

**Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.**

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2018-012

Please cite this paper as:

Andrés, Javier, José E. Boscá, Javier Ferri, and Cristina Fuentes-Albero (2020). "Household's Balance Sheets and the Effect of Fiscal Policy," Finance and Economics Discussion Series 2018-012r1. Washington: Board of Governors of the Federal Reserve System, <https://doi.org/10.17016/FEDS.2018.012r1>.

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Households' Balance Sheets and the Effect of Fiscal Policy

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This version, May 2020

Abstract

Using households' balance sheet composition in the Panel Survey of Income Dynamics, we identify six household types. Since 1999, there has been a decline in the share of patient households and an increase in the share of impatient households with negative wealth. Using a six-agent New Keynesian model with search and matching frictions, we explore how changes in households' shares affect the transmission of government spending shocks. We show that the relative share of households in the left tail of the wealth distribution plays a key role in the aggregate marginal propensity to consume, the magnitude of fiscal multipliers, and the distributional consequences of government spending shocks. While the output and consumption multipliers are positively correlated with the share of households with negative wealth, the size of the employment multiplier is negatively correlated. Moreover, our calibrated model can deliver jobless fiscal expansions.

JEL CLASSIFICATION: E21, E62

KEYWORDS: Panel Survey of Income Dynamics, household balance sheet, fiscal policy, six-agent New Keynesian model, search and matching.

We thank Lea E. Rendell and Samuel Messer for outstanding research assistance. We thank Stephanie Aaronson and seminar participants at the University of Sydney, Monash University, Cardiff Business School, University of Nottingham, Universitat Autònoma de Barcelona, European Central Bank, Bank of Spain, Reserve Bank of Australia, 12th Dynare Conference (Rome), LACEA-LAMES Medellín 2016, 13th Euroframe Conference (Utrecht), CGBCR conference (Manchester), LISER, the 41st SAEe (Bilbao), 23rd International Conference on Computing in Economics and Finance (CEF 2017), 32nd European Economic Association meeting (EEA 2017), "Heterogeneous Agents and Agent-Based Modeling: The Intersection of Policy and Research" workshop (2017), 3rd Melbourne Institute Macroeconomic Policy Meetings, and GCER 2019 Conference. Javier Andrés, José E. Bosca, and Javier Ferri acknowledge the financial support of the Fundación Rafael del Pino; BBVA Research; the Spanish Ministry of Economy and Competitiveness (grant ECO2014-53150-R); and the Generalitat Valenciana (Conselleria d'Educació, Investigació, Cultura i Esports (grant GVPROMETEO2016-097)). The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System.

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1 Introduction

The 2008 financial turmoil hit households' financial position hard: Credit froze, and the prices of financial and real assets plummeted. In the aftermath of the Great Recession, there was a widespread consensus on the use of discretionary fiscal policy as a tool to mitigate the adverse effects of the crisis.¹ In this paper, we aim to isolate the role of households' balance sheets in the transmission of government spending shocks. To do so, we first identify, using data from the Panel Survey of Income Dynamics (PSID)², six types of households as a function of their balance sheet composition and show that their relative shares have changed significantly since the Great Recession. Second, using the empirical weights from the PSID and the distribution of private debt across households, we calibrate a six-agent New Keynesian model to study the aggregate and agent-specific responses to a government spending shock. We conclude that the share of households in the left tail of the wealth distribution has a disproportionate effect on the aggregate marginal propensity to consume, the value of the fiscal multiplier, and the distributional consequences of fiscal shocks.

Our identification strategy using the PSID is based on first classifying households as patient (Ricardian) or impatient using their ratio of non-housing net worth to income. We then further disaggregate impatient households by looking at the assets and liabilities sides of their balance sheets. On the asset side, we focus only on real estate holdings classifying households as a function of homeownership status. On the liabilities side, we consider mortgage debt holdings for homeowners and uncollateralized debt holdings – credit card debt, student loans, etc – for non-homeowners. Among homeowners, we consider three types of households: homeowners without a mortgage, homeowners with high leverage, and homeowners with low leverage. Non-homeowners can be indebted or debt free. Indebted non-homeowners are households without real estate but with uncollateralized debt holdings; that is, impatient households with negative wealth. We document that the shares of these six types of households in the PSID were quite stable until 2007, when the share of patient households began to steadily decline and the share of impatient households with negative wealth started to increase.

We propose a six-agent New Keynesian model with search and matching frictions in which each household type mimics the characteristics of the households' categories identified in the PSID. Using the empirical shares and the distribution of debt to calibrate the model,

¹The U.S. Congress passed the Economic Stimulus Act of 2008, the American Recovery and Reinvestment Act of 2009, and several smaller stimulus measures that became law in 2009 and 2010. Overall, the fiscal stimulus was about 7 percent of GDP.

²Panel Study of Income Dynamics is a public-use dataset for the United States that is produced and distributed by the Institute for Social Research, University of Michigan, Ann Arbor, MI (2017).

we find that the effects of fiscal policy shocks on individual consumption are very sensitive to the structure of a household’s balance sheet. First, we show that individual consumption responses are a decreasing function of the level of household wealth. Second, we find that the individual consumption response is an increasing function of households’ indebtedness level. We also find that the size of the fiscal effects is positively correlated with wealth inequality. In particular, we find a strong correlation between the Gini coefficient for wealth and the output fiscal multiplier. Therefore, as the distribution of household shares in the PSID has changed over time, the model-implied aggregate marginal propensity to consume and the output multiplier have changed significantly.

We find that the model-implied impact multiplier for output is almost 50 percent larger in 2013 than in 1999, mostly because of the increase in the share of households with negative wealth. This type of household is characterized by a sharp increase in consumption after an expansionary government spending shock, which reduces the marginal utility of further consumption, putting additional upward pressures on wages. In this context, firms become more reluctant to incur the cost of posting new vacancies, relying on adjustments in the intensive margin to meet the boost in demand. Consequently, in the model, the increase in the output multiplier since 1999 is paired with a decline in the employment multiplier. In our calibration, the model-implied decline in the employment multiplier around the Great Recession leads to a jobless recovery following an expansionary fiscal shock.

In exploring the normative issue of the welfare effects of government spending shocks, we find that the welfare cost varies substantially across households types. While an increase in government spending implies a welfare loss for patient households and impatient consumers with housing, the welfare of the remaining impatient households increases. Thus, the effect on aggregate welfare of changes in government spending depends critically on the distribution of wealth and debt in the population.

The rest of the paper is organized as follows. Section 2 overviews the related literature. Section 3 describes the data set and the criteria used to identify the types of households according to their balance sheet positions. Section 4 introduces the theoretical model. Section 5 discusses our calibration strategy. Section 6 explores the transmission mechanism of government spending shocks in the model and its evolution for each of the PSID waves. Section 7 analyzes the relationship between fiscal multipliers and wealth inequality and also explores the welfare effects of fiscal shocks. Section 8 concludes.

2 Related Literature

This paper is related to several strands of the literature on assessing the effects of fiscal policy. First, we overview contributions on the transmission of fiscal shocks in economies with liquidity or financial frictions. Second, we discuss papers that explore the role of households' debt balances and housing prices in the transmission of fiscal shocks. Third, we review the literature on the transmission of fiscal shocks in economies with heterogeneous households. Finally, we provide references on the time-varying nature of fiscal multipliers.

First, our paper is related to the literature on the effects of fiscal policy in an economy with liquidity or financial frictions. Using U.S. data, [Agarwal et al. \(2007\)](#), and using Singapore data, [Agarwal and Quian \(2014\)](#) show that, after a government transfer, spending increases the most for consumers who were most likely to be liquidity constrained. Similarly, [Johnson et al. \(2006\)](#) with U.S. data and [Jappelli and Pistaferri \(2014\)](#) with Italian data conclude that, after an unexpected transitory income shock, households with low liquid wealth exhibit a much higher marginal propensity to consume than more affluent households. Following [Kiyotaki and Moore \(1997\)](#); [Iacoviello \(2005\)](#); and [Liu et al. \(2016\)](#), we introduce financial rigidities in the form of housing collateral for indebted homeowners. We also allow some impatient non-homeowners to leverage up partially against their future labor income as in [Eggertsson and Krugman \(2012\)](#).

Second, in our model, the responses of asset prices and debt to the government spending shock are key in the characterization of the transmission mechanism of fiscal shocks. The empirical link between house price movements and household consumption has been widely studied in the literature (see, for example, [Campbell and Cocco, 2007](#); [Attanasio et al., 2009](#); and [Angrisani et al., 2015](#)), which concludes that unexpected variations in house prices cause household consumption to change. Moreover, [Parker et al. \(2013\)](#) find that, after a tax rebate, homeowners spend more than renters. Recently, researchers have studied the role of household debt in the transmission of fiscal policy. [Surico and Trezzi \(2015\)](#) find that the response of consumption to a change in property taxes is more pronounced for homeowners with mortgage debt, but [Cloyne and Surico \(2017\)](#) show that it is mortgage indebtedness and not homeownership the driver of the different consumption responses to a tax change. [Misra and Surico \(2014\)](#) find that, among households in the Consumer Expenditure survey, those with both a high level of mortgage debt and a high level of income have the largest propensity to consume after a tax rebate. [Acconcia et al. \(2015\)](#) show that government transfers have an effect on consumption only for indebted homeowners with low liquidity-to-wealth ratios. Also, [Demyanyk et al. \(2019\)](#) document that relative fiscal multipliers are higher in U.S. geographies with higher consumer indebtedness. In our model, we also find that individual

responses of consumption are increasing in the level of indebtedness. Moreover, we show that this result hinges on households having a non-negligible preference for housing.

Third, our paper is also related to the literature analyzing the effect of heterogeneous responses and distributional dynamics in the transmission of economic shocks. [Carroll et al. \(2014\)](#) and [Carroll et al. \(2017\)](#) propose models with heterogeneity in the rate of time preference to show that matching the wealth distribution is key to obtain a realistic distribution of the marginal propensity to consume. In [Kaplan and Violante \(2014\)](#) and [Kaplan et al. \(2014\)](#), households can store wealth in liquid or illiquid assets and there are two types of hand-to-mouth consumers: wealthy hand-to-mouth households, who invest in illiquid assets, and poor hand-to-mouth households, who do not have access to asset markets. They show that hand-to-mouth households, both wealthy and poor, have significantly stronger responses to transitory income shocks than non-hand-to-mouth households. [Krueger et al. \(2016\)](#) conclude that household heterogeneity in terms of earnings, wealth, and the time discount factor is essential to understand the amplification effect of aggregate productivity shocks. In particular, they find that the amplification channel is only present when there is a large fraction of households in the left tail of the distribution.

We now overview contributions on the role of household heterogeneity in the transmission of fiscal policy. [Antunes and Ercolani \(2020\)](#) study the effects of fiscal-driven expansions on output, credit, and welfare using a flexible prices model with household heterogeneity in terms of wealth and endogenous household borrowing against uncollateralized assets. They show that the dynamics of the household borrowing limit increases the utility of borrowers and wealth-poor agents while it reduces that of wealth-rich households. In a model with price rigidities and borrowing constraints, [Oh and Reis \(2012\)](#) show the importance of using targeted public transfers to redistribute wealth across agents to increase aggregate consumption, employment, and output. [Brinca et al. \(2016\)](#) develop a life-cycle model with incomplete markets and heterogeneous agents in asset holdings, productivity, and rate of time preference. They find that the fiscal multiplier is highly sensitive to the fraction of the population facing binding credit constraints and to the average wealth level in the economy. We develop a New Keynesian model with borrowing constraints, frictions in the labor market, and limited household heterogeneity and show that the effects of fiscal shocks are very sensitive to the fraction of households in the left tail of the wealth distribution.

[Debortoli and Galí \(2018\)](#) show that, within New Keynesian models, two-agent (TANK) models with constant shares can approximate well the effects of aggregate shocks in heterogeneous agents (HANK) models. In particular, after a shock, the channels operating in HANK models are: (i) changes in the average consumption gap between constrained and unconstrained households, (ii) variations in consumption dispersion within unconstrained

households, and (iii) changes in the share of constrained households. TANK models fully capture channel (i). In our paper, we also explore the role played by channel (iii) by looking at the effects in the transmission of fiscal shocks of exogenous changes in the distribution of household shares. Moreover, we provide empirical evidence suggesting that, after a temporary shock, we should not expect large variations in household shares on impact.

As in [Brinca et al. \(2016\)](#), [Brinca et al. \(2017\)](#) and [Carroll et al. \(2017\)](#), our model predicts a positive correlation between the fiscal multiplier and wealth inequality. [Agnello and Sousa \(2014\)](#) find that spending-driven fiscal adjustments deteriorate the income distribution, whereas in [Klein and Winkler \(2017\)](#), austerity leads to a strong and persistent increase in income inequality only in periods of private debt overhang. [DeGiorgi and Gambetti \(2017\)](#) find that after a government spending shock, consumption increases at the bottom of the consumption distribution but falls at the top, implying a reduction in consumption inequality. Similarly, [Anderson et al. \(2016\)](#) document a reduction in consumption inequality after a government spending shock when households are classified as a function of their wealth.

Finally, our model implies an increase in the value of aggregate fiscal multipliers during the Great Recession. Recent contributions to the literature explore the dependence of fiscal multipliers on the state of the economy. For example, [Auerbach and Gorodnichenko \(2012\)](#) estimate multipliers that are more than 4 times higher in recessions than in expansions. [Afonso et al. \(2018\)](#) find that, in the United States, multipliers at a four-quarter horizon can be much higher in periods of high financial stress. In particular, they show that the size of the fiscal multipliers was higher than average during the Great Recession. [Klein \(2017\)](#) concludes that fiscal consolidations lead to severe contractions when implemented in high private debt states, and [Bernardini and Peersman \(2018\)](#) find that the fiscal multiplier is higher in periods of private debt overhang. Moreover, [Bernardini et al. \(2019\)](#) show that a high degree of household indebtedness during recessions further increases the value of the fiscal multiplier.

3 Identifying household types in the data

In this section, we first describe our identification strategy for households in the Panel Study of Income Dynamics (PSID) as a function of their individual characteristics along three dimensions: attitude towards savings, homeownership, and access to credit. We focus on these three dimensions because they may affect the marginal propensity to consume out of a government spending shock. We then analyze the wealth and income distributions conditional on household type and compute average propensities to consume, which are standard features used to classify households in the literature. We show that our identification strategy

delivers household groups that cannot unequivocally be assigned to the standard wealth-income-consumption classifications. Finally, we compute transition probabilities across PSID waves to assess the persistence of households types.

3.1 Identification strategy

We use data for the 1999-2013 period from the Panel Study of Income Dynamics (PSID), which surveys a representative sample of U.S. households every odd year. Previous studies using data from the PSID, such as [Kaplan et al. \(2014\)](#) or [Krueger et al. \(2016\)](#), classify households according to their wealth to document patterns related to income or consumption. However, [Aguilar et al. \(2020\)](#) argue that when we consider households with heterogeneous preferences, the relationship between wealth and consumption behavior is blurred. In our paper, we classify households using several dimensions available in the household-level panel data provided by the PSID. In particular, we focus in the following characteristics: attitude towards savings, homeownership, and access to credit. We argue that, in the model we describe in Section 4, these characteristics are key in the conditional reaction of consumption, employment and working hours to fiscal shocks.

Table 1: HOUSEHOLD CLASSIFICATION: OUR PROPOSAL

	Threshold	Homeowner	Liabilities	Leverage
Patient: R	$W \geq a * I$	Unrestricted	Unrestricted	Unrestricted
Impatient: HH	$0 < W < a * I$	Yes	No	No
Impatient: BL	$0 < W < a * I$	Yes	Mortgage debt	Low
Impatient: BH	$0 < W < a * I$	Yes	Mortgage debt	High
Impatient: HNH	$0 < W < a * I$	No	No	No
Impatient: EK	$W \leq 0$	No	Non-mortgage debt	Unrestricted

Table 1 summarizes our identification strategy . As described in the first column, we use a threshold strategy to classify households as patient or impatient: a household is classified as patient (impatient) if her non-housing wealth is above (below) a certain percentage a of her income.³ Once a household qualifies as patient, we do not impose any additional restrictions on her balance sheet, as can be seen in the next columns of Table 1. We focus on non-housing wealth because investment in real estate may be considered compatible with a high discount of the future by impatient households to the extent that housing provides current utility

³We remove from our sample households contradictory information on homeownership, that is, households reporting not owning a house but reporting positive net equity. We also remove households with loan to value ratios above 3.

services. Non-housing wealth corresponds to the PSID variable “wealth” net of the equity value of the main home.⁴ Our definition of income includes salaries and other compensation plus private and government transfers.⁵ One of the novelties of the paper is the incorporation of households with negative wealth, who are classified as impatient households.

