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Households' Balance Sheets and the Effect of Fiscal Policy

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.

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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 (MPC), 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 a 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, 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, our model delivers individual consumption responses that are a decreasing function of the level of household wealth, which is along the lines of the empirical evidence provided by Anderson, Inoue, and Rossi (2016), Carroll, Slacalek, and Tokuoka (2014), and Kaplan, Violante, and Weidner (2014). Second, we find that the

1. The 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% of GDP.

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

individual consumption response is an increasing function of households' indebtedness level, which has been documented using UK data by Surico and Trezzi (2015) and Cloyne and Surico (2017). As in Brinca et al. (2016), Brinca et al. (2017), and Carroll et al. (2017), we 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.

We find that the effects of fiscal shocks are very sensitive to the fraction of households in the left tail of the wealth distribution. Therefore, as the distribution of household shares in the PSID has changed over time, the model-implied aggregate MPC and the output multiplier have changed significantly. Similarly, Brinca et al. (2016) find that the fiscal multiplier is highly sensitive to the fraction of the population facing binding constraints. In our model, given the documented increase in the share of households with negative wealth, we obtain that the model-implied impact multiplier for output is almost 50% larger in 2013 than in 1999. Households with negative wealth are 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 1 describes the data set and the criteria used to identify the types of households according to their balance sheet positions. Section 2 introduces the theoretical model. Section 3 discusses our calibration strategy. Section 4 explores the transmission mechanism of government spending shocks in the model and its evolution for each of the PSID waves. Section 5 analyzes the relationship between fiscal multipliers and wealth inequality and also explores the welfare effects of fiscal shocks. Section 6 concludes.

1. 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 toward savings, homeownership, and access

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	Nonmortgage debt	Unrestricted

to credit. We focus on these three dimensions because they may affect the MPC out of a government spending shock. We then analyze the wealth and income distributions conditional on household type and compute average propensities to consume (APC), 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.

1.1 Identification Strategy

We use data for the 1999–2013 period from the PSID, which surveys a representative sample of U.S. households every odd year. Previous studies using data from the PSID, such as Kaplan, Violante, and Weidner (2014) or Krueger, Mitman, and Perri (2016), classify households according to their wealth to document patterns related to income or consumption. However, Aguiar, Bils, and Boar (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 toward savings, homeownership, and access to credit. We argue that, in the model we describe in Section 2, these characteristics are key in the conditional reaction of consumption, employment, and working hours to fiscal shocks.

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

3. We 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.

households to the extent that housing provides current utility 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)–(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 the traditional hand-to-mouth consumers in Galí, Vallés, and López-Salido (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 a 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% to 35% as we move from $a = 0.25$ to $a = 0.75$. For clarity purposes, the empirical analysis reported here is done with $a = 0.50$.

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% share of patient households, and hence, a 60% share of impatient households. The share of impatient households without assets is larger than the share of impatient households

4. Non-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, and 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."

5. Income incorporates salary; dividends; rent payments received; worker compensation; trust fund income; financial support from relatives; financial support from nonrelatives; 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

with assets. These shares are, on average, 40% and 20%, 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% in 1999 to 37% in 2013, while the share of impatient households with negative wealth increases from 16% to 24%.[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% in 1998 to 21.8% in 2010, at which level it remained in 2013.

1.2 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

6. Our 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.

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

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

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 $p25 \geq wealth > p10$.

for these two variables in addition to the APC. 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 toward savings, not in terms of the liquidity constraints they may face given their income.

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 patients. 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 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

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 $p25 \geq wealth > p10$.

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

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% tail of the wealth distribution. Most impatient households with positive wealth fall into the interquartile ranges around the median of the wealth distribution.[8]

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—25–50 and 50–75—highlight the diversity of household types in the middle of the wealth distribution.

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% lower than the median income of impatient homeowners with mortgage debt.

8. Section 1 in the Online Appendix 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 18 in Section 5.1.

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 $p25 \geq RealIncome > p10$.

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.

Comparing Tables 4 and 7, we observe that, at the median, a patient household has a non-housing wealth that is 65% 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% of households in the 0–10 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.

