce the output of the economy. The lifetime utility function of the household is

$$\sum_{t=0}^{\infty} \beta^t E_0 \left[\frac{(c_{it})^{1-\sigma}}{1-\sigma} + \gamma \frac{(h^s_{it})^{1-\theta}}{1-\theta} + \delta \frac{(h^w_{it})^{1-\eta}}{1-\eta} \right],$$

the household's budget constraint is given by

$$c_{it} + h^s_{it} + h^w_{it} + b_{it} = w_t l_t e_{it} + h^w_{it-1} + r^h_t h^w_{it-1} + (1 + r^b_t) b_{it-1} - \Psi(h^w_{it}, h^w_{it-1}),$$

and households face a borrowing constraint

$$b_{it} \geq \bar{b}.$$

Households spend on consumption (c_{it}), housing services (h^s_{it}) that are rented, housing wealth (h^w_{it}) and bonds (b_{it}). Households earn income dependent on the wage (w_t) in the economy, labor supplied (l_t) and idiosyncratic productivity (e_{it}). Savings can be made through housing ownership or bonds. Bonds earn interest (r^b_t) and housing is rented at a rental rate (r^h_t) to provide housing services at each period. Households can live in the house they own or rent. If a household lives in the house it owns, we consider that it pays an implicit rent to itself ($h^s_{it} = r^h_t h^w_{it}$). While changing the amount of housing rented is costless, there is an adjustment cost ($\Psi(h^w_{it}, h^w_{it-1})$) to change the amount of housing owned in the household's portfolio.

All the housing stock is rented to households. An agent does not need to live in the housing it owns, it can own real estate but live in a rented house. For example, an agent with high real estate ownership that gets a low salary is not stuck to living in its housing stock but can rent lower housing services from others, given its low salary, and earn income from renting its own property. This is a generalization of existing models with housing in utility, in which households have to live in the housing they own. Details about how existing models are a special case of our more general framework are in the appendix.

A way to incorporate the illiquidity of housing as an asset is simply to add a cost to households for changing their real estate holdings. This expenditure is considered a sunk cost and is included in the goods market expenditure. The adjustment cost is similar to Auclert, Bardóczy, Rognlie and Straub (2021), but instead of referring to illiquid assets it refers to housing and is given by

$$\Psi(h^w_{it}, h^w_{it-1}) = \frac{\chi_1}{\chi_2} \left| \frac{h^w_{it} - h^w_{it-1} - r^h_t h^w_{it-1}}{h^w_{it-1} - r^h_t h^w_{it-1} + \chi_0} \right|^{\chi_2} \left(h^w_{it-1} - r^h_t h^w_{it-1} + \chi_0 \right).$$

0.2.2 Production

A representative firm works under perfect competition that results in zero profits. It hires the aggregate labor supplied by the union to produce a final good with a production function that only takes labor as input

$$Y_t = L_t.$$

The firm maximizes profit at each period, given by

$$\Pi_t = Y_t - w_t L_t.$$

Since the economy has perfect competition, flexible prices and sticky wages, real wages remain equal to 1 at all times. When a shock hits, it is inflation that adjusts to maintain the equality on both sides of the wage-Phillips curve equation, after changes in labor supply and consumption.

0.2.3 Broker

A broker intermediates the rental market and finances itself issuing bonds. The broker matches home owners who are renting out to households that want to rent. It earns revenue from the rent paid by households and from bonds that pay a coupon in the following period. This is used to pay home owners for the properties they rented out and to pay the coupon on bonds emitted in the previous period. Outlays and receipts balance out, as,

$$H_t^s + B_t = r_t^h H_{t-1}^w + (1 + r_t^b) B_{t-1}.$$

The broker is competitive and acts solely as an intermediary, so it does not make any profit.

The central bank sets the interest rate of the economy (r^*). Bonds earn a return (r_t^b) which is equal to the interest rate of the economy discounted by a spread (ϕ)

$$1 + r_t^* = 1 + r_t^b + \phi.$$

The spread serves as a liquidity premium that households pay for being able to sell bonds without an adjustment cost. They get liquidity that they can use for other expenditures, such as consumption in case of a reduction in their income.