The classification criteria for balance sheet composition used for impatient households can be found in columns 2 to 4 in Table 1. We define five types of impatient households depending on whether they have assets, liabilities, or both in their balance sheet. In our identification strategy, we restrict the asset side of the balance sheet to one type of asset, real estate, while we consider two types of liabilities: mortgages (collateral-based debt) and non-collateral debt. In the PSID, non-collateral debt includes credit cards, student loans, medical and legal bills, and personal loans.

Among impatient households with real estate holdings, we distinguish three types of households: (i) households who own houses but do not borrow against them, that is, impatient homeowners without liabilities, labeled as *HH*; (ii) households whose loan-to-value ratios exceed the median loan-to-value ratio in the sample, that is, impatient homeowners with high leverage, labeled as *BH*; and (iii) households with a low loan-to-value ratio, that is, impatient homeowners with low leverage, labeled as *BL*. In addition, we consider two types of impatient households without assets: (i) households who, along the lines of traditional hand-to-mouth consumers of Galí et al. (2007), do not hold any assets or liabilities, labeled as *HNH*; and (ii) households who borrow against their future labor income, as in Eggertsson and Krugman (2012), that is, indebted impatient households without assets or households with negative wealth, labeled as *EK*.

Because the value for the threshold a is determinant for the number of households classified as patient or impatient, we explore several values for $a \in (0, 1)$. In Table 2, we report the empirical shares for the 1999 wave for $a = \{0.25, 0.50, 0.75\}$. The shares for patient households decrease from 58 percent to 35 percent as we move from $a = 0.25$ to $a = 0.75$. For clarity purposes, the empirical analysis reported here is done with $a = 0.50$.

⁴Non-housing wealth balances include the net value of farm or business assets; the value of checking accounts, savings accounts, money market funds, certificates of deposits, savings bonds, Treasury bills, and other IRAs; the value of debts other than mortgages (credit cards, student loans, medical and legal bills, personal loans); the net value of real estate other than main home; the value of private annuities or IRAs; the value of shares of stock in publicly held corporations; mutual or investment trusts; the value of other investments in trusts or estates, bond funds, life insurance policies, and special collections; and the net value of vehicle or other assets “on wheels”.

⁵Income incorporates salary; dividends; rent payments received; worker compensation; trust fund income; financial support from relatives; financial support from non-relatives; child support received; alimony received; supplemental security income; temporary assistance for needy families (state program) and other welfare; pensions/annuity; lump sum payments (inheritances, itemized deductions); and financial support given to others.

Table 2: PSID SAMPLE WEIGHTS (IN %) FOR YEAR 1999

	$a = 0.25$	$a = 0.50$	$a = 0.75$
Patient: R	58	43	35
Impatient: HH	3	5	6
Impatient: BL	4	7	9
Impatient: BH	7	11	13
Impatient: HNH	13	19	21
Impatient: EK	16	16	16

Table 3: PSID SAMPLE WEIGHTS (IN %)

	1999	2001	2003	2005	2007	2009	2011	2013
Patient: R	43	43	43	42	42	38	38	37
Impatient: HH	5	4	4	4	4	3	4	4
Impatient: BL	7	7	8	8	7	7	6	6
Impatient: BH	10	11	11	10	10	10	9	8
Impatient: HNH	19	19	18	19	18	20	20	21
Impatient: EK	16	16	16	17	19	22	23	24
Total Impatient	57	57	57	58	58	62	62	63

Table 3 reports the empirical weights for each type of household in each PSID wave from 1999 to 2013. Our identification strategy leads, on average, to a 40 percent share of patient households and, hence, a 60 percent share of impatient households. The share of impatient households without assets is larger than the share of impatient households with assets. These shares are, on average, 40 percent and 20 percent, respectively.⁶ Over time, the distribution of shares is quite stable until 2007, when there are bigger shifts across categories. The largest changes in the relative share in the population are for patient households and indebted impatient households without assets, *EK*. The share of patient households declines from 43 percent in 1999 to 37 percent in 2013, while the share of impatient households with negative wealth increases from 16 percent to 24 percent.⁷ Similarly, using data from the Survey of Consumer Finances, Wolff (2017) shows that the percentage of households with zero or negative wealth increases from 18 percent in 1998 to 21.8 percent in 2010, at which

⁶Our classification is not primarily driven by differences in the age of the head of household since, on average, the age difference between patient and impatient households without assets is 8 years. Moreover, the average age within groups remains fairly stable in the sample period. Hence, we argue that the observed changes occurred in consumption patterns are hard to be associated with age and that age difference is not large enough to invalidate our abstraction from age conditional on type in the next section.

⁷Appendix A.1 overviews the classification suggested by Kaplan et al. (2014) of households as Ricardians, wealthy hand-to-mouth, and poor hand-to-mouth. We also provide there a comparison between the two classifications.

level it remained in 2013.

3.2 Wealth, income, and consumption

Given that we use the comparison between non-housing wealth and income to classify households as patient or impatient, we analyze here the conditional distributions for these two variables in addition to the average propensities to consume. From our analysis, we conclude that, conditional on type, patient households are not only the wealthiest ones, but they are also the only ones in the highest interquartile ranges of the wealth distribution. Impatient households with negative wealth are, by construction, the least wealthy and concentrate mostly in the lower interquartile ranges on the wealth distribution. In terms of income, we show that patient households are not the highest earners in the PSID. In fact, we report non-negligible shares of patient households in all interquartile ranges of the income distribution. Therefore, we argue that our identification strategy classifies households in terms of their attitude towards savings, not in terms of the liquidity constraints they may face given their income.

3.2.1 Wealth

Table 4 reports the percentiles of the wealth distribution for each household category. Indebted impatient households without assets—households with negative wealth, *EK*—not surprisingly are the least wealthy for all wealth quantiles. More importantly, for all wealth quantiles, patient households can be classified as the wealthiest households, which aligns well with our classification of these households as savers or patient. Moreover, Table 4 also provides evidence on the dispersion of the wealth distribution for each type of household. The most disperse wealth distribution corresponds to patient households.

Table 4: NON-HOUSING (REAL) WEALTH PERCENTILES FOR YEAR 1999

Household	p10	p25	p50	p75	p90
Patient: R	20,986	44,248	104,932	265,489	643,496
Impatient: HH	1,264	2,528	6,827	13,907	26,423
Impatient: BL	2,718	6,827	16,765	29,330	46,777
Impatient: BH	2,655	6,068	13,527	23,136	36,663
Impatient: HNH	649	1,896	5,057	11,378	18,964
Impatient: EK	-25,538	-9,482	-1,517	0	0

Note: The values represent the cutoff values for real non-housing wealth.

Table 5 reports the shares of each type of household that belong to the interquartile

ranges of the overall wealth distribution in our sample for 1999. While most of the Ricardian households are concentrated in the interquartile ranges above the median wealth in the sample, impatient households with negative wealth, *EK*, are concentrated in the lower 25 percent tail of the wealth distribution. Most impatient households with positive wealth fall into the interquartile ranges around the median of the wealth distribution.

Table 5: DISTRIBUTION OF HOUSEHOLDS ACROSS REAL NON-HOUSING WEALTH PERCENTILES FOR EACH HOUSEHOLD TYPE: 1999

Percentile	p0- p10	p10 - p25	p25 - p50	p50 - p75	p75 - p90	p90 - p100
Patient: R	0	1	4	27	40	29
Impatient: HH	0	7	60	32	1	0
Impatient: BL	0	3	36	55	5	1
Impatient: BH	0	4	45	48	3	0
Impatient: HNH	0	12	67	20	1	0
Impatient: EK	41	59	0	0	0	0

Note: Percentiles are in bold to represent the bracket containing that percentile; that is, p10 - **p25** indicates that $p25 \geq wealth > p10$.

If we now consider the overall wealth distribution of the households in our sample, we can run the identification strategy defined in Table 1 for each interquartile range. Table 6 shows that the lowest 10 percentiles of the overall wealth distribution are populated only by indebted impatient households without assets and that the highest 25 percentiles are mostly populated by patient households. However, the interquartile ranges around the median—25 to 50 and 50 to 75—highlight the diversity of household types in the middle of the wealth distribution.

Table 6: DISTRIBUTION OF HOUSEHOLDS WITHIN REAL NON-HOUSING WEALTH PERCENTILES FOR YEAR 1999

Percentile	p0- p10	p10 - p25	p25 - p50	p50 - p75	p75 - p90	p90 - p100
Patient: R	0	3	6	38	94	99
Impatient: HH	0	2	9	5	0	0
Impatient: BL	0	2	11	17	3	0
Impatient: BH	0	4	24	25	3	0
Impatient: HNH	0	18	50	15	1	0
Impatient: EK	100	71	0	0	0	0

Note: Percentiles are in bold to represent the bracket containing that percentile; that is, p10 - **p25** indicates that $p25 \geq wealth > p10$.

3.2.2 Income

Let us now consider the income distribution, which is summarized by the quantiles in Table 7. In this case, the picture is slightly different: Patient households do not have the highest level of income. For example, the median income of a patient household is 12 percent lower than the median income of impatient homeowners with mortgage debt.

Comparing Table 4 and Table 7, we observe that, at the median, a patient household has a non-housing wealth that is 65 percent larger than her income, while the wealth-to-income ratio for impatient households is below 1. Moreover, Table 8 shows that the share of patient households for all income interquartiles is significant, even for the lowest ones. For example, almost 30 percent of households in the 0 to 10 percentile bracket are classified as patient. Thus, we argue that the threshold strategy we propose here allows us to separate households as a function of their attitude toward savings, not as a function of the liquidity constraints linked to income limitations. This is why we label patient households as Ricardian – because we can assume they behave following Ricardian equivalence.

Table 7: (REAL) INCOME PERCENTILES FOR YEAR 1999

Household	p10	p25	p50	p75	p90
Patient: R	15,219	35,247	63,212	105,943	163,801
Impatient: HH	11,436	22,756	40,961	62,260	88,496
Impatient: BL	29,836	48,041	71,050	107,460	156,892
Impatient: BH	31,644	50,569	71,530	101,151	135,903
Impatient: HNH	12,642	22,124	36,688	54,994	78,383
Impatient: EK	5,194	11,584	24,020	42,864	61,548

Table 8: DISTRIBUTION OF HOUSEHOLDS WITHIN REAL INCOME PERCENTILES FOR YEAR 1999

Percentile	p0- p10	p10 - p25	p25 - p50	p50 - p75	p75 - p90	p90 - p100
Patient: R	27	19	30	41	55	69
Impatient: HH	2	6	6	4	2	1
Impatient: BL	2	4	7	11	13	13
Impatient: BH	1	8	12	22	20	14
Impatient: HNH	22	35	28	15	8	3
Impatient: EK	47	28	18	8	3	1

Note: Percentiles are bold to represent the bracket containing that percentile; that is, p10 - **p25** indicates that $p25 \geq RealIncome > p10$.

The figure in Appendix A.2 shows the evolution of non-housing wealth for each household category over time. The two distributions that change the most are the one for Ricardians,

which shifts more density to its right tail, and the one for impatient households with negative wealth, EK , which gets a fatter left tail. These results point toward an increase in wealth inequality, which is evident when computing the Gini coefficient: it increases from 0.851 in 1999 to 0.874 in 2013, as reported in Table 20 in Section 7.1.

3.2.3 Consumption

In order to explore consumption behavior, we report the average propensities to consume (APC) for each household type in Table 9. APCs are lower than in the literature because we exclude from consumption any housing related expenditures. As standard in the literature, households that are, on average, wealthier have lower average propensities to consume. As shown in Table 9, patient households have significantly lower APCs than impatient households without assets— HNH and EK —who, as reported in Table 6, are in the lower end of the wealth distribution. However, patient households have almost identical average propensities to consume as impatient indebted homeowners— BL and BH —which resonates with Aguiar et al. (2020) observation on the relationship between wealth and consumption being blurry when households have heterogeneous preferences. Moreover, impatient homeowners without liabilities— HH —have APCs similar to the ones for impatient households without assets nor liabilities— HNH . As expected, households with negative wealth— EK —have the largest APCs.

Using PSID data, Fisher et al. (2019) show that APCs are monotonically decreasing with income and wealth. In our case, when comparing households in the two ends of the wealth and income distributions, R versus EK and BH versus EK , respectively, we also observe the same pattern in APCs. Fisher et al. (2019) find that APCs increase notably for all quintiles but the first between 1999 and 2013. We document a fall in APCs between 2007 and 2009 for our household categories, consistent with some precautionary savings behavior. When comparing APCs in 1999 and 2013, we only find an increase in APCs for EK households.

In Section 6.1, we show that the response of the marginal propensity to consume (MPC) conditional to a government spending shock can also be different across households groups, but not necessarily related with the APC reported in Table 9.

3.3 Transition probabilities

Finally, we explore type persistence by computing transition probabilities.⁸ Table 10 reports transition probabilities between 1999 and 2001. Looking at the diagonal elements,

⁸Transition probabilities are computed considering households that were classified in two consecutive waves, which means that, for example, some households in our 1999 sample are dropped when computing the transition probabilities because they were not classified in the 2001 wave.

Table 9: AVERAGE PROPENSITY TO CONSUME

	1999	2001	2003	2005	2007	2009	2011	2013
Patient: R	0.28	0.28	0.30	0.28	0.29	0.26	0.28	0.28
Impatient: HH	0.31	0.34	0.32	0.34	0.37	0.31	0.35	0.32
Impatient: BL	0.26	0.27	0.28	0.28	0.28	0.26	0.27	0.25
Impatient: BH	0.28	0.27	0.28	0.30	0.29	0.26	0.28	0.29
Impatient: HNH	0.35	0.35	0.38	0.37	0.38	0.33	0.36	0.36
Impatient: EK	0.36	0.38	0.40	0.42	0.43	0.37	0.41	0.41

Note: Consumption includes food, transportation, childcare, education, and healthcare but excludes any housing related expenditures. The average propensity to consume is computed as the ratio of consumption expenditures for a given type of household over income.

we conclude that the persistence of being patient or impatient is quite large. For example, conditional on being classified as patient, *R*, in 1999 (columns), the probability of being impatient in 2001 (rows) is only 24 percent. Conditional on being an impatient household with assets (*HH*, *BH*, or *BL*), the probability of exiting the impatient status is, on average⁹, 37 percent. Such probability is only 19 percent for impatient households without assets nor liabilities, *HNH*, and 9 percent for impatient households with negative wealth, *EK*. Moreover, the probability of switching within types of impatient is relatively low. For example, the probability of becoming impatient without assets for those impatient households with assets is only 5.8 percent on average. Similarly, the probability of becoming impatient with assets for households without assets is only 6.7 percent on average.

As shown in Tables A.3-A.8 in Appendix A.3, these results are quite robust across waves. The take-away message from our results on transition probabilities is that we cannot expect second-order effects on household transitions to be prominent after the economy receives a government spending shock.

Table 10: TRANSITION PROBABILITIES 1999 WAVE TO 2001 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.759	0.416	0.399	0.287	0.190	0.091
HH	0.033	0.404	0.044	0.019	0.013	0.009
BL	0.064	0.056	0.419	0.172	0.016	0.005
BH	0.058	0.052	0.113	0.446	0.070	0.020
HNH	0.062	0.048	0.022	0.060	0.484	0.307
EK	0.024	0.024	0.003	0.016	0.226	0.568

Note: The transition probabilities are computed using only those households that, being classified in 1999, were also classified in 2001.

⁹We compute the average across the entries in the first row of Table 10 for *HH*, *BH*, and *BL* households.

Our results are consistent with [Aguiar et al. \(2020\)](#). Using PSID data from 1999 to 2015, they classify households as unconstrained (not hand-to-mouth), low net worth (hand-to-mouth), and high net worth households with negligible or negative liquid assets (wealthy hand-to-mouth). They compute transition probabilities across categories and also conclude that household type is persistent. In particular, they obtain that those classified as hand-to-mouth in a given year have only 19 percent chance to become unconstrained. Wealthy hand-to-mouth households have a 42 percent probability of exiting the constrained status. Finally, unconstrained households face an 18 percent probability of becoming constrained.

4 The model

We consider a standard New Keynesian model with balance sheet heterogeneity in the household sector and search and matching frictions. [Andrés et al. \(2015\)](#) argue that the response of the intensive and extensive margins of labor to fiscal shocks is key to explaining the size of the output multiplier in the presence of financial heterogeneity. We assume that there is perfect risk sharing among household members and that all workers are equally productive and delegate the negotiation of wages and hours with firms to a union. Thus, in equilibrium, all households earn the same labor income. Abstracting from labor income heterogeneity and from the potential interactions between employment status and household balance sheet composition are strong assumptions. But, in this way, we can isolate the role of diversity in households' balance-sheet composition in the transmission of government spending shocks.