Consumption. To explore consumption behavior, we report the 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 who are, on average, wealthier have lower APC. 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 APC as impatient indebted homeowners—*BL* and *BH*—which resonates with Aguiar, Bils, and Boar (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

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.

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 households with negative wealth, *EK*.

In Section 4.1, we show that the response of the 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.

1.3 Transition Probabilities

Finally, we explore type persistence by computing transition probabilities.[9] Table 10 reports transition probabilities between 1999 and 2001. Looking at the diagonal elements, 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%. Conditional on being an impatient household with assets (*HH*, *BH*, or *BL*), the probability of exiting the impatient status is, on average,[10] 37%. Such probability is only 19% for impatient households without assets nor liabilities, *HNH*, and 9% 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% on average. Similarly, the probability of becoming impatient with assets for households without assets is only

9. Transition probabilities are computed considering households who 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.

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

6.7% on average.[11] We argue that our results suggest that second-order effects on household transitions are not expected to be large after a government spending shock.

2. THE MODEL

We consider a standard New Keynesian model with balance sheet heterogeneity in the household sector and search and matching frictions. 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.

2.1 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 ith-type households and $\tau^i = \frac{N^i}{N}$ be the weight of the ith-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 who 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).

11. These results are quite robust across waves as reported in Section 2 in the Online Appendix . Using PSID data from 1999 to 2015, Aguiar, Bils, and Boar (2020) also conclude that households types are persistent. 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).

We consider two types of impatient households without housing holdings: *(i)* traditional hand-to-mouth consumers à la Galí, Vallés, and López-Salido (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,

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

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 Ricardian 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 $n_t^i = (1 - \sigma)n_{t-1}^i + \rho_t^w(1 - n_{t-1}^i)$.

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,

$$\rho_t^w (1 - n_{t-1}) = \chi_1 v_t^{\chi_2} [(1 - n_{t-1}) l_2]^{1-\chi_2}, \quad (2)$$

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

$$\lambda^i_{ht} \equiv \frac{\partial \Omega^i_t}{\partial n^i_{t-1}} = \lambda^i_{1t} w_t l_{1t} + \left(\phi_1 \frac{[1-l_{1t}]^{1-\eta}}{1-\eta} - \phi_2 \frac{[1-l_2]^{1-\eta}}{1-\eta} \right) + \left[1 - \sigma - \rho^w_t\right] \beta^i \mathbb{E}_t \lambda^i_{ht+1}, \tag{3}$$

where λ^i_{1t} 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.

Ricardian households. Patient households are the only savers in the economy. They lend d^R_t to the private sector and d^P_t 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^n_t. Patient households are also the owners of physical capital, k^R_t. They undertake productive investment, j^R_t, which is subject to adjustment costs. Patient households accrue any extraordinary profits of firms in the form of dividends, f^R_t.

Patient consumers choose paths for consumption, c^R_t; housing holdings, x^R_t; leisure, $1 - l_{1t}$; private lending, d^R_t; public lending, d^P_t; and investment, j^R_t 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

$$c^R_t + j^R_t \left[1 + \frac{\phi}{2}\left(\frac{j^R_t}{k^R_{t-1}}\right)\right] + q_t \left[x^R_t - x^R_{t-1}\right] + d^R_t + d^P_t = w_t n_{t-1} l_{1t} + r_t k^R_{t-1} + \left(1 + r^n_{t-1}\right) \frac{d^P_{t-1} + d^R_{t-1}}{1+\pi_t} + f^R_t + trh_t, \tag{4}$$

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, $[x^R_t - x^R_{t-1}]$ is housing investment, and trh_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 given by $k^R_t = (1-\delta)k^R_{t-1} + j^R_t$.

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

$$c_t^{HH} + q_t\left(x_t^{HH} - x_{t-1}^{HH}\right) = w_t n_{t-1} l_{1t}, \tag{5}$$

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

$$c_t^i + q_t\left(x_t^i - x_{t-1}^i\right) + \left(1 + r_{t-1}^n\right)\frac{b_{t-1}^i}{1+\pi_t} = w_t n_{t-1} l_{1t} + b_t^i. \tag{6}$$

Indebted impatient homeowners can borrow against the expected future value of their housing holdings up to a fraction m^i.[12] 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 toward being indebted, portfolio management preferences, etc.

$$b_t^i \le m^i \mathbb{E}_t\left[\frac{q_{t+1}\left(1+\pi_{t+1}\right)x_t^i}{1+r_t^n}\right], \tag{7}$$

with m^i being larger for indebted impatient homeowners with high leverage than for those with low leverage[13]—that is, $m^{BH} > m^{BL}$.