0.2.4 Union

A competitive labor packer aggregates a continuum of labor services with a constant elasticity of substitution ($\frac{\mu_w}{\mu_w - 1} > 1$). Unions set wages to maximize the average utility of households, taking as given their consumption and savings decisions. Setting a nominal wage (W_t) incurs in a quadratic adjustment cost

$$\frac{\mu_w}{\mu_w - 1} \frac{1}{2\kappa_w} [ln(W_t/W_{t-1})]^2.$$

In equilibrium, aggregate wage inflation

$$1 + \pi_t^w = (1 + \pi_t) w_t / w_{t-1}$$

evolves according to the Phillips curve

$$ln(1 + \pi_t^w) = \kappa_w \left(\varphi L_t^{1+\nu} - \frac{w_t L_t}{\mu_w} \int e_{it} c_{it}^{-\sigma} \, di \right) + \beta ln(1 + \pi_{t+1}^w).$$

This wage Phillips curve is a standard result in the literature and is derived in Auclert, Bardóczy, Rognlie and Straub (2021).

0.2.5
Market Clearing

The final good produced is used for consumption of goods, housing consumption and owned housing adjustment cost

$$Y_t = C_t + H_t^s + \int \Psi(h_{it}^w, h_{it-1}^w)\, di.$$

0.2.6
Standard Model

The standard model is similar to the housing-wealth-in-utility model but does not consider the preference for housing ownership. This is equivalent to just setting $\delta = 0$. Therefore, households are indifferent to owning or renting. The lifetime utility function of the household is, therefore,

$$\sum_{t=0}^{\infty} \beta^t E_0 \left[\frac{(c_{it})^{1-\sigma}}{1-\sigma} + \gamma \frac{(h_{it}^s)^{1-\theta}}{1-\theta} \right].$$

The model we propose in this research is different to the models with housing developed by existing papers. If we look at the latter, housing only exists as an asset because agents derive utility from it. Therefore, without housing in the utility function, there would be no real estate expenditure. This comes from the fact that the price of housing is constant in steady state and real estate cannot be rented out. Thus, no income flow is generated by housing ownership. So, households without housing in the utility function would simply save through bonds, because they would be receiving interest payments instead of no payments from owning houses. In the model developed in this research, however, bonds pay interest but owners can also receive rent from the housing they own. So, even without housing in the utility function, some agents would own houses to receive income from renting them.

0.3 Calibration

Table 2 presents the calibrated version of the HANK model. For the household problem, most parameters follow the calibration in Auclert, Bardóczy, Rognlie and Straub (2021). Households have a borrowing constraint equal to zero for bonds.

Table 2: Calibration for Baseline and Standard models

Parameter		Value (HWiU/Std)	Target/Source
Households			
β	Discount factor	0.959/0.968	$B + H^w = 14$
γ	Taste for housing services	0.45	$H^s = 0.175\ Y$ - ϕB
δ	Taste for housing wealth	0.2/0	Kaplan et al (2020)
θ	IE of housing service	2	$\theta = \sigma$
η	IE of housing wealth	3	$\eta > \sigma$
σ	Inverse IES	2	Standard
$\bar{b}$	Borrowing constraint	0	McKay et al. (2016)
χ_0	Portfolio adj. cost pivot	0.25	Auclert et al (2021)
χ_1	Portfolio adj. cost scale	6.5	Auclert et al (2021)
χ_2	Portfolio adj. cost curvature	2	Auclert et al (2021)
ρ_e	Autocorrelation of earnings	0.966	Auclert et al (2021)
σ_e	Std of log earnings	0.92	Auclert et al (2021)
Labor			
φ	Disutility of labor	2	Auclert et al (2021)
ν	Inverse Frisch elasticity	1	Auclert et al (2021)
κ_w	Slope of wage Phillips curve	0.1	Auclert et al (2021)
μ_w	Steady state wage markup	1.1	Auclert et al (2021)
Broker			
ϕ	Liquidity premium	0.005	Auclert et al (2021)
Discretization			
n_e	Points in Markov chain for e	8	
n_b	Points on bond grid	50	
n_h	Points on housing grid	170	

We calibrate the model to the US and make use of parameters already established in the literature. Calibrating a model for Germany and other for Italy would result in several parameters being different. So, we would not be able to measure the difference in steady-state properties and response to monetary policy that derives exclusively to a different preference for home ownership.