4.1 Households

The economy is populated by N households who differ in their degree of impatience, the conditions of access to credit, and homeownership status. Let N^i denote the mass of i^{th} type households and $\tau^i = \frac{N^i}{N}$ be the weight of the i^{th} type households in the total population.

Ricardian households, R , are the standard financially unconstrained patient households in macro models. Ricardian households are net savers/lenders that own assets other than their main home (physical capital, deposits, public debt, etc.) and do not have liabilities. In our economy, Ricardian households coexist with financially constrained individuals who are more impatient than them. Some, but not all, impatient households are net borrowers. We assume that borrowers face a binding borrowing constraint due to some underlying friction in the credit market.

While some impatient households are homeowners, others do not have housing. Among impatient homeowners, we distinguish three types of households according to the quality

of the collateral services provided by their real estate: (i) households who own houses but do not have access to credit – *HH* households; (ii) households who can borrow against a high proportion of the expected value of their real estate holdings – *BH* households; and (iii) households who can borrow against a low proportion of the expected value of their home – *BL* households. Impatient homeowners with access to credit resemble borrowers à la Kiyotaki and Moore (1997) and Iacoviello (2005).

We consider two types of impatient households without housing holdings: (i) traditional hand-to-mouth consumers à la Galí et al. (2007) who have zero net worth – *HNH* households; and (ii) households who borrow against their current and expected future labor income, as in Eggertsson and Krugman (2012) – *EK* households – and, hence, have negative wealth.

The specification of preferences is common across household types although parameterizations are type-specific. Households' life time utility function is defined over consumption, c_t^i ; housing holdings, x_t^i ; and leisure of her employed and unemployed members. l_{1t} are hours worked per employee, and l_2 are hours spent job seeking by the unemployed members of the household. Hours worked are determined through the bargaining process between the union and firms, while the hours devoted to job seeking are determined exogenously,

$$\mathbb{E}_t \sum_{t=0}^{\infty} \beta_t^i \left[\ln c_t^i + \phi_x^i \ln x_t^i + \phi_1 n_{t-1}^i \frac{[1 - l_{1t}]^{1-\eta}}{1 - \eta} + \phi_2 (1 - n_{t-1}^i) \frac{[1 - l_2]^{1-\eta}}{1 - \eta} \right], \quad (1)$$

where β_i is the type-specific discount rate. In particular, we assume that all impatient households share the same discount factor, β_I , and that the discount rate for Ricardians households, β_R , is larger than that for impatient households. As shown in Iacoviello (2005), in the absence of uncertainty, the assumption $\beta_R > \beta_I$ ensures that the borrowing constraints for impatient households are binding. We assume that homeowners share the same parameter governing preferences over housing, $\phi_x^R = \phi_x^{HH} = \phi_x^{BH} = \phi_x^{BL} = \phi_x$, and this parameter is set to zero for households without real estate holdings. The remaining preference parameters are the Frisch elasticity of labor supply, η ; the valuation of leisure by employed members of the household, ϕ_1 ; and the valuation of leisure by the unemployed members, ϕ_2 .

Another common feature of the optimization problem of households is the law of motion for employment, n_t^i , in the constraint set, which is given by

$$n_t^i = (1 - \sigma) n_{t-1}^i + \rho_t^w (1 - n_{t-1}^i), \quad (2)$$

Under our model assumptions, $n_t^i = n_t$ for all households and jobs are destroyed each period at the exogenous rate σ . New employment opportunities come at the rate ρ_t^w , which is the probability that an unemployed worker finds a job. This probability is taken as exogenous

by individual workers, but it is endogenously determined at the aggregate level according to the matching function,

$$\rho_t^w (1 - n_{t-1}) = \chi_1 v_t^{\chi_2} [(1 - n_{t-1}) l_2]^{1-\chi_2}, \quad (3)$$

where v_t stands for the number of active vacancies during period t , and χ_1 and χ_2 are the parameters of the Cobb-Douglas matching function.

Finally, let Ω_t^i be the value function for household i . Let us derive here the marginal value of employment for a worker, λ_{ht}^i , which plays a key role in the bargaining process discussed in the following. Essentially, λ_{ht}^i measures the marginal contribution of a newly created job to the household's utility

$$\lambda_{ht}^i \equiv \frac{\partial \Omega_t^i}{\partial n_{t-1}^i} = \lambda_{1t}^i w_t l_{1t} + \left(\phi_1 \frac{[1 - l_{1t}]^{1-\eta}}{1 - \eta} - \phi_2 \frac{[1 - l_2]^{1-\eta}}{1 - \eta} \right) + [1 - \sigma - \rho_t^w] \beta^i \mathbb{E}_t \lambda_{ht+1}^i, \quad (4)$$

where λ_{1t}^i is the household's marginal utility of consumption. The first term on the right hand side captures the value of the cash flow generated by the new job at time t , evaluated in consumption terms. The second term represents the net utility from the newly created job. The third term represents the “capital value” of an additional employed worker, conditional on her keeping the employment status in the future.

Given our assumptions, the labor market decisions, both for the extensive and the intensive margins, are identical for all households and, hence, they receive the same labor income. Thus, in our model, heterogeneity in consumption can only be driven by differences in balance sheet composition. In the remainder of this subsection, we describe the constraint set for each type of household.

4.1.1 Ricardian households

Patient households are the only savers in the economy. They lend d_t^R to the private sector and d_t^P to the public sector through short-term nominal contracts. We assume that the nominal returns on public and private loans are equal to the policy rate, r_t^n . Patient households are also the owners of physical capital, k_t^R . They undertake productive investment, j_t^R , which is subject to adjustment costs. Patient households accrue any extraordinary profits of firms in the form of dividends, f_t^R .

Patient consumers choose paths for consumption, c_t^R ; housing holdings, x_t^R ; leisure, $1 - l_{1t}$; private lending, d_t^R ; public lending, d_t^P ; and investment, j_t^R to optimize their lifetime utility subject to the budget constraint, the capital accumulation equation, and the law of motion

for employment. The budget constraint for patient households is given by

$$\begin{aligned} c_t^R + j_t^R \left[1 + \frac{\phi}{2} \left(\frac{j_t^R}{k_{t-1}^R} \right) \right] + q_t [x_t^R - x_{t-1}^R] + d_t^R + d_t^P = w_t n_{t-1} l_{1t} + r_t k_{t-1}^R \\ + (1 + r_{t-1}^n) \frac{d_{t-1}^P + d_{t-1}^R}{1 + \pi_t} + f_t^R + tr h_t, \end{aligned} \quad (5)$$

where $w_t n_{t-1} l_{1t}$ is the labor income earned by the fraction of employed workers, q_t stands for the real price of housing, $[x_t^R - x_{t-1}^R]$ is housing investment, and $tr h_t$ stands for lump sum transfers (taxes) from (to) the government. We assume that debt contracts are in nominal terms and there is a fixed amount of real estate in the economy.

The capital accumulation equation is

$$k_t^R = (1 - \delta) k_{t-1}^R + j_t^R. \quad (6)$$

4.1.2 Impatient homeowners

Impatient homeowners use all of their disposable income to consume and invest in housing. In addition to the law of motion of employment, their constraint set contains a budget constraint and, if they are indebted, a borrowing constraint. The budget constraint of impatient homeowners without liabilities, HH , is given by

$$c_t^{HH} + q_t (x_t^{HH} - x_{t-1}^{HH}) = w_t n_{t-1} l_{1t}, \quad (7)$$

while the borrowing constraint for indebted impatient homeowners, $i = \{BH, BL\}$, is

$$c_t^i + q_t (x_t^i - x_{t-1}^i) + (1 + r_{t-1}^n) \frac{b_{t-1}^i}{1 + \pi_t} = w_t n_{t-1} l_{1t} + b_t^i. \quad (8)$$

Indebted impatient homeowners can borrow against the expected future value of their housing holdings up to a fraction m^i ¹⁰

$$b_t^i \leq m^i \mathbb{E}_t \left[\frac{q_{t+1} (1 + \pi_{t+1}) x_t^i}{1 + r_t^n} \right], \quad (9)$$

with m^i being larger for indebted impatient homeowners with high leverage than for those

¹⁰The loan-to-value ratio is a reduced form parameter capturing debtor characteristics. This is standard in the literature (see, for example, [Iacoviello and Neri \(2010\)](#), [Liu et al. \(2016\)](#), and [Boscá et al. \(2020\)](#)). Hence, differences in m^i are capturing things such as different education levels, differences in delinquency rates, financial record with past loans, the sector/region in which the household works, age, family composition, attitude towards being indebted, portfolio management preferences, etc.

with low leverage¹¹ – that is, $m^{BH} > m^{BL}$.

4.1.3 Impatient non-homeowners

Impatient non-homeowners do not have housing. We ignore the question of whether that is due to a lack of access to the market or preferences, but we just assume that their valuation of homeownership is zero by imposing $\phi_x^j = 0$ in the utility function. Impatient households without assets or liabilities, HNH , are the traditional hand-to-mouth consumers and their constraint set is characterized by the following budget constraint:

$$c_t^{HNH} = w_t n_{t-1} l_{1t}. \quad (10)$$

We assume that indebted households without collateralizable assets, EK , borrow against a weighted sum of their current and future labor income. In particular, their borrowing constraint is given by

$$b_t^{EK} \leq m^{EK} \left(0.1 w_t n_t l_t + \mathbb{E}_t \left[\sum_{j=1}^3 0.3 \frac{(1 + \pi_{t+j}) w_{t+j} n_{t+j} l_{1,t+j}}{1 + r_t^n} \right] \right) \quad (11)$$

and their budget constraint by

$$c_t^{EK} + (1 + r_{t-1}^n) \frac{b_{t-1}^{EK}}{1 + \pi_t} = w_t n_{t-1} l_{1t} + b_t^{EK}. \quad (12)$$

4.2 Firms

Production in our model economy is organized in three different levels. Firms in the competitive wholesale sector use labor and capital to produce a homogeneous good, which is bought by monopolistically competitive intermediate firms. These intermediate firms transform the homogenous good into firm-specific varieties that are bought by retail firms. The competitive retail sector is populated by firms producing homogeneous final goods, y_t , by combining a continuum of intermediate goods.

4.2.1 Retailers

The retail sector is populated by infinitely lived and perfectly competitive firms producing final goods, y_t , by combining a continuum of intermediate goods, $y_t^l, l \in [0, 1]$, according to

¹¹The values of m^i , where $i = BH, BL$ and EK , are calibrated by targeting the distribution of debt among households in the PSID.

a Dixit-Stiglitz aggregator. The profit maximization problem for retailers is given by

$$\text{Max}_{y_t^l} \left\{ P_t y_t - \int_0^1 P_t^l y_t^l d_l \right\},$$

subject to

$$y_t = \left[\int_0^1 (y_t^l)^{(1-1/\theta)} d_l \right]^{\frac{\theta}{\theta-1}}. \quad (13)$$

4.2.2 Intermediate goods producers

There is a continuum of infinitely lived producers of intermediate goods, indexed by $l \in [0, 1]$, operating under monopolistic competition. They buy the wholesale good at price P_t^w and transform it into a firm-specific variety y_t^l that is sold to the retail firm at price P_t^l .

Intermediate goods producers face a pricing problem in a sticky price framework à la Calvo (1983). At any given period, an intermediate producer is allowed to reoptimize her price with probability $(1 - \omega)$. Those firms that do not reoptimize their prices set them using a partial indexation rule: $P_t^l = (1 + \pi_{t-1})^\varsigma P_{t-1}^l$. The fraction of firms that set their prices optimally choose the price P_t^* that maximizes the present value of expected profits.

4.2.3

Wholesale producers

There is a continuum of infinitely lived wholesale producers, indexed by $j \in [0, 1]$, operating under perfect competition. Firms in the wholesale sector are the actual producers in the model economy. Production is conducted combining labor and capital using a Cobb-Douglas technology. Factor demands are obtained by solving the profit maximization problem faced by each wholesale producer

$$\min_{k_t, v_t} E_t \sum_{t=0}^{\infty} \beta_R^t \frac{\lambda_{1t+1}^R}{\lambda_{1t}^R} (y_t - r_t k_{t-1} - w_t n_{t-1} l_{1t} - \kappa_v v_t), \quad (14)$$

subject to

$$y_t = A k_{t-1}^{1-\alpha} (n_{t-1} l_{1t})^\alpha, \quad (15)$$

$$n_t = (1 - \sigma) n_{t-1} + \rho_t^f v_t. \quad (16)$$

Future profits are discounted using the stochastic discount factor of patient households because they are the owners of the firms. We assume that all workers are perfect substitutes in production irrespective of their balance sheet position. The probability of filling a vacancy

at any given period t , ρ_t^f is exogenous from the perspective of the firm but, at the aggregate level, this probability is endogenously determined by the following condition:

$$\rho_t^w (1 - n_{t-1}) \rho_t^f v_t = \chi_1 v_t^{\chi_2} [(1 - n_{t-1}) l_2]^{1-\chi_2}. \quad (17)$$

The solution to the previous optimization problem delivers the following first order conditions with respect to capital and vacancies:

$$r_t = (1 - \alpha) \frac{y_t}{k_{t-1}} \quad (18)$$

$$\frac{\kappa_v}{\rho_t^f} = \beta_R \mathbb{E}_t \left[\frac{\lambda_{t+1}^R}{\lambda_{1t}^R} \frac{\partial V_{t+1}}{\partial n_t} \right], \quad (19)$$

where V_t stands for the value function of the wholesale producer. Equation (19) reflects that firms choose the number of vacancies so that the marginal posting cost per vacancy, κ_v , is equal to the expected present value of holding the vacancy, where $\frac{\partial V_{t+1}}{\partial n_t}$. The marginal value of an additional match for the firm, λ_{ft} , is

$$\lambda_{ft} = \alpha \frac{y_t}{n_{t-1}} - w_t l_{1t} + (1 - \sigma) \beta_R \mathbb{E}_t \left[\frac{\lambda_{1t+1}^R}{\lambda_{1t}^R} \frac{\partial V_{t+1}}{\partial n_t} \right]. \quad (20)$$

The marginal contribution of a new job to profits is equal to the marginal product net of the wage bill, plus the capital value of the new job, adjusted by the probability of the match continuing in the future.

Given that capital is pre determined, wholesale producers respond to unanticipated shocks by adjusting labor input. In addition, to optimally choosing vacancy postings in response to the shock, wholesale producers decide on the intensive margin of labor by engaging in a negotiation with the trade union described below.

4.3 Trade in the Labor Market: The Labor Contract

Following [Andrés et al. \(2013\)](#), we assume that although households types may differ in their reservation wages, they delegate wage and hours bargaining to a trade union. The trade union maximizes the aggregate marginal value of employment for workers

$$\lambda_{ht} = \sum_{i \in I} \tau^i \frac{\lambda_{ht}^i}{\lambda_{1t}^i}, \quad (21)$$

where $\frac{\lambda_{ht}^i}{\lambda_{1t}^i}$ represents the premium, in terms of consumption, of employment over unemployment for household type i . The premiums are weighted according to the shares in the population for each type of household. Delegating the bargaining process to a union implies that all households receive the same wage, work the same number of hours, and face the same unemployment rate.

The Nash bargaining problem maximizes the weighted product of the surpluses of the union and the representative wholesale firm

$$\max_{w_t, l_{1t}} \left[\sum_{i \in I} \tau^i \frac{\lambda_{ht}^i}{\lambda_{1t}^i} \right]^{\lambda^w} (\lambda_{ft})^{1-\lambda^w} = (\lambda_{ht})^{\lambda^w} (\lambda_{ft})^{1-\lambda^w}, \quad (22)$$

where $\lambda^w \in [0, 1]$ represents the union's bargaining power.