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:

$$c_t^{HNH} = w_t n_{t-1} l_{1t}. \tag{8}$$

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

$$b_t^{EK} \le m^{EK}\left(0.1 w_t n_t l_t + \mathbb{E}_t\left[\sum_{j=1}^{3} 0.3\frac{\left(1+\pi_{t+j}\right) w_{t+j} n_{t+j} l_{1,t+j}}{1+r_t^n}\right]\right) \tag{9}$$

12. The 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, Miao, and Zha 2016, and Boscá et al. 2020).

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

and their budget constraint by

$$c_t^{EK} + \left(1 + r_{t-1}^n\right) \frac{b_{t-1}^{EK}}{1 + \pi_t} = w_t n_{t-1} l_{1t} + b_t^{EK}. \tag{10}$$

2.2 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.

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 a Dixit–Stiglitz aggregator. Retailers choose the level of production that maximizes their profits, $(P_t y_t - \int_0^1 P_t^l y_t^l d_l)$, subject to $y_t = [\int_0^1 (y_t^l)^{(1-1/\theta)} d_l]^{\frac{\theta}{\theta-1}}$.

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 $P_t^{\star}$ that maximizes the present value of expected profits.

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

$$\min_{k_t, v_t} E_t \sum_{t=0}^{\infty} \beta_R^t \frac{\lambda_{1t+1}^R}{\lambda_{1t}^R} \left(y_t - r_{t-} k_{t-1} - w_t n_{t-1} l_{1t} - \kappa_v v_t\right), \tag{11}$$

subject to

$$y_t = A k_{t-1}^{1-\alpha} (n_{t-1} l_{1t})^{\alpha}, \tag{12}$$

$$n_t = (1-\sigma)n_{t-1} + \rho_t^f v_t. \tag{13}$$

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:

$$\rho_t^w (1-n_{t-1})\,\rho_t^f v_t = \chi_1 v_t^{\chi_2}[(1-n_{t-1})\,l_2]^{1-\chi_2}. \tag{14}$$

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

$$r_t = (1-\alpha)\,\frac{y_t}{k_{t-1}}, \tag{15}$$

$$\frac{\kappa_v}{\rho_t^f} = \beta_R \mathbb{E}_t\left[\frac{\lambda_{t+1}^R}{\lambda_{1t}^R}\frac{\partial V_{t+1}}{\partial n_t}\right], \tag{16}$$

where V_t stands for the value function of the wholesale producer. Equation (16) 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

$$\lambda_{ft} = \alpha\frac{y_t}{n_{t-1}} - w_t l_{1t} + (1-\sigma)\,\beta_R \mathbb{E}_t\left[\frac{\lambda_{1t+1}^R}{\lambda_{1t}^R}\frac{\partial V_{t+1}}{\partial n_t}\right]. \tag{17}$$

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 predetermined, 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.

2.3 Trade in the Labor Market: The Labor Contract

Following Andrés, Boscá, and Ferri (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

$$\lambda_{ht} = \sum_{i \in I} \tau^i \frac{\lambda^i_{ht}}{\lambda^i_{1t}}, \tag{18}$$

where $\frac{\lambda^i_{ht}}{\lambda^i_{1t}}$ 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 τ_i. 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

$$\max_{w_t, l_{1t}} \left[\sum_{i \in I} \tau^i \frac{\lambda^i_{ht}}{\lambda^i_{1t}} \right]^{\lambda^w} \left(\lambda_{ft}\right)^{1-\lambda^w} = (\lambda_{ht})^{\lambda^w} \left(\lambda_{ft}\right)^{1-\lambda^w}, \tag{19}$$