The four non-standard parameters refer to housing services and housing ownership in the utility function of households (θ, γ, η, δ). We first set $\theta = \sigma$ since housing services consumption is treated similarly to goods consumption, so both have the same elasticity of substitution. Then we set γ so that rents and implicit rents account for about 17% of total expenditure in steady state, which is the share of rent to output in the US. Parameter η is set so that the elasticity for housing wealth is less significant than for consumption, which indicates that, on the margin and at same levels, consumption expenditure gives more utility than home ownership. Finally, we set δ to be similar to what is used in Kaplan, Mitman and Violante (2020) in a somewhat similar context. This paper has a model in which owners have housing in the utility and calibrate a taste for it of $\delta = 0.2$. In the standard model, we set $\delta = 0$, which eliminates the preference for home ownership.

Parameter β is slightly different between both versions but is set so that the total wealth of the economy equals 14. This is equivalent to setting total wealth as 3.5 times the annual output, which is also in line with what is observed in the US. The part referring to the supply of labors by unions follows exactly from Auclert, Bardóczy, Rognlie and Straub (2021), generating a wage New Keynesian Phillips curve with slope of 0.1. The disutility of labor is set to 2. The broker has a liquidity premium in steady state of 0.005 between the interest rate of the economy and interest rate on bonds. In steady state the economy has 0 inflation. We normalize output to 1 and, since $Y = L$, labor supply is also 1.

The process for productivity follows a discretized version of an AR(1) process, whose parameters (ρ_e and σ_e) also follow the calibration used in Auclert, Bardóczy, Rognlie and Straub (2021) model with two assets

$$ln(e_{it}) = \rho ln(e_{it}) + \sigma \varepsilon_{it}$$

such that $\rho = \rho_e$ and $\sigma/\sqrt{1-\rho^2} = \sigma_e$.

0.4 Wealth Distribution

This section presents the steady-state results. We find that the distribution of assets in the economy is significantly different when households have a preference for real estate ownership.

First, by endogenously choosing in which asset to save, the preference for ownership leads households to hold more savings in real estate. This is consistent with real-world evidence. Italy's real estate represents a larger share of their total wealth than Germany's.

Table 3 shows some key steady-state macroeconomic aggregates. Output and total wealth are the same for the two versions of the model by construction. The two versions endogenously generate a total consumption level (goods consumption plus housing services consumption). Moreover, the two versions also endogenously allocate part of the total wealth to housing wealth and bonds. For households that derive utility from ownership, total housing ownership is higher, and bond holdings, lower.

Table 3: Steady-state macroeconomic aggregates

Variable		Baseline model	Standard model
Y	Output	1	1
$C + H^s$	Total consumption	0.99	0.99
$H^w + B$	Total wealth	14	14
H^w	Housing wealth	12.1	10.3
B	Bond wealth	1.9	3.7

Second, the preference for ownership reduces wealth inequality. This is also consistent with real-world evidence. Italy has a much more equal wealth distribution than Germany.

The upper left graph in Figure 1 compares the probability distribution of housing between the model in which agents prefer to be home owners and

the model in which they are indifferent to ownership. The addition of housing wealth to the utility function dramatically changes the wealth distribution in the economy. For low-asset households, the utility for home ownership makes them hold more housing wealth. On the other hand, for high-asset households, the marginal utility for more housing is low since their holdings of the asset are already high. With low-asset households holding relatively more housing and high-asset households holding relatively less, the distribution of housing becomes more egalitarian. We see that with home-ownership preferences, some real estate holdings shift from wealthy households to lower-wealth ones.