The solution to the Nash bargaining problem gives the optimal hours worked

$$\alpha \frac{y_t}{n_{t-1} l_{1t}} = \phi_1 (1 - l_{1t})^{-\eta} \sum_{i \in I} \frac{\tau^i}{\lambda_{1t}^i}, \quad (23)$$

and the optimal real wage

$$\begin{aligned} w_t l_{1t} = & \lambda^w \left[\alpha \frac{y_t}{n_{t-1}} + \frac{\kappa_v v_t}{1 - n_{t-1}} \right] \\ & + (1 - \lambda^w) \left[\phi_2 \frac{(1 - l_2)^{1-\eta}}{1 - \eta} - \phi_1 \frac{(1 - l_{1t})^{1-\eta}}{1 - \eta} \right] \sum_{i \in I} \frac{\tau^i}{\lambda_{1t}^i} \\ & + (1 - \lambda^w) (1 - \sigma - \rho_t^w) \sum_{\tilde{i} \in \tilde{I}} \tau_{\tilde{i}}^i \mathbb{E}_t \left[\frac{\tilde{\lambda}_{ht+1}^i}{\tilde{\lambda}_{1t+1}^i} \left(\beta^R \frac{\lambda_{1t+1}^R}{\lambda_{1t}^R} - \beta^{\tilde{i}} \frac{\tilde{\lambda}_{1t+1}^{\tilde{i}}}{\lambda_{1t}^{\tilde{i}}} \right) \right], \quad (24) \end{aligned}$$

where $i \in I$ refers to all types of households and $i \in \tilde{I}$ refers to the impatient consumers. The wage prevailing in the search equilibrium is a weighted average of the highest feasible wage, which is given by the marginal product of labor plus hiring costs, and the outside option for the union members. This outside option has two components. The first is the weighted sum of the lowest acceptable wage for each type of household, which is given by the difference in the utility of leisure between employment and unemployment. The second is a weighted sum for impatient households of an inequality term in utility. Impatient households cannot smooth consumption intertemporally because they are constrained. However, when a match occurs, impatient households know that such a match continues with probability $(1 - \sigma)$ in the future, yielding labor income that can be used for consumption. Hence, impatient households use the labor negotiations to improve their lifetime utility by narrowing the gap

in utility with respect to intertemporal optimizing households. If the share of households with the wider gap in utility increases, then the resulting optimal wage in the bargaining process will be higher.

4.4 Policy Instruments and Resources Constraint

The monetary authority follows a Taylor-type interest rate rule,

$$1 + r_t^n = (1 + r_{t-1}^n)^{r_R} [(1 + \pi_t)^{1+r_\pi} (1 + \bar{r}^n)]^{1-r_R}, \quad (25)$$

where \bar{r}^n is the steady-state level of the interest rate. The parameter r_R captures the level of interest rate inertia and r_π represents the weight given to inflation in the policy rule.

Revenues and expenditures are made consistent by the government intertemporal budget constraint,

$$d_t^P = g_t + trh_t + \frac{1 + r_{t-1}^n}{1 + \pi_t} d_{t-1}^P. \quad (26)$$

To ensure stationarity of the debt-to-GDP ratio, we impose the following fiscal policy reaction function:

$$trh_t = trh_{t-1} - \psi_1 \left[\frac{d_t^P}{gdp_t} - \frac{\bar{d}^P}{gdp} \right] - \psi_2 \left[\frac{d_t^P}{gdp_t} - \frac{d_{t-1}^P}{gdp_{t-1}} \right], \quad (27)$$

where $\psi_1 > 0$ captures the speed of adjustment from the current debt-to-GDP ratio toward the debt-to-GDP target ratio, $\left(\frac{\bar{d}^P}{gdp} \right)$. The value of $\psi_2 > 0$ is chosen to ensure a smooth adjustment of current debt toward its steady-state level.

Finally, the aggregate resource constraint guarantees that the sum of demand components plus the cost of posting vacancies equals aggregate output,

$$y_t = A_t k_{t-1}^{1-\alpha} (n_{t-1} l_{1t})^\alpha = c_t + j_t \left(1 + \frac{\phi}{2} \left[\frac{j_t}{k_{t-1}} \right] \right) + g_t + \kappa_v v_t. \quad (28)$$

where

$$c_t = \sum_{i \in I} \tau^i c_t^i. \quad (29)$$

5 Calibration

In this section, we first discuss the calibration of the novel parameters in the model: the household-specific parameters. Second, we assess the performance of the model in matching distributions in the PSID. Finally, we overview the calibration of the remaining parameters, which are standard in the literature.

To calibrate the household-specific parameters, we target the aggregate real-estate-holdings-to-GDP ratio, the aggregate (private) debt-to-GDP ratio, and the empirical distribution of debt among indebted households. We report our calibration targets in Table 11. To obtain the aggregate level of real estate holdings, we use data from the Financial Accounts of the United States on the market value of real estate for households and nonprofit organizations. Then, we calculate the ratio of real estate holdings to GDP, and target its average over the period 1999–2013, which is 1.4. The aggregate level of private debt is computed as follows: We multiply the sum of mortgage debt and consumer credit from the Financial Accounts of the United States by the fraction of mortgage debt and liquid debt held by non-Ricardian households in the PSID. The corresponding debt-to-GDP ratio is 0.18. We also target the empirical distribution of debt among indebted households in the 1999 PSID wave, as reported in the lower panel in Table 11.

Table 11: CALIBRATION TARGETS

Aggregate moments:		
	<i>Real estate holdings/GDP</i>	1.40
	<i>Debt/GDP</i>	0.18
Micro moments:		
	<i>Household Type</i>	<i>Debt/Total Debt</i>
	<i>R</i>	0.00
	<i>HH</i>	0.00
	<i>BL</i>	0.23
	<i>BH</i>	0.73
	<i>HNH</i>	0.00
	<i>EK</i>	0.04

Table 12 reports the calibrated values for household-specific parameters. Following Iacoviello (2005), the intertemporal discount factor for patient households, β^R , is equal to 0.99, and for impatient households, β^I , is equal to 0.95. For each year in the analysis, we impose the share of each type of household in the PSID sample, τ^i . In particular, the second column in Table 12 shows the empirical weights corresponding to the 1999 wave. Given β^R , β^I , τ^i , and our calibration targets, we obtain endogenously the preference parameter over housing, ϕ_x , which is assumed to be identical for all homeowners, and the loan-to-value ratios for indebted households, m^i , reported in the third and last column in Table 12, respectively. The new calibration reveals a significantly higher capacity to extract collateral from their housing holdings for *BH* than for *BL* households.

We report the performance of our model in Table 13. As shown in the first two columns, we not only match the aggregate real estate value to GDP ratio, but also our model closely

Table 12: CALIBRATED PARAMETERS: HOUSEHOLD-SPECIFIC PARAMETERS

$Type$	β	τ^i	ϕ_x^i	m^i
R	0.99	0.43	0.143	—
HH	0.95	0.05	0.143	—
BL	0.95	0.07	0.143	0.688
BH	0.95	0.10	0.143	0.908
HNH	0.95	0.19	0	—
EK	0.95	0.16	0	0.272

replicates the distribution of real estate holdings across homeowners in the PSID. The static solution of the model implies that Ricardian households hold 84 percent of the total value of housing in the model economy, impatient homeowners without liabilities, HH , hold 1.4 percent, and impatient homeowners with low, BL , and high leverage, BH , hold 4 percent and 11 percent respectively. In the 1999 wave of the PSID, Ricardian households hold 75 percent of the total value of housing, HH households hold 3 percent, BL households hold 9 percent, and BH households hold 13%¹².

Table 13: MOMENT COMPARISON

	Real estate/GDP		Debt/Total Debt ⁽¹⁾		Debt/GDP	
	Model	Data	Model	Data	Model	Data
R	1.17	1.05	0.00	0.00	0.00	0.00
HH	0.02	0.04	0.00	0.00	0.00	0.00
BL	0.06	0.13	0.23	0.23	0.04	0.04
BH	0.15	0.14	0.73	0.73	0.13	0.13
HNH	0.00	0.00	0.00	0.00	0.00	0.00
EK	0.00	0.00	0.04	0.04	0.01	0.01
Total	1.40	1.40	1.00	1.00	0.18	0.18

(1) Total debt is computed adding the debt in the PSID in 1999 of all households, but those classified as Ricardians.

The middle columns in Table 13 show that the model at the steady state can replicate the empirical distribution of debt among indebted households, once Ricardian households are excluded from the sample. As reported in the bottom row of the last two columns, we match the aggregate debt-to-GDP ratio as well. As a byproduct of matching the aggregate

¹²We have also run the model with the parameters resulting from an alternative strategy, in which we allow ϕ_x to differ across homeowners by targeting the empirical distribution of real state holdings in the PSID. The results under this calibration strategy are very similar to the ones reported for our baseline calibration, given the close match of the distribution of real estate holdings with the baseline calibration.

debt-to-GDP ratio and the distribution of debt across households, the model replicates the empirical distribution of debt to GDP ratios among non-Ricardian indebted households.

Table 14 shows the calibration for the remaining parameters in the model. We overview here the parameters linked to the monetary and fiscal policy rules, preferences, and search and matching frictions in the labor market.

The specification of the fiscal reaction function and its calibration following Andrés et al. (2016) guarantees a unique equilibrium for a loose enough fiscal rule. The steady state value of transfers is such that the resulting public debt-to-output ratio is equal to 73 percent, which is the sample average in the years under analysis, 1999 to 2013. Similarly, the steady state value of the spending-to-output ratio is equal to its sample average, 17 percent. Taylor's rule parameters, $r_R = 0.73$ and $1 + r_\pi = 1.30$ are taken from Iacoviello (2005).

Regarding preference parameters, we assume that the labor supply elasticity, η , is equal to 2 so that the average individual labor supply elasticity, given by $(\eta^{-1} [1/\bar{l}_1 - 1])$, is equal to 1, as in Andolfatto (1996). Following Andolfatto (1996) and Chéron and Langot (2004), we set the fraction of time spent working, \bar{l}_1 , equal to 1/3 and the fraction of time households spend searching, l_2 , equal to 1/6. Values for ϕ_1 and ϕ_2 are obtained in conjunction with the marginal value of employment using a system of steady state equations.

Finally, we discuss the calibration of the parameters linked to the labor market. Workers' bargaining power, λ^w , is assumed to be equal to 0.4, which is also within the range of standard values in the literature¹³. We also assume that the equilibrium unemployment rate is socially efficient (see Hosios, 1990), which implies that $\lambda^w = 1 - \chi_2$, and then we set the elasticity of matching to vacancies $\chi_2 = 0.6$, which is close to the 0.5 value in Monacelli et al. (2010). The scale parameter of the matching function, χ_1 , can be computed using the identity between matching flows and unemployment flows, evaluated at the steady state.¹⁴ We calibrate the ratio of recruiting expenditures to output, $\kappa_v \bar{v} / \bar{y}$, to represent 0.5 percentage points of output as in Chéron and Langot (2004) and Choi and Ríos-Rull (2009), and very close to the value of 0.44 implied by the calibration of Monacelli et al. (2010). From this ratio, we can obtain the cost of vacancy posting κ_v , which is then equal to 0.04. Following Andolfatto (1996) and Chéron and Langot (2004), we set the exogenous transition rate from employment to unemployment, σ , equal to 0.15 and the probability of a vacant position becoming a productive job, \bar{p}^f , equal to 0.9. The long-run employment rate, \bar{n} , is set to 0.75, as in Choi and Ríos-Rull (2009).

¹³For example, this value falls between the one in Christiano et al. (2011) and Mortensen and Nagypal (2007)

¹⁴Matching flows at the steady state are equal to $\chi_1 \bar{v}^{\chi_2} [(1 - \bar{n}) l_2]^{1-\chi_2}$ and the unemployment flows are equal to $\sigma \bar{n}$.

Table 14: CALIBRATION: OTHER PARAMETERS

Parameter	Value	Source
Technology:		
Output elasticity to labor, α	0.7	Choi and Ríos-Rull (2009)
Depreciation rate of capital, δ	0.025	Inside plausible literature range
Elasticity of final goods, θ	6	Inside plausible literature range
Frictions:		
Calvo parameter, ω	0.75	Inside plausible literature range
Investment adjustment costs, ϕ	5.5	QUEST II
Inflation indexation, ς	0.4	Kolasa et al. (2012)
Policy:		
Fiscal reaction parameter, ψ_1	0.01	Andrés et al. (2016)
Fiscal reaction parameter, ψ_2	0.2	Andrés et al. (2016)
Steady state gov.-debt-to-output, \bar{d}^p/\bar{y}	0.73	Sample average 1999-2013
Steady state spending to output ratio, \bar{g}/\bar{y}	0.17	Sample average
Interest rate smoothing, r_R	0.73	Iacoviello (2005)
Interest rate reaction to inflation, $1 + r_\pi$	1.30	Iacoviello (2005)
Preferences:		
Labor elasticity, η	2	Andolfatto (1996)
Time spent job searching by unemployed, l_2	1/6	Andolfatto (1996) and Chéron and Langot (2004)
Time spent working, \bar{l}_1	1/3	Andolfatto (1996) and Chéron and Langot (2004)
Leisure preference (empl.), ϕ_1	1.59	Steady-state equations
Leisure preference (unempl.), ϕ_2	1.04	Steady-state equations
Labor market:		
Workers' bargaining power, λ^w	0.4	Inside plausible literature range
Scale parameter matching, χ_1	1.56	Steady-state equations
Matching elasticity, χ_2	0.6	Monacelli et al. (2010)
Cost of vacancy posting, κ_v	0.04	Choi and Ríos-Rull (2009)
Transition rate, σ	0.15	Andolfatto (1996) and Chéron and Langot (2004)
Vacancy filling probability, $\bar{\rho}^f$	0.9	Andolfatto (1996) and Chéron and Langot (2004)
LR employment ratio, \bar{n}	0.75	Choi and Ríos-Rull (2009)

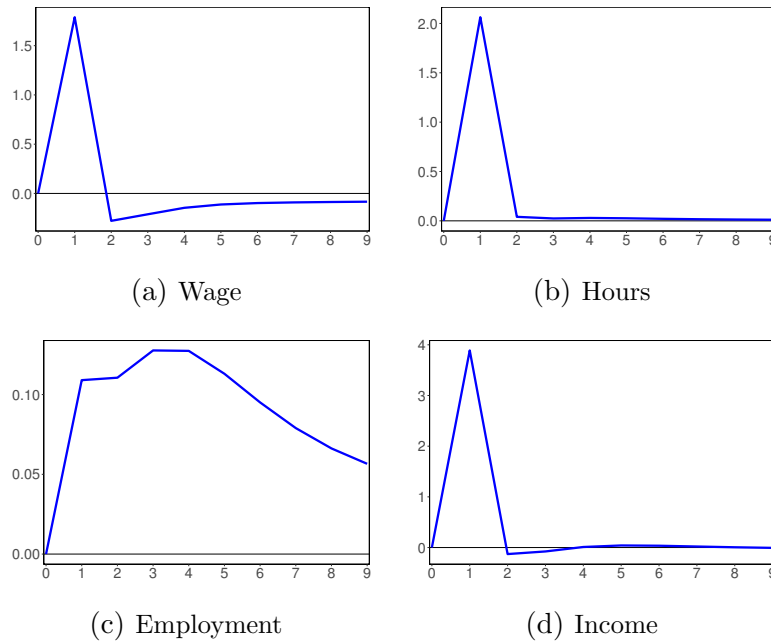
6 The transmission mechanism of government spending shocks

In this section, we study the transmission of government spending shocks in the model economy calibrated with the empirical weights of 1999. The size of the government spending shock is equal to 1 percent of output, and the shock is assumed to fall exponentially according to the function $g_t = \rho_g g_{t-1}$ with $\rho_g = 0.75$. First, we analyze the responses of the representative member of each type of household. Second, we discuss the aggregate effects of fiscal shocks and their sensitivity to changes in the distribution of households. Finally, we analyze the role of the following two channels in shaping the transmission of fiscal shocks: search and matching frictions and housing.

6.1 Individual Responses

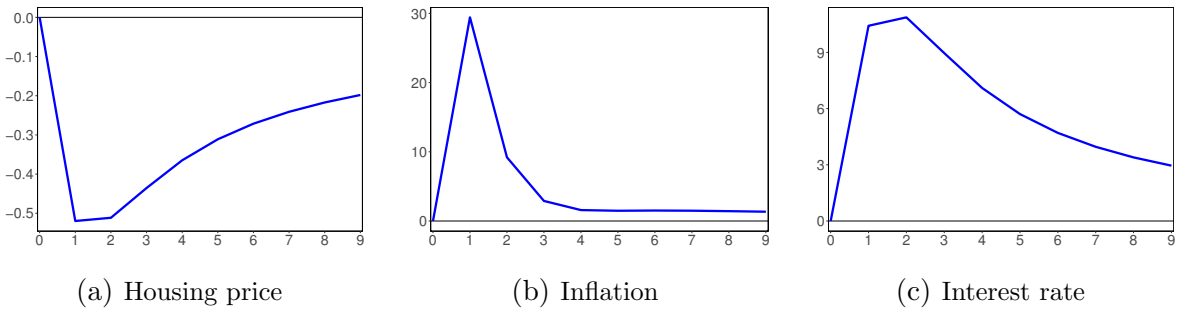
Households' responses to a government spending shock are determined by the income effect, wealth effect, and credit effects. Given our assumptions regarding labor market frictions, the income effect is identical for all households in the model economy irrespective of their balance sheet characteristics. However, the wealth and credit effects are type-specific.