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

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

$$\alpha \frac{y_t}{n_{t-1} l_{1t}} = \phi_1 (1 - l_{1t})^{-\eta} \sum_{i \in I} \frac{\tau^i}{\lambda^i_{1t}}, \tag{20}$$

and the optimal real wage

$$\begin{aligned} w_t l_{1t} = {} & \lambda^w \left[\alpha \frac{y_t}{n_{t-1}} + \frac{\kappa_v v_t}{1 - n_{t-1}} \right] \\ & + (1 - \lambda^w) \left[\phi_2 \frac{(1 - l_2)^{1-\eta}}{1 - \eta} - \phi_1 \frac{(1 - l_{1t})^{1-\eta}}{1 - \eta} \right] \sum_{i \in I} \frac{\tau^i}{\lambda^i_{1t}} \\ & + (1 - \lambda^w) \left(1 - \sigma - \rho^w_t\right) \sum_{\tilde{i} \in \tilde{I}} \tau^i_t \mathbb{E}_t \left[\frac{\lambda^{\tilde{i}}_{ht+1}}{\lambda^{\tilde{i}}_{1t+1}} \left(\beta^R \frac{\lambda^R_{1t+1}}{\lambda^R_{1t}} - \beta^{\tilde{i}} \frac{\lambda^{\tilde{i}}_{1t+1}}{\lambda^{\tilde{i}}_{1t}} \right) \right], \end{aligned} \tag{21}$$

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 component 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 component 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.

2.4 Policy Instruments and Resources Constraint

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

$$1+r_t^n = \left(1+r_{t-1}^n\right)^{r_R}\left[(1+\pi_t)^{1+r_\pi}(1+\bar{r}^n)\right]^{1-r_R}, \tag{22}$$

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,

$$d_t^P = g_t + trh_t + \frac{1+r_{t-1}^n}{1+\pi_t} d_{t-1}^P. \tag{23}$$

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

$$trh_t = trh_{t-1} - \psi_1\left[\frac{d_t^P}{gdp_t} - \overline{\frac{d^P}{gdp}}\right] - \psi_2\left[\frac{d_t^P}{gdp_t} - \frac{d_{t-1}^P}{gdp_{t-1}}\right], \tag{24}$$

where $\psi_1 > 0$ captures the speed of adjustment from the current debt-to-GDP ratio toward the debt-to-GDP target ratio, $(\overline{\frac{d^P}{gdp}})$. 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,

$$y_t = A_t k_{t-1}^{1-\alpha}(n_{t-1}l_{1t})^\alpha = c_t + j_t\left(1+\frac{\phi}{2}\left[\frac{j_t}{k_{t-1}}\right]\right) + g_t + \kappa_v v_t. \tag{25}$$

where $c_t = \sum_{i\in I}\tau^i c_t^i$.

3. CALIBRATION

To introduce our calibration strategy, we first discuss the calibration of the novel parameters in the model: the household-specific parameters. Second, we assess the

TABLE 11

Calibration Targets

Aggregate moments:	*Real estate holdings/GDP*	1.40
	Debt/GDP	0.18
Micro moments:	*Household type*	*Debt/total debt*
	R	0.00
	HH	0.00
	BL	0.23
	BH	0.73
	HNH	0.00
	EK	0.04

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

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 in the PSID. 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 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 in Table 11, we obtain endogenously the preference parameter over housing, ϕ_x, which is assumed to be

TABLE 13

Moment Comparison

	Real estate/GDP		Debt/Total debt [a]		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

Note: [a]Total debt is computed adding the debt in the PSID in 1999 of all households, but those classified as Ricardians.

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. Our 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 replicates the distribution of real estate holdings across homeowners in the PSID. The static solution of the model implies that Ricardian households hold 84% of the total value of housing in the model economy, impatient homeowners without liabilities, *HH*, hold 1.4%, and impatient homeowners with low, *BL*, and high leverage, *BH*, hold 4% and 11%, respectively. In the 1999 wave of the PSID, Ricardian households hold 75% of the total value of housing, *HH* households hold 3%, *BL* households hold 9%, and *BH* households hold 13%[14].