The lower left graph in Figure 1 compares the probability distribution of bonds between the housing wealth in the utility model and the standard model. For bonds, households with home-ownership preference have higher housing ownership and consequently lower bond holdings. Almost half of those have zero bonds. It also shows that they are more liquidity constrained in case of shocks. By holding more housing and less bonds, the liquidity of their assets is lower. On the other hand, low-asset households have higher total asset holdings, which compensates and generates an effect in the opposite direction.

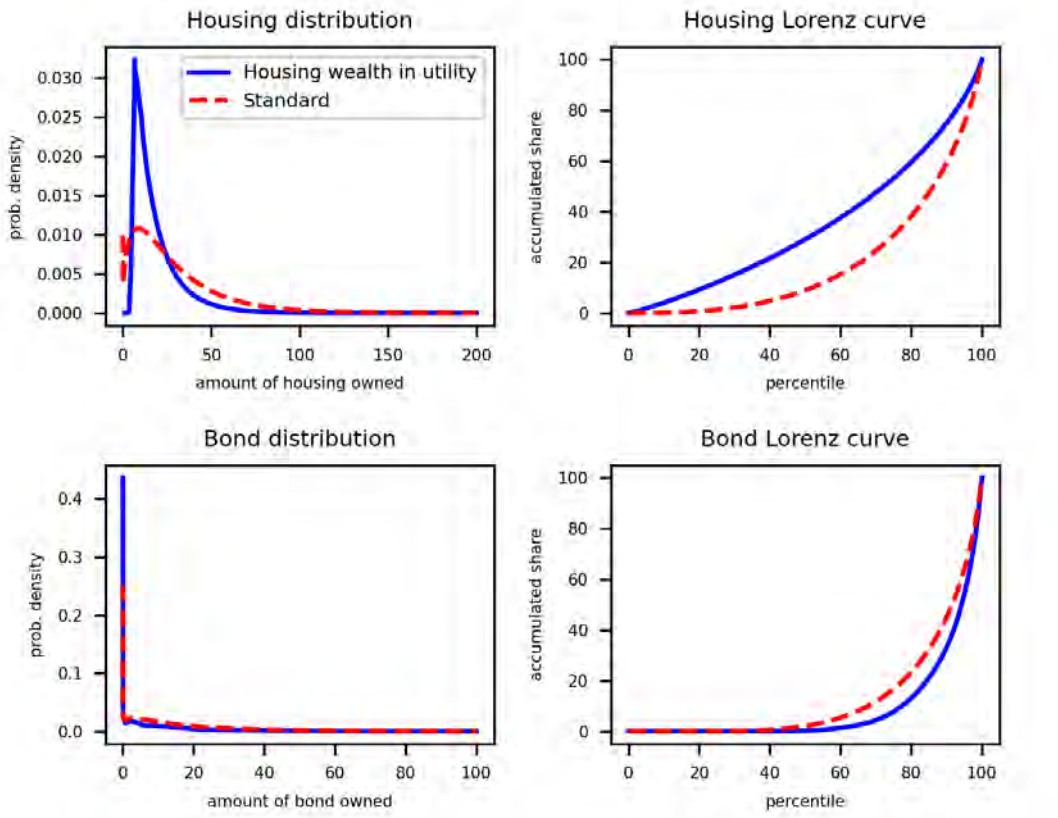

Figure 1: Probability distributions and Lorenz curves

The upper right graph in Figure 1 shows that the holding of housing differs significantly between the versions. In the bottom percentiles of the distribution, households own more housing when they have the home-ownership preference. As a result, for the top percentiles, the amount of real estate owned is lower in this version. The consequence is the Lorenz curve of housing ownership, which shows that wealth inequality is much higher in the standard model. Low-asset households also hold a significantly higher share of the housing wealth in the baseline model.

The bond Lorenz curve in the bottom right of Figure 1 also shows higher inequality in liquidity in the baseline model. In this version, low-asset households have less bonds. This is a consequence of the preference for saving in real estate. But it will not make a significant difference, since the bottom 50% holds less than 2% of total bond wealth in both versions. The difference

in bond holdings is generated mostly in the top 50%.

The distribution of consumption between the versions, to the contrary, is practically identical. This is a consequence of making the versions as similar as possible with the only difference in the home-ownership preference.