Figure 1: INCOME EFFECT: RESPONSE TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)



After an expansionary fiscal shock, given that capital is predetermined in our model economy, wholesale producers meet the additional product demand by increasing their labor demand. Wholesale producers can adjust both the intensive and extensive margin of labor input. While hours are optimally chosen each period, a newly filled vacancy is a potentially long-lasting relationship with the worker, as separations are not endogenous. As shown in Figure 1, in response to an expansionary government spending shock, wholesale firms mostly rely on adjusting the intensive margin on impact, only creating some employment in the subsequent periods. The relative magnitude of the response of hours and employment is quite different: While the peak of hours is at around a 2 percent increase, the peak of employment is at around a 0.15 percent increase. The bargaining between the wholesale producers and the union results in an increase of wages on impact. The positive strong responses of hours and wages on impact, in addition to the very moderate increase in employment, translate into an increase of labor income for households. Therefore, the income effect of the government spending shock is positive and identical for all households.

Figure 2: WEALTH EFFECT: RESPONSE TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)

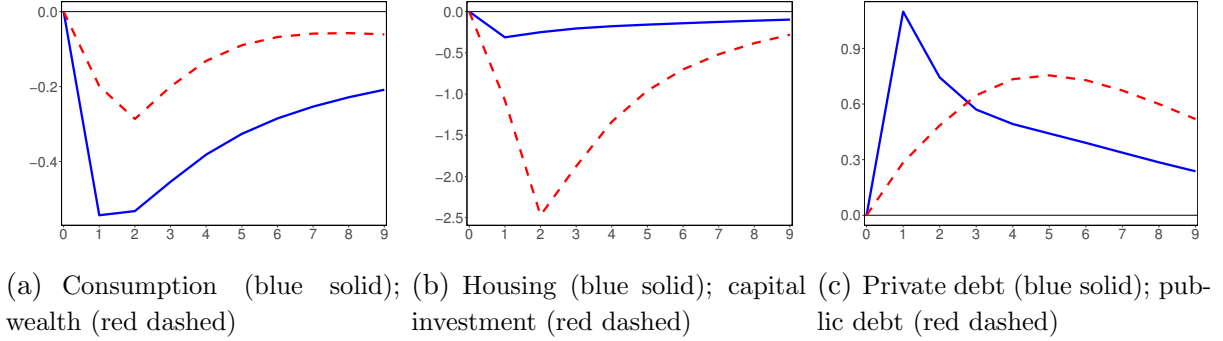


Note: The responses of inflation and interest rate is in basis points.

Although the wealth effect is type-specific, there are some common features. For example, given the deflationary pressures on housing prices triggered by the government spending shock, as shown in Figure 2, the wealth of homeowners in the model economy declines on impact. The inflationary pressures in overall prices reduce the real burden of debt for indebted impatient households. Fisher effects depress the real return on lending activities for patient households, which implies an even larger negative wealth effect for them. Therefore, while the wealth effect is clearly negative for patient households and impatient homeowners without liabilities, the sign of the wealth effect for impatient indebted homeowners is ambiguous, depending on their balance sheet composition and the calibration of the model.

Overall, the resources available for consumption for patient households are more scarce

Figure 3: PATIENT HOUSEHOLDS: RESPONSES TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)

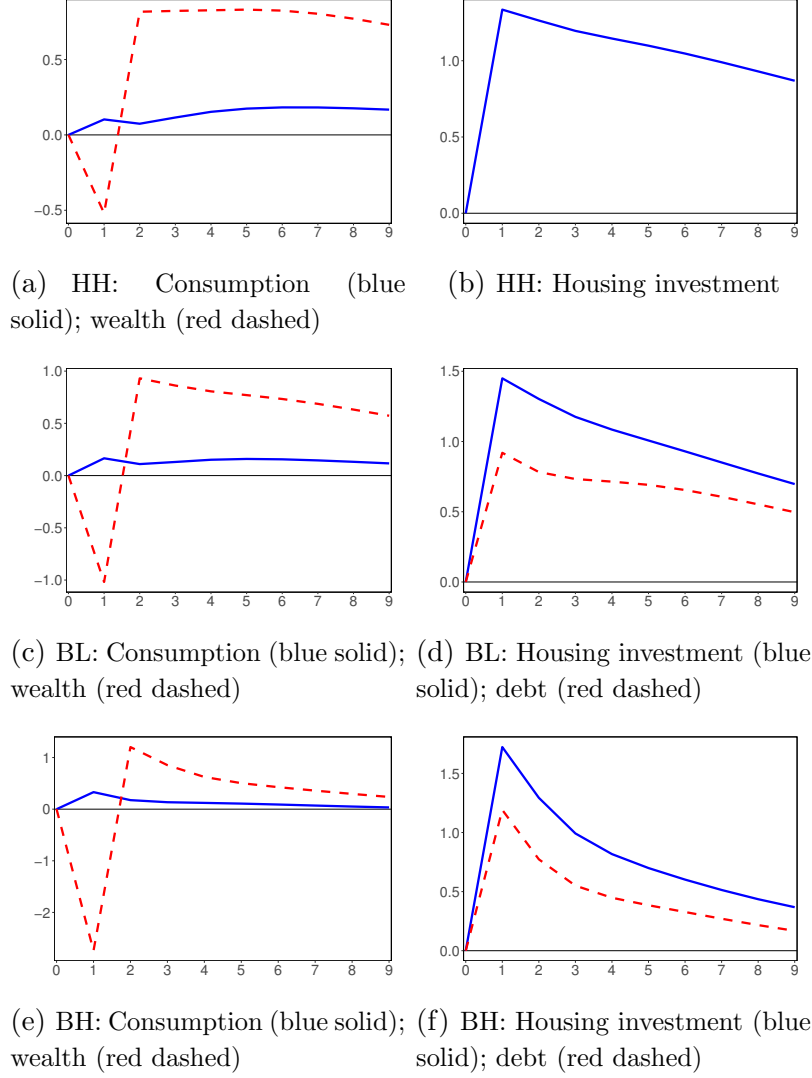


after an expansionary government spending shock because, as shown in Figure 3(c), the fiscal shock triggers an expansion of both public and private debt that, in our model, must be financed by patient households. As shown in Figure 3(b), the negative wealth effect translates into a negative response of investment in both housing (blue solid line) and physical capital (red dashed line) for patient households. Therefore, as reported in Figure 3(a), the negative wealth and credit effects more than dominate the positive income effect resulting in a negative response of consumption (blue solid line) by patient households on impact that exceeds that of wealth (red dashed line).

Figure 4 reports the impulse response functions for impatient homeowners. The wealth effect for impatient homeowners without liabilities, HH , is unambiguously negative, given the devaluation of the housing holdings. As shown in Figure 4(a), the income effect dominates the wealth effect for impatient homeowners without liabilities, as the response of consumption (blue solid line) is positive on impact and the demand for housing increases on impact as well, as reported in Figure 4(b). Impatient homeowners use the investment in real estate to do some intertemporal smoothing.

The sign of the wealth effect for impatient indebted homeowners depends on the relative size of the negative housing price effect and the positive Fisher effect. Given our calibration, the drag in wealth linked to the response of housing prices dominates, as shown by the red dashed lines in Figure 4(c) and Figure 4(e). The size of the drop in wealth for impatient homeowners is a negative function of the level of housing holdings at the steady state. As reported in Table A.10 in Appendix A.4, the level of housing at the steady state is positively correlated with household indebtedness for impatient households. Therefore, the response of wealth for impatient indebted homeowners with high leverage is much larger than the response for homeowners with low leverage, and the latter is larger than the response for

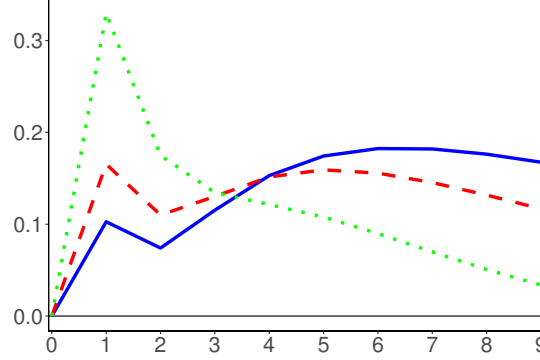
Figure 4: IMPATIENT HOMEOWNERS: RESPONSES TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)



impatient homeowners without liabilities.

The credit effect for impatient indebted homeowners is clearly positive. The borrowing ability of these households is determined by the expected value of their housing holdings. As shown in Figure 2, housing prices decline on impact but then converge steadily to their steady-state level from below. The fall in current housing prices increases the demand for housing by non-Ricardian households, which increases the total value of the collateral because it depends on the discounted expected liquidation value of current housing holdings. Therefore, after a government spending shock, there is an expansion of mortgage credit (red dashed lines in Figure 4(d) and Figure 4(f)). Despite the potentially large negative wealth

Figure 5: IMPATIENT HOMEOWNERS: RESPONSE OF CONSUMPTION TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)



Note: The blue solid line represents the response of impatient homeowners without liabilities, the red dashed line is the response of impatient homeowners with low leverage, and the green dotted line represents the response of impatient homeowners with high leverage.

effect, the positive income and credit effects dominate so that the response of consumption is positive for all impatient indebted homeowners as shown by the blue solid lines in Figure 4(c) and Figure 4(e).

The response of consumption among impatient homeowners is positively correlated with the level of indebtedness. Figure 5 shows that the consumption response on impact of impatient indebted homeowners with high leverage (green dotted line) is larger than the response of impatient indebted homeowners with low leverage (red dashed line), which is larger than the response of impatient indebted homeowners without liabilities (blue solid line). These results are along the lines of Cloyne and Surico (2017), who conclude that consumption by indebted homeowners is more sensitive to fiscal shocks than that of homeowners without a mortgage.

For impatient non-homeowners, the wealth effect on impact is always non-negative. Impatient households without assets or liabilities, HNH , have a zero wealth effect, and, hence, their consumption response mimics the response of labor income, as shown in Figure 6(a). Given the inflationary pressures, the wealth effect for households holding only liabilities, EK , is unambiguously positive. Moreover, the credit effect for impatient households with negative wealth is also positive, as reported in Figure 6(c). The positive income, wealth, and credit effects imply the strong response of consumption (blue solid line) for households with negative wealth in Figure 6(b).

Figure 7 shows that the responses of individual consumption range from a 0.5 percent decline for patient households to over a 4 percent increase for impatient non-homeowners. Moreover, this figure shows that, in our model, the response of individual consumption is

Figure 6: IMPATIENT NON-HOMEOWNERS: RESPONSES TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)

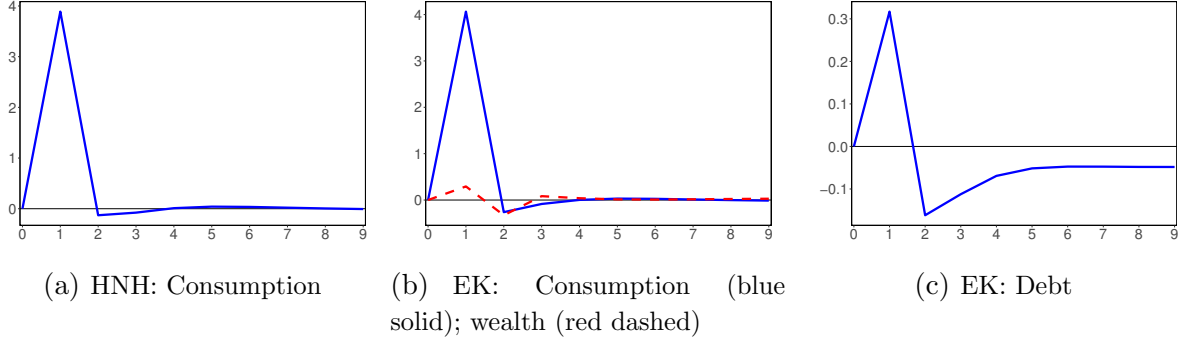
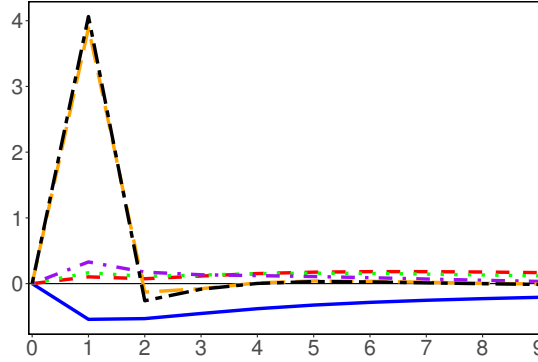


Figure 7: RESPONSE OF CONSUMPTION TO A GOVERNMENT SPENDING SHOCK (IN DEVIATIONS FROM STEADY STATE)



Note: The blue line represents the response of patient households, the red dashed line is the response of impatient homeowners without liabilities, the green dotted line corresponds to the response of impatient homeowner with low leverage, the purple dashed line is the response of impatient homeowners with high leverage, the yellow dashed line is the response of impatient households without assets or liabilities, and the black dashed line represents the response of households with negative wealth.

negatively correlated with the level of wealth. These results are along the lines of the recent empirical evidence linking wealth and consumption such as [Anderson et al. \(2016\)](#); [Carroll et al. \(2014\)](#); [Kaplan et al. \(2014\)](#); and [DeGiorgi and Gambetti \(2017\)](#).

Table 15 summarizes the sign of the contributions of each channel to households' consumption, given our calibration.

Table 15: SOURCES OF THE IMPACT CONSUMPTION RESPONSE

	Assets	Liab.	Wealth	Fresh credit	Income	Total
<i>R</i>	-	0	-	-	+	-
<i>HH</i>	-	0	-	0	+	+
<i>BL</i>	-	+	+	+	+	+
<i>BH</i>	-	+	+	+	+	+
<i>HNH</i>	0	0	0	0	+	+
<i>EK</i>	0	+	+	+	+	+

6.2 Aggregate Responses

The relative weight of each type of household in the population determines the sign and magnitude of the aggregate consumption multiplier. The two extreme responses to a fiscal shock are associated with Ricardian and households with negative wealth. Therefore, changes in the relative share of these two types of households in the overall population are key in the transmission of fiscal shocks. Table 3 in Section 3 shows that, since 1999, the shares that have changed the most are precisely the ones at the opposite ends of the distribution.

We assess the effect of the observed changes in households' shares in the transmission of government spending shocks by computing the multipliers for economies that are identical except for the shares of household types. Table 16 reports the evolution of the aggregate impact multipliers. Given the theoretical nature of our exercise, and the assumptions made in their calculation, we do not draw any particular conclusion from the absolute values or the sign in the case of the employment multiplier in Table 16. We focus on the relative variation across cross-sections of the United States because the evolution of the multipliers over time shows the effect of the change in the distribution of household wealth and debt in the population. This exercise provides an indicator of what can be missed, in terms of the effects of fiscal policy, in models that do not allow for a fine enough disaggregation of the household sector.

Table 16: THE EVOLUTION OF FISCAL EFFECTS

	1999	2001	2003	2005	2007	2009	2011	2013
Output	1.440	1.447	1.447	1.515	1.594	1.875	1.941	2.130
Consumption	0.975	0.989	0.990	1.119	1.268	1.808	1.933	2.291
Hours	2.063	2.073	2.074	2.171	2.284	2.689	2.784	3.057
Employment	0.109	0.104	0.103	0.052	-0.011	-0.252	-0.315	-0.497

Note: The multipliers are defined as percentage variation of the variable on impact.

In the years before the Great Recession, these multipliers remained fairly stable, but they have changed substantially since 2005. The output multiplier increases by almost 50 percent from 1999 to 2013, with about 80 percent of that increase occurring between 2005 and 2013. The increase in the size of the output multiplier is similar to the change in the response of aggregate consumption.¹⁵

Empirical evidence on the dynamic nature of fiscal multipliers can be found, among other papers, in [Auerbach and Gorodnichenko \(2012\)](#) who estimate multipliers that are more than 4 times higher in recessions than in expansions, although the difference is not shown on impact but materializes as time goes on. [Riera-Crichton et al. \(2015\)](#) estimate the difference in the fiscal multiplier between expansions and recessions to be 2.3 against 1.3. [Afonso et al. \(2018\)](#) find that multipliers at a four-quarter horizon can be much higher in periods of high financial stress than in periods of stability. They also note that the size of the fiscal multipliers was higher than average in the 2008 financial crisis.

[Bernardini and Peersman \(2018\)](#) and [Bernardini et al. \(2019\)](#) link government multipliers and private debt. [Bernardini and Peersman \(2018\)](#) find that, in periods of high private debt, government spending multipliers can be much higher, with cumulative multipliers of 4.5 after four quarters. Also [Bernardini et al. \(2019\)](#), using data on U.S. states, estimate that multipliers can reach a value above 4 when the state is in recession, and that a high degree of household indebtedness during recessions further increases the value of the multiplier by 2.