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 by-product of matching the aggregate 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, Boscá, and Ferri (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%, which is the sample average in the years under analysis,

14. We 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.

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, Rubaszek, and Skrzypczynski (2012)
Policy:		
Fiscal reaction parameter, ψ_1	0.01	Andrés, Boscá, and Ferri (2016)
Fiscal reaction parameter, ψ_2	0.2	Andrés, Boscá, and Ferri (2016)
Steady state gov.-debt-to-output, $\overline{d^p}/\bar{y}$	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, Perotti, and Trigari (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)

1999–2013. Similarly, the steady-state value of the spending-to-output ratio is equal to its sample average, 17%. 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 literature.[15] 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

15. For example, this value falls between the one in Christiano, Trabandt, and Walentin (2011) and Mortensen and Nagypal (2007)

is close to the 0.5 value in Monacelli, Perotti, and Trigari (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.[16] 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, Perotti, and Trigari (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, $\bar{\rho}^f$, equal to 0.9. The long-run employment rate, $\bar{n}$, is set to 0.75, as in Choi and Ríos-Rull (2009).

4. THE TRANSMISSION MECHANISM OF GOVERNMENT SPENDING SHOCKS

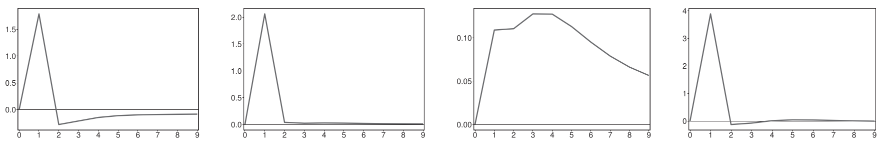
In this section, we study the transmission of government spending shocks in the model economy calibrated with the empirical weights of 1999. The size of the government spending shock is equal to 1% of output, and the shock is assumed to fall exponentially according to the function $g_t = \rho_g g_{t-1}$ 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.

4.1 Individual Responses

Households' responses to a government spending shock are determined by the income effect, wealth effect, and credit effect. 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.

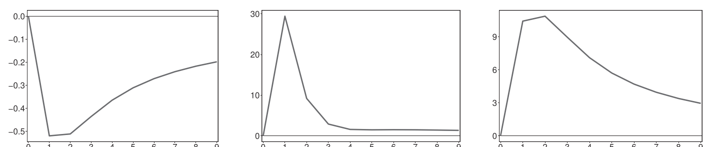
After an expansionary fiscal shock, given that capital is predetermined in our model economy, wholesale producers meet the additional product demand by increasing their labor demand. Wholesale producers can adjust both the intensive and extensive margin of labor input. While hours are optimally chosen 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 mag-

16. Matching 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 $\sigma\bar{n}$.



(a) Wage (b) Hours (c) Employment (d) Income

Fig 1. Income Effect: Response to a Government Spending Shock (in Deviations from Steady State).



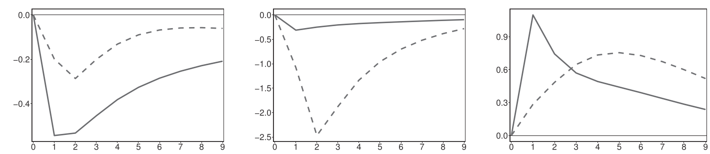
(a) Housing price (b) Inflation (c) Interest rate

Fig 2. Wealth Effect: Response to a Government Spending Shock (in Deviations from Steady State).

nitude of the response of hours and employment is quite different: While the peak of hours is at around a 2% increase, the peak of employment is at around a 0.15% 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.

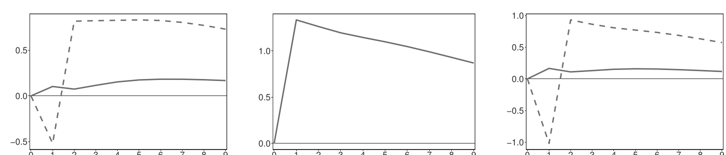
Although the wealth effect is type-specific, there are some common features. For example, given the deflationary pressures on housing prices triggered by the government spending shock, as shown in Figure 2, the wealth of homeowners in the model economy declines on impact. The inflationary pressures in 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 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 (solid line) and physical capital (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 (solid line) by patient households on impact that exceeds that of wealth (dashed line).