Table 4: Percentage of asset holdings by wealth bracket

Moment	Baseline model	Standard model
Total wealth		
Top 10%	25.5%	33.9%
50th to 90th percentile	49.2%	55.1%
Bottom 50%	25.3%	11.0%
Housing wealth		
Top 10%	23.0%	36.6%
50th to 90th percentile	48.7%	54.9%
Bottom 50%	28.3%	8.5%
Bond wealth		
Top 10%	55.5%	47.3%
50th to 90th percentile	44.4%	50.9%
Bottom 50%	0.1%	1.8%

Table 4 presents some of the statistics from the wealth distribution in each version of the model. It shows how much of housing and bonds are owned by different tranches of the population in each model. We see that there is a significant difference especially in housing ownership. In the baseline model, the bottom 50% have more than three times as much a share of total housing than in the standard model (28.3% against 8.5%). Also, the share of housing owned by the top 10% is significantly lower (25.5% against 33.9%). This shows the additional wealth of the bottom 50% that a preference for home ownership generates. We see that most of the additional wealth comes from the top 10%.

0.5 Monetary Transmission

The objective of this section is to analyze whether the difference in the income distribution generated by home-ownership preferences has consequences for monetary policy. We find that the same monetary policy generates different responses among the two economies. In the real world, this can can hinder the monetary policy's effectiveness and cause diverging economic outcomes on countries with different housing preferences.

In the comparison between Germany and Italy, the European Central Bank decides a rate policy which is the same for both countries. The goal is to see how differently an economy with a preference for home ownership and one indifferent to it react to the same shock. The HANK literature shows that the reactions to deviations from the steady state are mostly driven by agents with few assets, who therefore have high marginal propensity to consume. If the lower percentile households now have more wealth, it is expected that shocks will have a lower impact magnitude.

Figure 2 shows the response of the economies to a 25-basis-point reduction in the central bank's interest rate (r^*). Both versions are plotted in each graph.