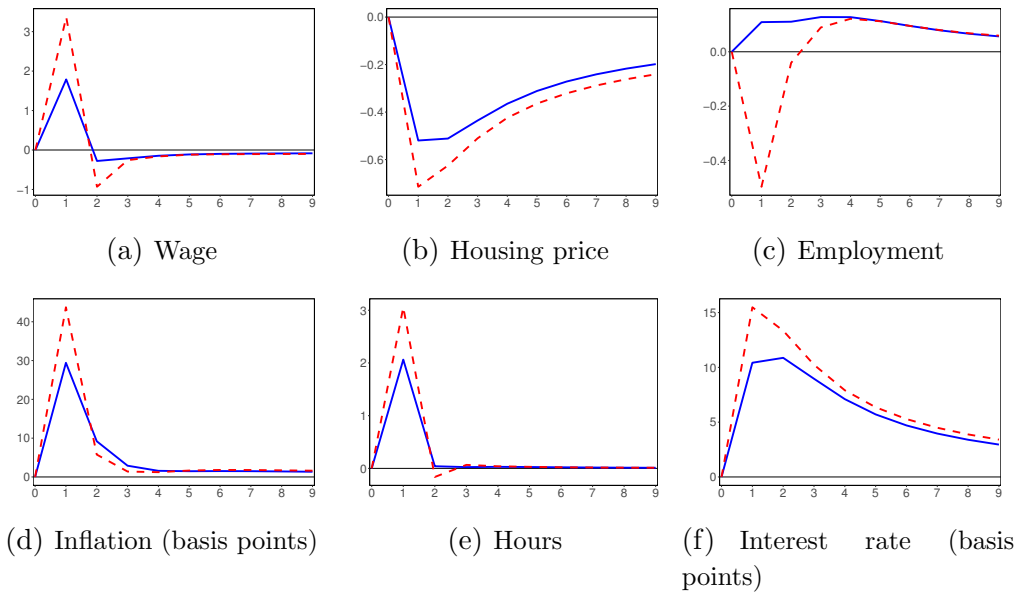
The model predicts an increase in real wages following the expansion in government spending that is consistent with the empirical evidence ([Galí, Vallés, and López-Salido, 2007](#); [Caldara and Kamps, 2008](#); [Pappa, 2009](#); and [Andrés, Boscá and Ferri, 2015](#)). According to our model, the wage increase becomes stronger as the share of constrained consumers—in particular, impatient non-homeowners, *HNH* and *EK* types—increases. If we consider the optimal hours wage and wage equations (equation 23 and equation 24, respectively) we can see that an increase in the share of impatient indebted households without assets, τ^{EK} , strengthens workers' bargaining power, given that the marginal utility of consumption of this type of household, λ_t^{EK} , falls strongly after the fiscal shock. The higher bargaining power of workers is reflected in the higher wages and hours worked of employed workers. Higher wages limit the incentives of firms to create new jobs through vacancy posting because additional vacancies now have a lower expected surplus. Firms are more prone to meet the additional output demand through a strong increase in hours worked per employee than through job

¹⁵All of the results are robust to alternative parameterizations, other thresholds in the empirical identification of the different households types ($a = 0.25$ and $a = 0.75$), and distributing transfers/taxes among households according to their total income. Table A.9 in Appendix A.3 reports the sensitivity analysis.

creation. In this way, the model predicts a simultaneous increase in the output multiplier and a reduction in the employment multiplier so that recoveries driven by fiscal expansions are less intense in job creation as we move from a primarily Ricardian economy to one with a relatively large share of severely constrained households.

The evolution of total hours and employment multipliers suggests that the changes in the distribution of households have strengthened the response of the intensive labor margin versus the extensive margin to government spending shocks. Figure 8 reports the impulse response functions for aggregate hours and employment in 1999–blue solid lines– and in 2013–red dashed lines. As shown in Figure 8 and in Table 16, while government spending shocks were neutral on employment in the early years under analysis, they have had a crowding-out effect on employment since the Great Recession, and the positive effect on total hours has increased over time. Our results point toward not just a smaller crowding-in effect for employment but also a crowding-out of the extensive margin with a contemporaneous enhancement of the crowding-in effect for the intensive margin. We argue that the main takeaway regarding the evolution of the employment multiplier is that the ability of government shocks to generate employment, if any, has become weaker over time.

Figure 8: IMPULSE RESPONSE FUNCTIONS (IN DEVIATIONS FROM STEADY STATE): AGGREGATE VARIABLES, 1999 VERSUS 2013



Note: The blue solid line represents the response in an economy with the empirical weights of 1999. The red dashed line is the response with the 2013 empirical weights.

In the literature, there is no consensus about the effect of government spending shocks on employment. Using VAR analysis, [Caldara and Kamps \(2008\)](#) estimate that employment

does not respond to government spending shocks, while [Dupor and Guerrero \(2016\)](#) estimate small employment effects that can be negative if fiscal policy starts when unemployment is low. However, also using a VAR, [Yuan and Li \(2000\)](#) show that a temporary government spending shock increases hours worked per worker but reduces employment. [Alesina et al. \(2002\)](#) show that expansionary fiscal policy puts upward pressure on private-sector wages, leading to a decline in profits and employment. And, more recently, [Pappa \(2009\)](#) uses state-level data for the United States and concludes that government employment shocks reduce total employment in some states. In the theoretical front, [Cantore et al. \(2014\)](#) show, in a model with search and matching, deep habits, and a CES technology function with a low elasticity of substitution between labor and capital, that a jobless recovery—a recovery with low job creation—can be generated after a positive government spending shock.

6.2.1 Contribution of household’s type to the aggregate multipliers

To further analyze the marginal contribution of each household type to the aggregate multipliers, we perform a theoretical counterfactual exercise. As reported in Table 17, we include progressively more types of households in the model economy. All the economies across rows are characterized by the same parameter vector; only household shares change across economies. The economy in the first row in Table 17 is populated entirely by households that can engage in intertemporal smoothing—that is, in our terminology, patient or Ricardian households, R . In this economy, a positive government spending shock crowds out consumption and investment but expands hours worked and employment. In the remaining rows in Table 17, we set the share of patient households to 50 percent of the population and distribute sequentially the remaining 50 percent equally among the categories of impatient households present in each economy. The sequence to add categories of impatient households is chosen so that the size of the output multiplier increases when we add an additional household category.

Table 17: IMPACT MULTIPLIERS. DIFFERENT COUNTERFACTUALS

	Output	Consumption	Hours	Employment
R	0.854	-0.221	1.223	0.449
$R+HH$	0.862	-0.150	1.234	0.425
$R+HH+BL$	0.869	-0.133	1.244	0.424
$R+HH+BL+BH$	0.881	-0.107	1.261	0.436
$R+HH+BL+BH+HNNH$	0.980	0.086	1.403	0.394
$R+HH+BL+BH+HNNH+EK$	1.082	0.282	1.549	0.339

As shown in the second column in Table 17, the introduction of impatient homeowners

with assets but without liabilities is enough to deliver a significant change in the response of aggregate consumption. But, in our calibration, it is the introduction of households without assets, *HNH* and *EK*, that brings the consumption multiplier to positive territory since households without assets are the ones with the largest propensity to consume in these economies.

In our model, there is a strong relationship between consumption and labor supply. As usual, households with lower marginal utilities of consumption are willing to supply labor services only at a higher wage. In a search and matching environment like ours, the marginal utility of consumption of all households is taken into account in the wage negotiation. Therefore, the inclusion of households with larger consumption multipliers increases the equilibrium wage resulting from the bargaining process, *ceteris paribus* all the other parameters of the economy. Firms substitute employment for hours worked when the equilibrium wage increases, as shown in column 3 and column 4 in Table 17. As shown in the bottom two rows in Table 17, the inclusion of households with the highest increases in consumption and, hence, the lowest marginal utilities of consumption, *HNH* and *EK*, implies a relatively large substitution between employment and hours worked.

The analysis above suggests that if the household distribution changes so that the share of impatient households without assets increases, the equilibrium wage will increase and firms will meet additional demand by relying more on the intensive than the extensive margin of labor input.

6.2.2 Multipliers at different time horizons

Thus far, we have focused on impact multipliers. In this section, we analyze the model implied multipliers at longer horizons. Following Uhlig (2010), let us define the net present value fiscal multiplier for variable x at a time horizon h as

$$\varrho_{xt} = \frac{\sum_{s=0}^h (1+r^n)^{-s} \hat{x}_s}{\sum_{s=0}^h (1+r^n)^{-s} \dot{g}_s}, \quad (30)$$

where \hat{x} stands for the relative deviation of variable x with respect to its steady state value, \dot{g}_s is the absolute deviation of government spending with respect to its steady state value, and r is the interest rate at the steady state¹⁶.

¹⁶Given that steady state output is normalized to one, the relative deviation is equivalent to the absolute deviation with respect to the steady state and, hence, equation 30 displays the usual definition of output multiplier when $s=0$.

Table 18 reports the net present value fiscal multipliers on impact, at a one-year horizon, and at a five-year horizon in 1999 and 2013. As reported in the first two columns in Table 18, the output multipliers in 1999 and 2013 are only significantly different on impact. However, for the other variables, the differences between the multipliers in 1999 and 2013 remain sizable at all horizons. While the size of the multiplier decreases for output, consumption and hours as we widen the time horizon, the size of multiplier employment increases. Moreover, the size of the investment multiplier increases in absolute terms; that is, as we widen the time horizon, the crowd-out effect of government spending shock in private investment increases. The evolution of the multipliers over time and at different horizons for consumption and investment explain our results for the output multiplier. That is, the similarity of the multipliers across time at different horizons for output is driven by the offsetting evolution of the consumption and investment multipliers¹⁷.

Table 18: MULTIPLIERS AT DIFFERENT HORIZONS

	Output		Consumption		Hours		Employment		Investment	
	1999	2013	1999	2013	1999	2013	1999	2013	1999	2013
Impact	1.440	2.130	0.975	2.291	2.063	3.057	0.109	-0.497	-1.076	-1.787
One year	0.618	0.619	0.107	0.336	0.797	1.110	0.173	-0.123	-2.463	-3.231
Five year	0.391	0.350	-0.240	-0.131	0.595	0.817	0.306	0.111	-2.518	-3.111

6.3 Addressing the relevance of different channels

6.3.1 Search and matching frictions

To illustrate the role played by the search and matching setting of the model, we compare the multipliers in our baseline economy, characterized by a worker's bargaining power parameter of $\lambda^w = 0.4$ and cost of posting vacancies of $\kappa_v = 0.04$, with those of the following three economies: (i) an economy with a lower vacancy cost, $\lambda^w = 0.4$ and $\kappa_v = 0$, (ii) an economy in which workers have complete bargaining power $\lambda^w = 1$ and $\kappa_v = 0$, and (iii) a model economy in which firms have complete bargaining power $\lambda^w = 0$ and $\kappa_v = 0.04$. The remaining parameters are identical across model economies, and the households shares are set to the ones observed in 1999.

With the first counterfactual economy, we isolate the role played by vacancy posting frictions. In the other two counterfactual economies, we assess the importance of bargaining

¹⁷This result may be related with the flexibility of housing prices and the assumption of one-period debt, which are simplifying features of our model. Adding frictions to the movement of q_t , and considering debt with a longer maturity would likely increase persistence in the reaction of consumption and output.

power for our results. Table 19 reports the impact multipliers for output, consumption, hours, employment, and labor income for the baseline economy in the first column. The counterfactual economy with no cost of vacancy posting, but with the same sharing of the matching surplus between workers and firms, corresponds to the second column. In the next column, we report the results for an economy with workers having full bargaining power and free vacancy posting¹⁸. In the last column, we show the counterfactual economy with firms having full bargaining power but with the same cost of posting vacancies than in the baseline economy.

Table 19: LABOR MARKET FRICTIONS: SENSITIVITY ANALYSIS

	$\lambda^w = 0.4, \kappa_v = 0.04$	$\lambda^w = 0.4, \kappa_v = 0$	$\lambda^w = 1, \kappa_v = 0$	$\lambda^w = 0, \kappa_v = 0.04$
Output	1.44	1.47	2.74	1.20
Consumption	0.98	1.00	3.43	0.47
Hours	2.06	2.12	3.94	1.71
Employment	0.11	0.19	-0.98	0.35
Labor income	3.9	3.9	12.09	2.18

As shown in the second column, lowering the vacancy posting cost, κ_v , affects the employment multiplier, whose value almost doubles with respect to the baseline economy. After an increase in government spending, firms react by expanding production and opening more vacancies, which are now cheaper. These new vacancies are filled by new workers, hence increasing employment.

The second and third columns, as well as the first and fourth columns, only differ in the agents' bargaining power. The greater (smaller) the capacity of the firms to appropriate the surplus from the matching between vacancies and workers is, the more (less) willing firms are to rely in the extensive margin to ramp up production. In fact, as the third column shows, the effect on employment can be negative when an additional matching does not report any surplus to firms. In this case, firms prefer to rely only in more hours per worker.

In terms of the output multipliers, whereas the cost of opening vacancies does not seem to make a significant difference, the parameter that controls the bargaining power plays a major role. For instance, in an economy in which workers have all the bargaining power, the output multiplier is significantly larger than in the baseline, mostly driven by the boost in labor income generated by the shock.

We conclude that the features of labor market, as characterized by λ and κ_v play a significant role in shaping the relative size of the effects of government spending shocks and,

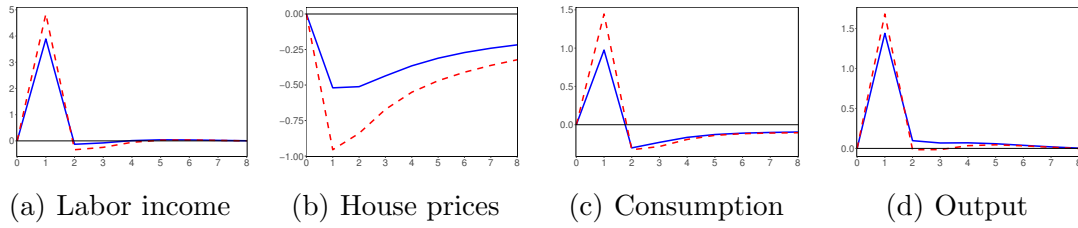
¹⁸With these assumptions, wages resulting from the matching process are equal to the marginal product of labor.

more importantly, in defining the relative role of the intensive and extensive margins in the response of the labor input.

6.3.2 Housing

Next, we assess the role of housing in the transmission of fiscal shocks by comparing the effects of a government spending shock in our model economy vis-a-vis a counterfactual economy in which the housing channel is virtually closed. In particular, we reduce the stock of housing in the economy to a level compatible with an almost zero marginal utility of housing. Excluding housing holdings, the steady state in the counterfactual economy is the same as in the baseline, which means some non-zero level of housing holdings are needed in order to keep the same aggregate volume of financial assets and their distribution among households.

Figure 9: CLOSING THE HOUSING MECHANISM: AGGREGATE VARIABLES

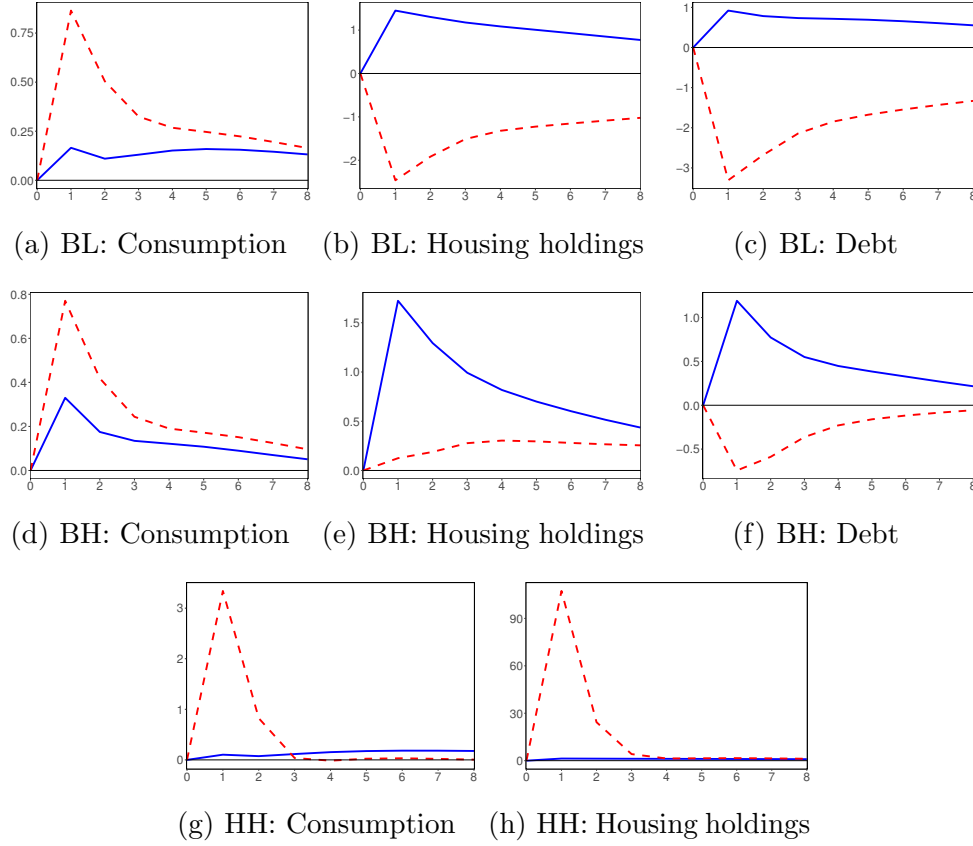


Note: Response to a government spending shock equivalent to 1 percent of GDP. The blue solid line represents the impulse response function in the baseline economy and the red dashed line represents the impulse response function in the counterfactual economy.