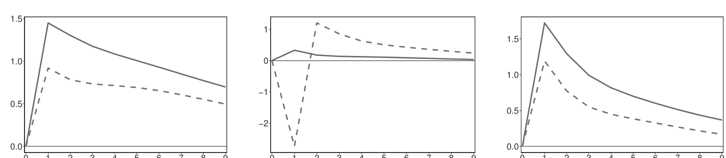


(a) Consumption (solid); wealth (dashed)
(b) Housing (solid); capital investment (dashed)
(c) Private debt (solid); public debt (dashed)

Fig 3. Patient Households: Responses to a Government Spending Shock (in Deviations from Steady State).



(a) **HH**: Consumption (solid); wealth (dashed)
(b) **HH**: Housing investment
(c) **BL**: Consumption (solid); wealth (dashed)



(d) **BL**: Housing investment (solid); debt (dashed)
(e) **BH** Housing investment (solid); debt (dashed)
(f) **BH**: Housing investment (solid); debt (dashed)

Fig 4. Impatient Homeowners: Responses to a Government Spending Shock (in Deviations from Steady State).

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 (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 dashed lines in Figures 4(c) and 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. Therefore, the response of wealth for impatient indebted homeowners with high leverage is much larger than the response for homeowners with low

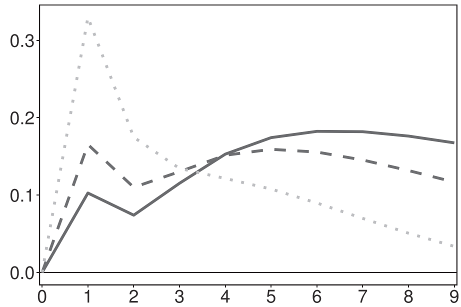


Fig 5. Impatient Homeowners: Response of Consumption to a Government Spending Shock (in Deviations from Steady State).

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

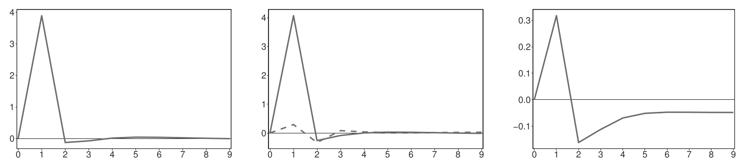
leverage, and the latter is larger than the response for impatient homeowners without liabilities.[17]

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 (dashed lines in Figures 4d and 4f). Despite the potentially large negative wealth 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 solid lines in Figures 4(c) and 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 (dotted line) is larger than the response of impatient indebted homeowners with low leverage (dashed line), which is larger than the response of impatient indebted homeowners without liabilities (solid line). These results are along the lines of Surico and Trezzi (2015) and 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 nonnegative. 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

17. As reported in section 3 in the Online Appendix , the level of housing at the steady state is positively correlated with household indebtedness for impatient households.



(a) HNH: Consumption (b) EK: Consumption (solid); wealth (dashed) (c) EK: Debt

Fig 6. Impatient Non-homeowners: Responses to a Government Spending Shock (in Deviations from Steady State)

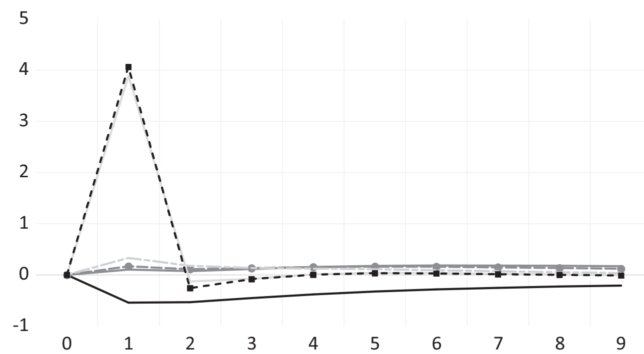


Fig 7. Response of Consumption to a Government Spending Shock (in Deviations from Steady State).

NOTES: The black solid line represents the response of patient households, the grey solid line is the response of impatient homeowners without liabilities, the grey dashed line with circles corresponds to the response of impatient homeowner with low leverage, the light grey short/long dashed line is the response of impatient homeowners with high leverage, the solid light grey line is the response of impatient households without assets or liabilities, and the black dashed line with squares represents the response of households with negative wealth.