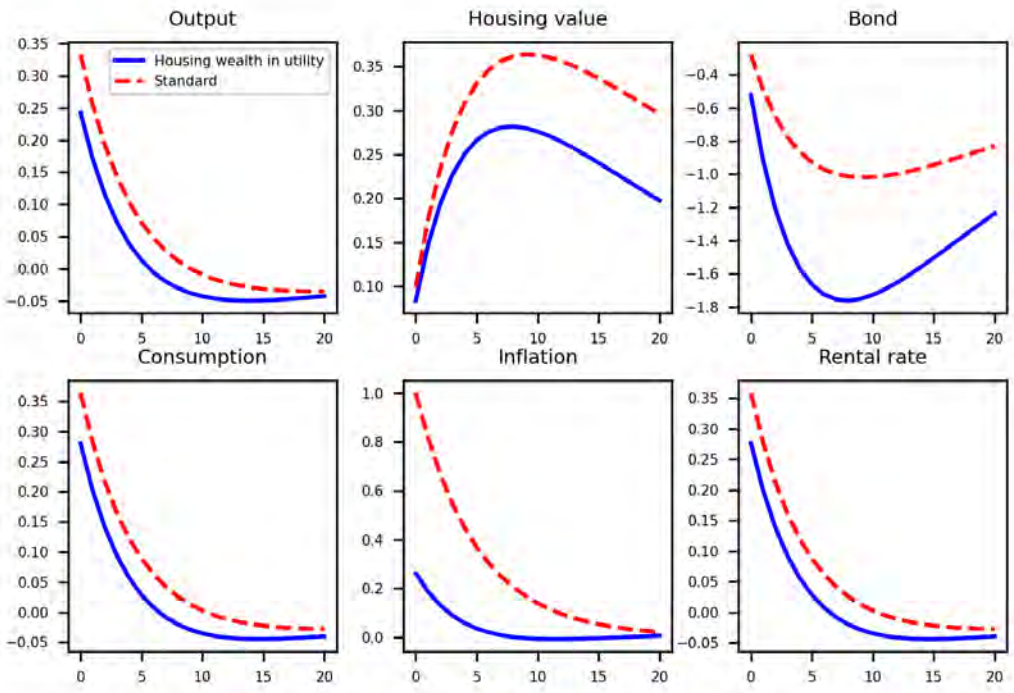

Figure 2: Impulse response functions to change in real interest rate

The response to the interest rate shock is dampened when agents desire to own housing. For output, the baseline model reacts with an increase in output of less than 0.25%. In comparison, the standard model reacts with an increase of more than 0.33% in the quarter following the shock. That is, the shock in output is about 30% stronger in the standard model. If we look at consumption, the difference is similar, as almost all of output goes to consumption. The shock increases consumption in the following quarter by about 0.28% in the baseline model while increasing consumption by about 0.36% in the standard model. More total assets reduce low-asset households' marginal propensity to consume (MPC). Even with lower liquidity (less bonds), these low-asset agents' higher savings can be used to pay for the adjustment cost in case of shocks. Thus, the lower liquidity is less relevant for shocks.

Looking at the asset holdings of households, we see that, given a reduction on interest paid by bonds, there is a substitution effect. Agents increase the total share of housing in the economy's portfolio, increasing the value of

housing. In contrast, the value of bonds goes down. It is noteworthy that the effect is smaller in the baseline model. This is a result of the higher level of housing ownership in steady state. Therefore, when the shock hits, the percentage increase is smaller. In contrast, in the standard model, as low-asset individuals already have lower real estate holdings, the marginal effect is larger. For bonds, the inverse is true, since the baseline model bond holdings are about half of the standard model's, the percentage reduction in bonds is higher. In absolute terms, still, the response in the baseline model is lower.

Since the substitution of assets is lower in the baseline model, so is the cost of adjusting housing ownership. Thus, it contributes to the fact that the difference in the effect of the shock on output is larger than the difference on consumption.

The impact in inflation is also of higher magnitude in the model without home-ownership preference. In the standard model, inflation in the quarter following the shock is 1% up from steady state while it is only up 0.3% in the housing wealth in utility model. We can conclude that if the ECB uses interest rates as sole instrument of reducing inflation, the effect is disparate between countries. Finally, the rental rate is such that leads to the clearing of markets. So, since housing services consumption response is larger in the standard model, the rental rate also responds more to the interest rate shock.

0.5.1 Distributional Effects

Figure 3 shows the different reaction to a monetary policy shock in different wealth quintiles. The main takeaway is that the shock seems to favor low-asset households more in the standard model. For the top percentiles, the response is very similar. The increased wealth of low-asset households as a consequence of a home-ownership preference shields these agents to shocks and reduces their reaction.

The upper part of Figure 3 shows the effect of the monetary policy shock

in consumption. If we compare the effect in each quintile between the baseline and standard models, we see that the response of the bottom 20% in the baseline model is half of the response in the standard model. This difference is reduced with increasing wealth. The top 20% has the same response magnitude in both versions.

When comparing the effects in different quintiles in each version, in the baseline model, the response in consumption for the bottom 20% of households is almost the same as for the top 20%. In the standard model, the response in consumption for the bottom 20% of households is about twice as for the top 20%. So, in the baseline model, the response is flat despite the increasing wealth. For the standard model, the response shows a clear negative slope with the increase in wealth.

The bottom part of Figure 3 shows the effect of the monetary policy shock in housing wealth. For housing wealth, the baseline model also shows a much weaker response for low-asset households. In this version, low-asset households already have a significant amount of housing, so their marginal propensity to save in housing is low. The opposite happens in the standard model, it has a much stronger response for low-asset households. In this version, the low-asset agents have almost no housing or total savings. They have a high marginal propensity to save in order to get shielded from shocks. So, an expansionary shock leads them to a strong increase in housing wealth.