Figure 9 reports the responses of aggregate variables to a government spending shock in the baseline—blue solid—and the counterfactual economy—red dashed. The economy with an almost zero preference parameter over housing is characterized by larger aggregate responses. In particular, with our calibration, the fiscal multiplier in 1999 increases from 1.440 to 1.682.

Let us analyze the household specific impulse responses. Conversely to the baseline economy, a positive government spending shock triggers a contraction of private credit in the counterfactual economy as shown in the panels to the right in Figure 10. Consequently, the fresh credit channel for impatient homeowners with liabilities becomes negative. But, in the counterfactual economy, the wealth effect of the fiscal shock, which was negative in the baseline, is minimized significantly and the substitution effect between consumption and housing holdings in terms of preferences is almost zero. The smaller wealth and substitution effects bring indebted impatient homeowners to either increase housing holdings far less than in the baseline economy (see the middle panel in the second row in Figure 10) or reduce them (see the middle panel in the first row). The resources not being channeled to

Figure 10: CLOSING THE HOUSING MECHANISM: IMPATIENT HOMEOWNERS

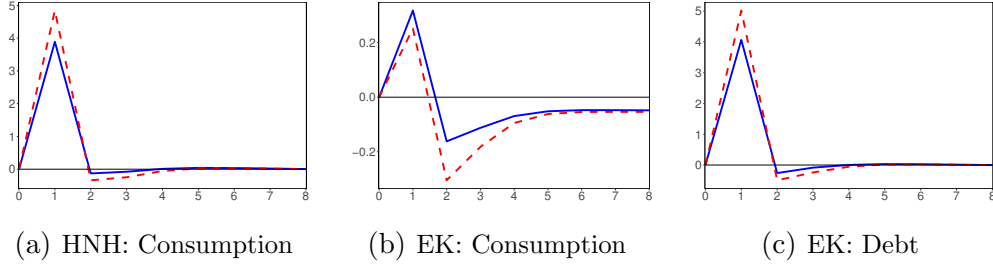


Note: Response to a government spending shock equivalent to 1 percent of GDP. The blue solid line represents the impulse response function in the baseline economy and the red dashed line represents the impulse response function in the counterfactual economy.

housing are used for consumption as shown in left panels in the first two rows in Figure 10. One of the most remarkable changes regarding household-specific responses is the response of consumption for impatient homeowners without liabilities as reported in the last row in Figure 10: Their consumption barely increases after the fiscal shock in the baseline economy, but their response is larger than the one for indebted impatient homeowners and not that far from the one for impatient non-homeowners (shown in the left panel in Figure 11). Therefore, if the preference over housing holdings is relatively small, the differences between "pure" hand-to-mouth consumers and hand-to-mouth consumers with assets almost wash out and our result of a positive correlation between the response of consumption and indebtedness levels does not hold.

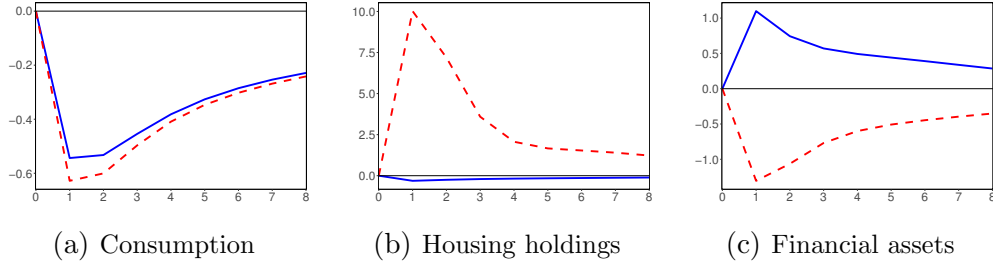
Let us also emphasize that, in the counterfactual economy, the contraction of private credit is larger than the expansion of public debt so that there is a decline in financial assets held by patient households as shown in the right panel of Figure 12. Therefore,

Figure 11: CLOSING THE HOUSING MECHANISM: IMPATIENT HOMEOWNERS WITHOUT ASSETS



Note: Response to a government spending shock equivalent to 1 percent of GDP. The blue solid line represents the impulse response function in the baseline economy and the red dashed line represents the impulse response function in the counterfactual economy.

Figure 12: CLOSING THE HOUSING MECHANISM: RICARDIANS



Note: Response to a government spending shock equivalent to 1 percent of GDP. The blue solid line represents the impulse response function in the baseline economy and the red dashed line represents the impulse response function in the counterfactual economy.

in an economy in which housing plays a small role but there is still collateralized debt, an expansionary government spending shock delivers a contraction of credit instead of an expansion.

7 Government spending multipliers and wealth distribution

7.1 Wealth Inequality and the Fiscal Multiplier

In this section, we look at the link between the distribution of wealth and the effects of fiscal policy shocks. According to the Gini coefficients reported in Table 20 for all observations in the PSID – first column – and the observations in our sample – second column–, wealth inequality has increased during the sample period. Visual inspection suggests that the increase in the Gini coefficient in wealth from 0.851 in 1999 to 0.874 in 2013 is mostly due to divergences between household groups, as the within-group coefficients have remained more

Table 20: GINI COEFFICIENTS (NON-HOUSING REAL WEALTH)

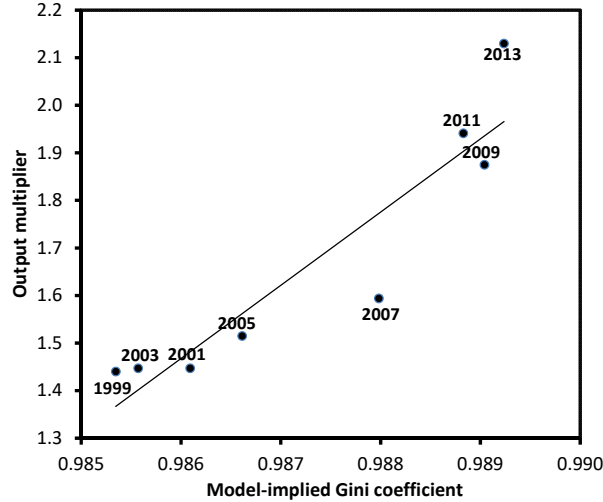
	PSID	Sample	R	HH	BL	BH	HNH
1999	0.862	0.851	0.729	0.589	0.527	0.482	0.545
2001	0.856	0.843	0.708	0.597	0.527	0.508	0.582
2003	0.858	0.844	0.712	0.529	0.472	0.501	0.581
2005	0.867	0.853	0.718	0.530	0.512	0.485	0.566
2007	0.874	0.861	0.729	0.564	0.481	0.475	0.580
2009	0.885	0.872	0.734	0.538	0.515	0.499	0.562
2011	0.884	0.872	0.731	0.530	0.500	0.496	0.548
2013	0.885	0.874	0.732	0.567	0.586	0.466	0.533

Note: The first column refers to the overall PSID population, while the second column reports the coefficients for the sub-sample we consider in the analysis.

stable.

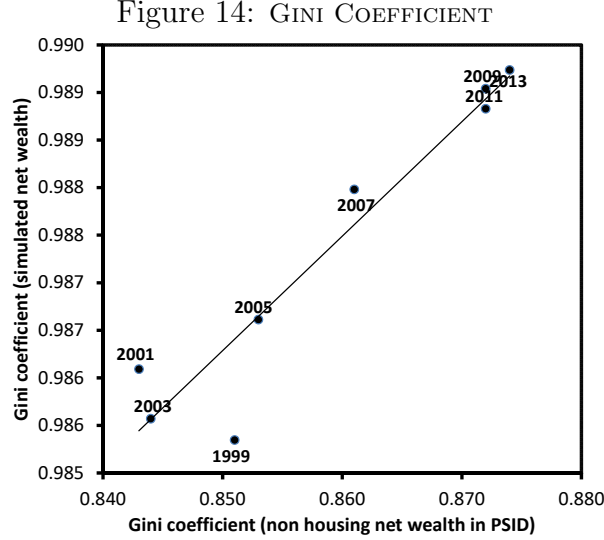
In Figure 13, we plot the model-implied output multipliers against the model-based Gini coefficients. Both variables are computed using the observed household shares (see Table 3) and the model-implied wealth. Figure 13 shows a positive correlation between the output multiplier and wealth inequality. Given that the output multiplier increases with the share of constrained agents in the economy, we argue that our model suggests that discretionary fiscal policy can be more effective in more unequal economies.

Figure 13: OUTPUT MULTIPLIER AND INEQUALITY IMPLIED BY THE MODEL



In Figure 14, we compare the between-groups coefficient – the second column in Table 20 – with the Gini coefficient implied by our model, which is based on treating each group as a representative household. There is a large positive correlation between the simulated and the observed wealth inequality indexes. Therefore, we conclude that our model is capable

of reproducing a significant proportion of the observed mean variation in wealth inequality. This result is consistent with the positive association between wealth inequality and the aggregate marginal propensity to consume documented by [Brinca et al. \(2016\)](#); [Carroll et al. \(2014\)](#); and [Krueger et al. \(2016\)](#).



7.2 Welfare Effects

So far, we have assessed the effects of government spending shocks on household consumption across household types. But households' utility also depends on their real estate holdings and leisure. So to evaluate the distributional consequences of government spending shocks in a more general way, we compute the effect of these shocks on households' welfare. We define welfare \bar{V}^i as the discounted sum of a household i period utility, conditional on the economy being at the steady state in period 0 (common to all the experiments) and remaining constant throughout

$$\bar{V}^i = \sum_{t=0}^{\infty} (\beta^i)^t \left[\ln(\bar{c}_t^i) + \phi_x^i \ln(\bar{x}_t^i) + \bar{n}_{t-1} \phi_1 \frac{(1-\bar{l}_{1t})^{1-\eta}}{1-\eta} + (1 - \bar{n}_{t-1}) \phi_2 \frac{(1-\bar{l}_{2t})^{1-\eta}}{1-\eta} \right],$$

where i is the index referring to household's type. We define $V^{i,s}$ as the welfare of a type i household under a shock, conditional on the state of the economy in period $t = 0$ and taking into account the reaction of the variables before returning again to their initial steady state

$$V^{i,s} = \sum_{t=0}^{\infty} (\beta^i)^t \left[\ln(c_t^{i,s}) + \phi_x^i \ln(x_t^{i,s}) + n_{t-1}^s \phi_1 \frac{(1-l_{1t}^s)^{1-\eta}}{1-\eta} + (1 - n_{t-1}^s) \phi_2 \frac{(1-l_{2t}^s)^{1-\eta}}{1-\eta} \right], \quad (31)$$

where $c_t^{i,s}$, $x_t^{i,s}$, $n_{t-1}^{i,s}$, and l_{1t}^s denote consumption, housing, employment rate, and hours per worker, respectively, under a fiscal shock.

We calculate the welfare cost Δ^i associated with a fiscal measure as the fraction of steady-state consumption that a household would be willing to give up in order to be as well off after the fiscal shock, that is,

$$V^{i,s} = \sum_{t=0}^{\infty} (\beta^i)^t \left[\ln [\bar{c}_t^i (1 - \Delta^i)] + \phi_x^i \ln (\bar{x}_t^i) + \bar{n}_{t-1} \phi_1 \frac{(1 - \bar{l}_{1t})^{1-\eta}}{1-\eta} + (1 - \bar{n}_{t-1}) \phi_2 \frac{(1 - \bar{l}_2)^{1-\eta}}{1-\eta} \right]. \quad (32)$$

Thus, from (31) and (32)

$$\Delta^i = 1 - \exp\{ (V^{i,s} - \bar{V}^i) (1 - \beta^i) \}, \quad (33)$$

where a negative value for Δ implies a welfare gain.

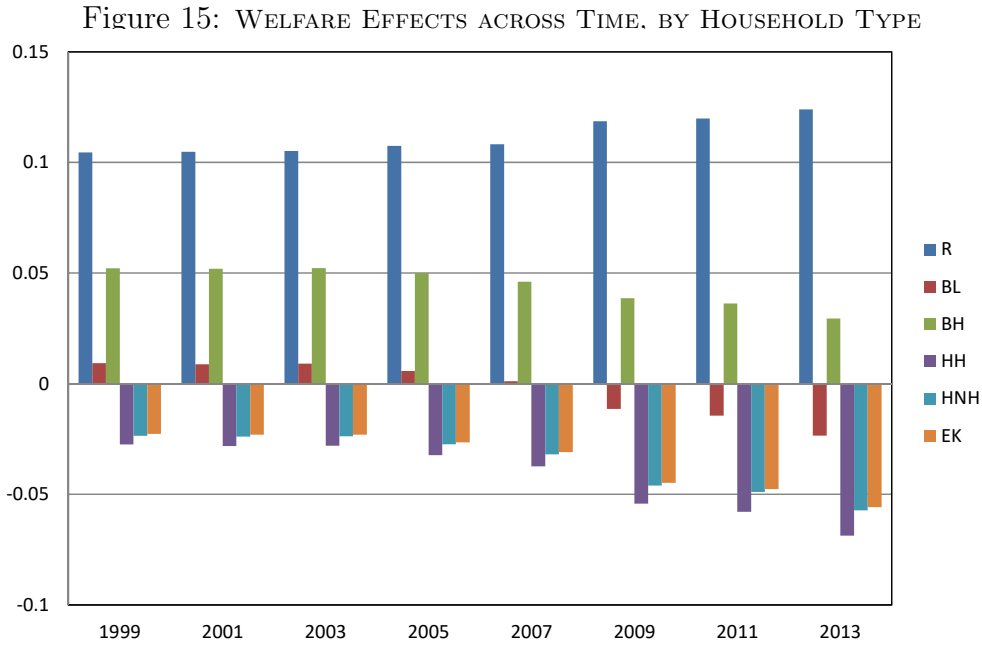


Figure 15 shows the welfare costs, if positive, and gains, if negative, for each type of household over time. After a government spending shock, welfare for Ricardian households (the richest type of households), but also for high- and low-leveraged impatient households with housing, BH and BL , declines, while welfare improves for all other types of impatient households. The welfare benefit from fiscal expansions increases considerably after 2007, mainly for the poorest types (HH , HNH , and EK households). Therefore, we argue that fiscal interventions are more effective in redistributing consumption when there is a higher degree of inequality.

Fiscal policy may thus have a non negligible distributional effect on welfare grounds, even under the assumption that government spending is pure waste and does not directly affect preferences. How each household’s welfare is affected depends on her position in the financial market. By the same token, our results point towards important welfare effects of fiscal consolidations that could harm the less financially well-off part of the population, in line with the results obtained by [Klein and Winkler \(2017\)](#).

8 Conclusion

We explore the macroeconomic implications of government spending shocks in an economy populated by six representative agents that differ in their attitude towards savings, real estate holdings, and access to credit. In particular, we classify households in the PSID into six types: (i) patient or Ricardian households; (ii) impatient households with real estate holdings and no liabilities; (iii) impatient households with housing and a high loan-to-value ratio; (iv) impatient households with housing and a low loan-to-value ratio; (v) impatient households without access to credit and without housing; and (vi) impatient households without housing but with access to non-mortgaged credit. We show that, since the Great Recession, the share of patient households has declined, while the share of households with negative wealth has increased.

We calibrate a DSGE model according to the observed evolution of household shares in the population to show that the heterogeneity in the household consumption response can account for important variations in the size of fiscal multipliers over time. More precisely, we find that our model is capable of accounting for a variety of facts that have been recently documented in the relevant literature: (i) the response of individual consumption to a government spending shock is negatively correlated with the individual’s net wealth and positively correlated with the level of indebtedness; (ii) the size of the fiscal multiplier is very sensitive to the distribution of wealth, increasing significantly with the fall in the share of Ricardian households and the increase in the share of households with negative wealth; (iii) the employment multiplier declines as the share of agents with zero or negative wealth in the population increases; (iv) output multipliers are positively correlated with wealth inequality; and (v) the welfare effect of fiscal shocks across households depends on their financial position: poorer (wealthier) households are the winners (losers) of increases in public spending.