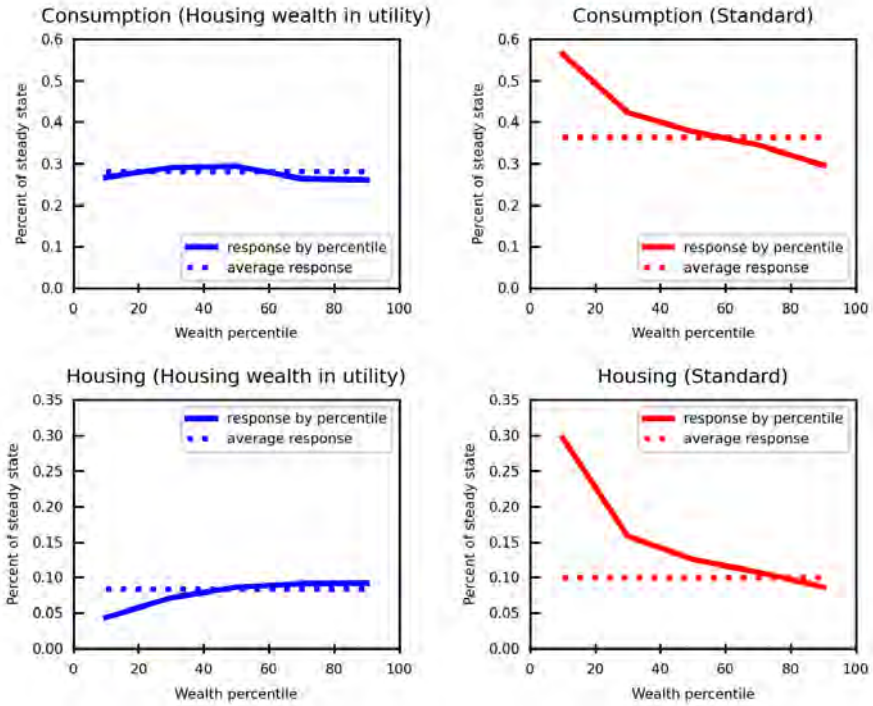

Figure 3: Response of consumption and housing wealth by quintile

0.6 Conclusion

This research studies the impact of housing ownership in wealth distribution and monetary policy. We build a baseline model to represent households who have a preference for home ownership. Then, we make a change to represent households who are indifferent between renting and owning real estate, similar to existing models in the literature and call it the standard model. The main takeaway in steady state is that when households prefer to own, low-asset individuals have a larger share of the total real estate, and the high-asset ones, a lower share. Thus, there is a reduction in wealth inequality in the economy. This is a result of the fact that if all households favor ownership, low wealth people have a higher marginal propensity to spend on housing ownership compared to the standard model. The wealthy, given high real estate holdings, have, comparatively, a low marginal propensity to spend on housing ownership. This has a significant consequence on monetary policy. The power of the response, especially in output, to a lowering of interest rates is dampened. In heterogeneous agents models, an important part of the response to shocks comes from low-asset households with high MPCs. If now these households hold more assets, the MPC is lower and the response to shocks is diminished.

Going forward, we would like to calibrate the two versions of the model to the economies of Italy and Germany to analyze how the response to the same monetary shock adversely affects both economies. This would allow us to use empirical data to look and quantify if the ECB low-interest-rate policy after the Eurozone crisis helped to amplify the economic divergence between these two economies.

0.7 References

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0.8
Appendix

0.8.1
First-order and Envelope Conditions

The algorithm used in the household sector follows almost identically from Auclert, Bardóczy, Rognlie an Straub (2021), with the following setup:

$$V_t(e_{it}, h^w_{it-1}, b_{it-1}) = \max \frac{(c_{it})^{1-\sigma}}{1-\sigma} + \gamma \frac{(h^s_{it})^{1-\theta}}{1-\theta} + \delta \frac{(h^w_{it})^{1-\eta}}{1-\eta} + \beta E_t \left[V_{t+1}(e_{it+1}, h^w_{it}, b_{it}) \right]$$

$$s.t. \quad c_{it} + h^s_{it} + h^w_{it} + b_{it} = w_t l_t e_{it} + h^w_{it-1} + r^h_t h^w_{it-1} + (1 + r^b_t) b_{it-1} - \Psi(h^w_{it}, h^w_{it-1})$$

$$b_{it} \geq \bar{b}$$

The first order conditions are:

$$(1 + \Psi_1(h^w_{it}, h^w_{it-1}))(-c_{it}^{-\sigma}) + \delta (h^w_{it})^{-\eta} + \beta E_t \left[\partial_{h^w} V_{t+1}(e_{it+1}, h^w_{it}, b_{it}) \right] = 0$$

$$(-c_{it}^{-\sigma}) + \beta E_t \left[\partial_b V_{t+1}(e_{it+1}, h^w_{it}, b_{it}) \right] = 0$$

$$(-c_{it}^{-\sigma}) + \gamma (h^s_{it})^{-\theta} = 0$$

The envelope theorem gives:

$$\partial_{h^w} V_t(e_{it}, h^w_{it-1}, b_{it-1}) = (1 + r^h_t + \Psi_2(h^w_{it}, h^w_{it-1}))c^{-\sigma}_{it}$$

$$\partial_b V_t(e_{it}, h^w_{it-1}, b_{it-1}) = (1 + r^b_t)c^{-\sigma}_{it}$$

Since $W_t(e_{it}, h^w_{it}, b_{it}) \equiv \beta E_t \left[V_{t+1}(e_{it}, h^w_{it}, b_{it})\right]$, if $e_{it+1} \to e_{it}$, we have:

$$W_{h_o}(e, h'_o, b') = \beta \Pi V_{h_o}(e', h'_o, b')$$

$$W_b(e, h'_o, b') = \beta \Pi V_b(e', h'_o, b')$$

If inequality constraints are non-binding:

$$W_{h_o}(e, h'_o, b') = (1 + \Psi_1(h'_o, h_o))c^{-\sigma} - \delta h^{-\eta}_o$$

$$W_b(e, h'_o, b') = c^{-\sigma}$$

Which leads to:

$$\frac{W_{h_o}(e, h'_o, b')}{W_b(e, h'_o, b')} + \frac{\delta h^{-\eta}_o}{c^{-\sigma}} = 1 + \Psi_1(h'_o, h_o)$$

This last equation is key to changing the algorithm used in Auclert, Bardóczy, Rognlie an Straub (2021) to adapt the housing ownership in the utility function characterization.

0.8.2 Observations

Many models already try to model housing by putting housing in the utility function such as Bécard and Gauthier (2022), Ferrante (2019), Iacoviello (2005), Iacoviello (2015), Iacoviello and Neri (2010), Piazzesi and Schneider (2016), Agénor, Jackson an da Silva (2024), among others. In all of them, households live in the housing they own. That is, the rent they pay for housing services is equal to the revenue they receive from renting the real estate they own. In the model in this paper, this would imply $h^s_{it} = r^h_t h^w_{it-1}$ for all i, such that the budget constraint becomes

$$c_{it} + h^w_{it} + b_{it} = w_t l_t e_{it} + h^w_{it-1} + (1 + r^b_t) b_{it-1} - \Psi(h^w_{it}, h^w_{it-1}).$$

As h^w_{it} in this paper's notation represents the current value of housing owned at a given time, we can make a small notation change that doesn't change results but puts into evidence prices. So we can write $h^w_{it} = q_t h_{it}$ and $h^w_{it-1} = q_t h_{it-1}$, with a fixed amount of housing $\int h_{it}\, di = \bar{h}$. This gives us a new budget constraint:

$$c_{it} + q_t(h_{it} - h_{it-1}) + b_{it} = w_t l_t e_{it} + (1 + r^b_t) b_{it-1} - \Psi(h_{it}, h_{it-1}).$$

If the housing adjustment cost is taken out, we have:

$$c_{it} + q_t(h_{it} - h_{it-1}) + b_{it} = w_t l_t e_{it} + (1 + r^b_t) b_{it-1},$$

which is a simplified version of the budget constraint in all the papers cited

previously.

Therefore, this paper extends the housing literature by differentiating between housing services consumption and housing ownership. This is a central theme in this work since even though everyone derives utility from the housing services consumption, in some countries there is also utility derived from the ownership of housing.

0.8.3 MPC

	Baseline	Standard
MPC	0.186	0.228

Table 5: MPC in each version of the model