In the model, we have restricted households to behave identically in the labor market, because we wanted to focus on the role played by their balance sheet position in the transmission of government spending shocks. A natural extension of our work is to explore the

relationship between households' balance sheet heterogeneity and labor income heterogeneity in a macro model informed by micro data, which is next in our research agenda.

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A Appendix

A.1 Comparison with [Kaplan et al. \(2014\)](#)

[Kaplan et al. \(2014\)](#) use a two-asset model with different liquidity characteristics for each asset to argue that there may be households behaving like traditional hand-to-mouth consumers, consuming their current income completely, while holding potentially large amounts of illiquid assets – the so-called wealthy hand-to-mouth consumers. While [Kaplan et al. \(2014\)](#) incorporate households with positive wealth to the hand-to-mouth pool, they exclude households with negative wealth. [Kaplan et al. \(2014\)](#) estimate the shares of non-hand-to-mouth, *N-HtM*; wealthy hand-to-mouth, *W-HtM*; and poor hand-to-mouth consumers, *P-HtM*, using two alternative surveys for the United States: the Survey of Consumer Finances and the PSID. Using the PSID, their definition of income reduces to labor earnings of the household plus government transfers and wealth is defined as the sum of net liquid wealth and net illiquid wealth. The latter is defined as the net value of home equity plus the net value of other real estate plus the value of private annuities or IRAs and the value of other investments in trusts or estates, bond funds, and life insurance policies. Net liquid wealth is defined as the difference between liquid assets and liquid debt. Liquid assets include the value of checking and savings accounts, money market funds, certificates of deposit, savings bonds, and Treasury bills plus directly held shares of stock in publicly held corporations, mutual funds, or investment trusts. Before 2011, they define liquid debt as the value of debts other than mortgages, such as credit cards, student loans, medical and legal bills, and personal loans. Since 2011, liquid debt only includes credit card debt. [Kaplan et al. \(2014\)](#) use a threshold strategy to separate hand-to-mouth behavior from intertemporally optimizing agents. A household is classified as non-hand-to-mouth, *N-HtM*, if her wealth exceeds half of her income.¹⁹ A hand-to-mouth household is wealthy hand-to-mouth, *W-HtM*, if she holds positive net illiquid wealth and poor hand-to-mouth, *P-HtM*, if she holds a non-positive net illiquid wealth.

Table [A.1](#) reports the percentages of each type of household we consider in the paper that would be classified as *N-HtM*, *W-HtM* or *P-HtM* by [Kaplan et al. \(2014\)](#). For example, the first row in Table [A.1](#) shows that of the Ricardian households we identify in the PSID, 86 percent would be classified as *N-HtM* by [Kaplan et al. \(2014\)](#), 6 percent would have been classified as *W-HtM*, and 9 percent as *P-HtM*. Among the impatient homeowners, those without liabilities, *HH*, are mostly classified as intertemporally optimizing agents by [Kaplan et al. \(2014\)](#). Note that the definition of wealth in [Kaplan et al. \(2014\)](#) includes the net

¹⁹[Kaplan et al. \(2014\)](#) restrict wealth for households in their sample to be non-negative, but net worth can be negative.

equity of the main home, which for *HH* households is positive. Hence, it is more likely that *HH* households satisfy the threshold condition with housing wealth despite not satisfying it when considering non-housing wealth. For indebted impatient households, 88 percent of those with low loan-to-value ratio, *BL*, are considered to be *N-HtM*, while only 38 percent of those with high loan-to-value ratio, *BH*, are classified as such. About half of the *BH* households are classified as *W-HtM* consumers. As expected, the vast majority of impatient households without assets are classified as *P-HtM* by [Kaplan et al. \(2014\)](#)’s identification strategy.

Table A.1: COMPARISON TABLE: PERCENT ADDS BY ROW, YEAR 1999

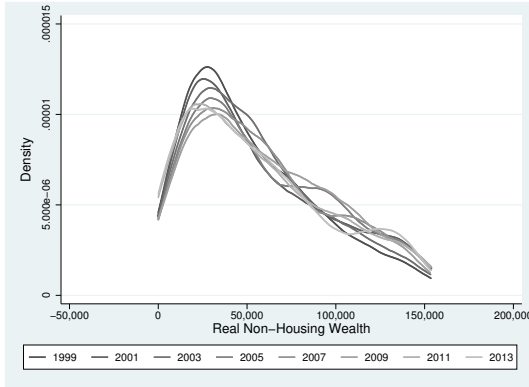
	NHTM	WHTM	PHTM
Patient: R	85	6	9
Impatient: HH	75	25	0
Impatient: BL	88	12	0
Impatient: BH	36	54	11
Impatient: HNH	4	14	82
Impatient: EK	1	8	90

In Table [A.2](#), we report which percentage of households classified as *N-HtM*, *W-HtM* or *P-HtM* by [Kaplan et al. \(2014\)](#) would be classified in each of our types. For example, out of the *N-HtM* consumers, only 67 percent would be considered Ricardians while 31 percent would be classified as impatient homeowners. Most *W-HtM* households are classified as impatient indebted homeowners with a high loan-to-value ratio, *BH*, followed by Ricardians, *R*, and impatient households without assets or liabilities, *HH*. Finally, *P-HtM* households mostly fall in the two categories we define for impatient non-homeowners.

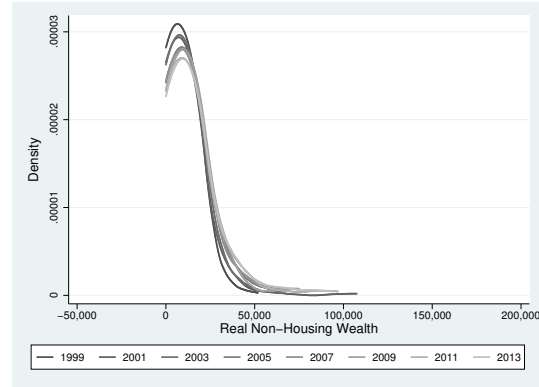
Table A.2: COMPARISON TABLE: PERCENT ADDS BY COLUMN, YEAR 1999

	NHTM	WHTM	PHTM
Patient: R	67	15	10
Impatient: HH	6	6	0
Impatient: BL	15	6	0
Impatient: BH	10	47	4
Impatient: HNH	2	18	45
Impatient: EK	0	8	41

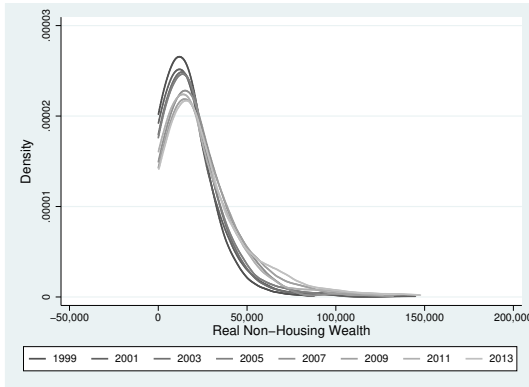
A.2 Real non housing wealth distributions over time



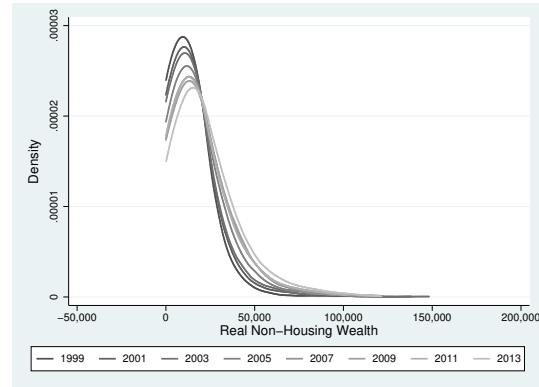
(a) Ricardian households



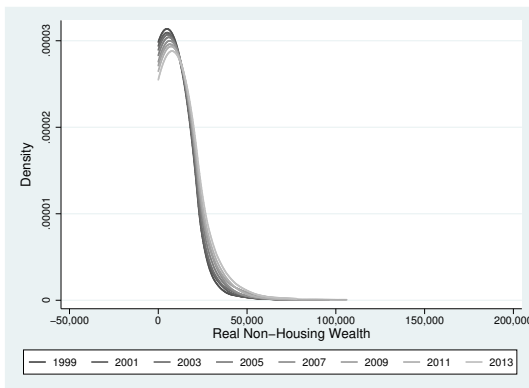
(b) Impatient homeowners without liabilities



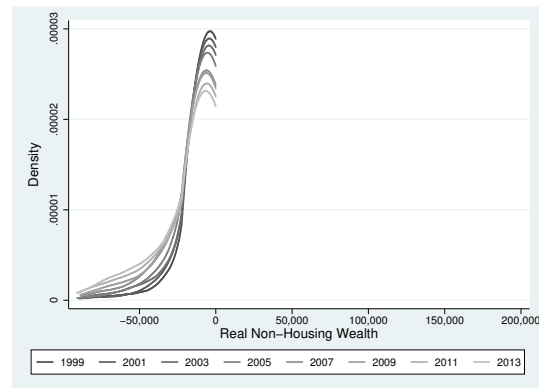
(c) Impatient homeowners with low leverage



(d) Impatient homeowners with high leverage



(e) Impatient non-homeowners without liabilities



(f) Impatient non-homeowners with negative wealth

A.3 Transition probabilities and sensitivity analysis

Table A.3: TRANSITION PROBABILITIES 2001 WAVE TO 2003 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.757	0.386	0.373	0.297	0.176	0.119
HH	0.039	0.417	0.041	0.017	0.018	0.006
BL	0.061	0.049	0.419	0.152	0.018	0.006
BH	0.051	0.040	0.114	0.468	0.080	0.013
HNH	0.062	0.072	0.053	0.044	0.496	0.282
EK	0.030	0.036	0	0.021	0.136	0.574

Table A.4: TRANSITION PROBABILITIES 2003 WAVE TO 2005 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.753	0.346	0.329	0.296	0.177	0.092
HH	0.038	0.415	0.037	0.008	0.017	0.009
BL	0.063	0.093	0.503	0.177	0.017	0.003
BH	0.053	0.045	0.086	0.431	0.064	0.021
HNH	0.060	0.061	0.035	0.065	0.502	0.253
EK	0.033	0.041	0.009	0.023	0.223	0.622

Table A.5: TRANSITION PROBABILITIES 2005 WAVE TO 2007 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.757	0.397	0.373	0.325	0.181	0.109
HH	0.028	0.406	0.052	0.012	0.012	0.008
BL	0.058	0.041	0.438	0.148	0.009	0.004
BH	0.047	0.037	0.105	0.436	0.063	0.020
HNH	0.067	0.078	0.024	0.051	0.505	0.260
EK	0.043	0.041	0.008	0.027	0.230	0.599

Table A.6: TRANSITION PROBABILITIES 2007 WAVE TO 2009 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.723	0.340	0.368	0.237	0.154	0.081
HH	0.034	0.464	0.026	0.011	0.009	0.004
BL	0.056	0.057	0.413	0.109	0.010	0.005
BH	0.063	0.033	0.169	0.548	0.043	0.015
HNH	0.072	0.086	0.017	0.065	0.524	0.242
EK	0.051	0.019	0.006	0.030	0.261	0.653

Table A.7: TRANSITION PROBABILITIES 2009 WAVE TO 2011 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.745	0.427	0.353	0.275	0.189	0.105
HH	0.038	0.455	0.056	0.018	0.015	0.008
BL	0.047	0.028	0.455	0.073	0.011	0.004
BH	0.054	0.009	0.112	0.546	0.038	0.013
HNH	0.075	0.057	0.012	0.058	0.503	0.226
EK	0.042	0.024	0.012	0.028	0.244	0.644

Table A.8: TRANSITION PROBABILITIES 2011 WAVE TO 2013 WAVE

Type	R	HH	BL	BH	HNH	EK
R	0.734	0.399	0.343	0.278	0.171	0.093
HH	0.038	0.484	0.076	0.018	0.016	0.007
BL	0.045	0.027	0.395	0.075	0.006	0.001
BH	0.051	0.016	0.140	0.558	0.032	0.013
HNH	0.078	0.031	0.038	0.056	0.557	0.217
EK	0.053	0.043	0.009	0.015	0.219	0.669

Table A.9: SENSITIVITY ANALYSIS: MULTIPLIERS FOR 1999 AND 2013

	Output		Consumption		Hours		Employment	
	1999	2013	1999	2013	1999	2013	1999	2013
<i>Benchmark</i>	1.440	2.130	0.975	2.291	2.063	3.057	0.109	-0.497
$\lambda^w \Rightarrow 0.4$ to 0.5	1.524	2.456	1.148	2.920	2.185	3.527	0.033	-0.797
$r_\pi = 0.30$ to 0.25	1.513	2.273	1.063	2.498	2.168	3.263	0.102	-0.556
$\rho_g = 0.75$ to 0.80	1.409	2.074	0.904	2.175	2.019	2.976	0.163	-0.422
$\beta^I = 0.95$ to 0.97	1.416	2.069	0.922	2.169	2.029	2.969	0.118	-0.455
$m^{BH} = 0.907$ to 0.80	1.425	2.091	0.948	2.218	2.042	3.000	0.113	-0.470
$m^{EK} = 0.272$ to 0.7	1.482	2.182	1.053	2.389	2.124	3.132	0.057	-0.586
$\omega = 0.75$ to 0.70	1.440	2.130	0.975	2.291	2.063	3.057	0.109	-0.497
$\phi = 5.5$ to 7.5	1.495	2.312	1.032	2.543	2.142	3.320	0.187	-0.433
$a = 0.5$ to 0.25	1.255	1.649	0.598	1.357	1.798	2.364	0.232	-0.073
$a = 0.5$ to 0.75	1.537	2.519	1.174	3.039	2.203	3.617	0.028	-0.900
$trh^R \neq trh^i$	2.140	3.030	2.185	3.900	3.072	4.357	-0.339	-2.083

Note: λ^w is worker's bargaining power, r_π is response to inflation in the Taylor rule, ρ_g is autocorrelation coefficient of the government spending shock, β^I is discount rate of impatient households, m^{BH} is loan-to-value ratio for impatient households with high leverage, ω is Calvo parameter, m^{EK} is loan-to-value ratio for impatient households with negative wealth, and ϕ is investment adjustment costs parameter, a is income-to-wealth threshold, $trh^R \neq trh^i$ is transfers received/taxes paid by all households according to their total income, which for Ricardians is the sum of labor income, the return on capital, and the return on private and public debt; and for impatient households, it is just labor income.

A.4 Steady-state analysis

Table A.10 reports the steady state levels of consumption, labor income, and gross and net wealth across the six household types in our model economy. The last column in Table A.10 reports the wealth-to-labor income ratio, which shows substantial variability. Despite the large degree of heterogeneity in net wealth at the steady state, the assumption on identical labor income translates into a more egalitarian distribution of consumption.²⁰

Table A.10: STEADY-STATE VALUES

	Cons ¹	Lab income ¹	Net wealth	Assets	Liabilities	Ratio ²
	(1)	(2)	(3)	(4)	(5)	(3)/(2)
R	0.762	0.578	36.721	36.721	0	15.9
HNH	0.578	0.578	0	0	0	0
HH	0.578	0.578	1.648	1.648	0	0.71
BL	0.554	0.578	1.096	3.511	2.415	0.47
BH	0.528	0.578	0.508	5.495	4.987	0.22
EK	0.575	0.578	-0.156	0	0.156	-0.07

Notes:¹Quarterly data. ²In annual terms

At the steady state, Ricardian consumers achieve the highest level of per capita consumption, followed by impatient households with no liabilities, *HNH* and *HH*. The steady-state consumption of impatient households with no liabilities is identical irrespective of whether they are homeowners, *HH*, or not, *HNH*. For households participating in the credit market, per capita consumption at the steady state is inversely related with their indebtedness level. Households use their income for consumption and interest payments on debt. Therefore, given that labor income is identical across households, heavily indebted consumers can only afford lower levels of consumption at the steady state. In our calibration, the indebtedness of impatient households with negative wealth, *EK*, is lower than that of impatient homeowners. Therefore, the consumption level at the steady state for *EK* households exceeds that for *BH* and *BL* households.

²⁰In Table A.10, the dispersion in labor income is, by construction, zero, and, hence, lower than that of net wealth. In fact, the observed dispersion in (median) non-housing wealth is larger than the dispersion in (median) income.