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 (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% decline for patient households to over a 4% increase for impatient non-homeowners. Moreover, this figure shows that, in our model, the response of individual consumption is negatively correlated with the level of wealth. These results are along the lines of recent empirical evidence provided, among others, by Anderson, Inoue, and Rossi (2016), Carroll, Slacalek, and Tokuoka (2014), and Kaplan, Violante, and Weidner (2014).

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
R	–	0	–	–	+	–
HH	–	0	–	0	+	+
BL	–	+	+	+	+	+
BH	–	+	+	+	+	+
HNH	0	0	0	0	+	+
EK	0	+	+	+	+	+

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 the percentage variation of the variable on impact.

4.2 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 households 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 1 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.[18]

18. Section 4 in the Online Appendix shows the marginal contribution of each household type to the aggregate multipliers by means of a theoretical counterfactual exercise.

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% from 1999 to 2013, with about 80% 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.[19]

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 four times higher in recessions than in expansions, although the difference is not shown on impact but materializes as time goes on. Riera-Crichton, Vegh, and Vuletin (2015) estimate the difference in the fiscal multiplier between expansions and recessions to be 2.3 against 1.3. Afonso, Baxa, and Slavík (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, De Schryder, and Peersman (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, De Schryder, and Peersman (2019), using data on the 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 (20) and equation (21), 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 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

19. All 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. We report the sensitivity analysis in Section 5 of the Online Appendix .

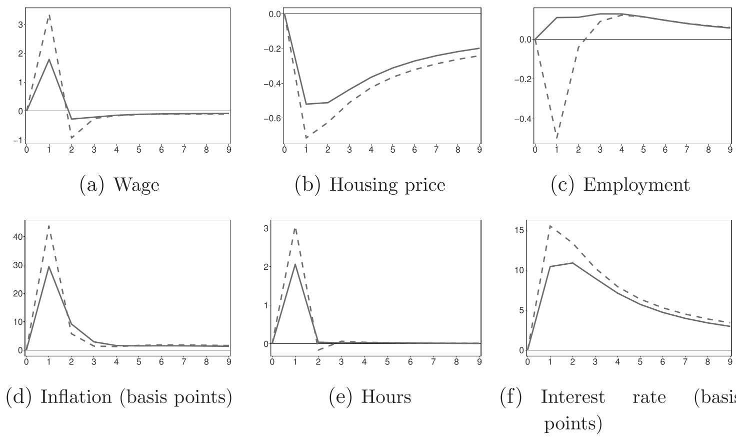


Fig 8. Impulse Response Functions (in Deviations from Steady State): Aggregate Variables, 1999 versus 2013.

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

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—solid lines—and in 2013—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 only 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.

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

TABLE 17

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

employment in some states. In the theoretical front, Cantore, Levine, and Melina (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.[20]

4.3 *Addressing the Relevance of Different Channels*

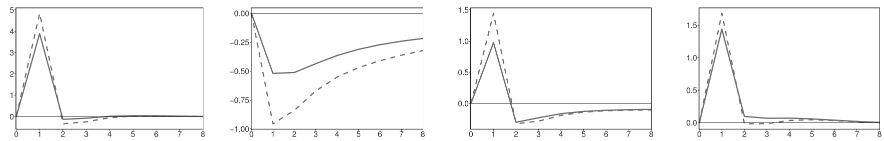
Search and matching frictions. To illustrate the role played by the search and matching setting of the model, we compare the multipliers in our baseline economy, characterized by a worker's bargaining power parameter of $\lambda^w = 0.4$ and cost of posting vacancies of $\kappa_v = 0.04$, with those 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 power for our results. Table 17 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 posting.[21] In the last column, we show the counterfactual economy with firms having full bargaining power but with the same cost of posting vacancies as in the baseline economy.

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 pro-

20. We have focused on impact multipliers, but we analyze the model-implied multipliers at longer horizons in Section 6 of the Online Appendix.

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



(a) Labor income (b) House prices (c) Consumption (d) Output

Fig 9. Closing the Housing Mechanism: Aggregate Variables.

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

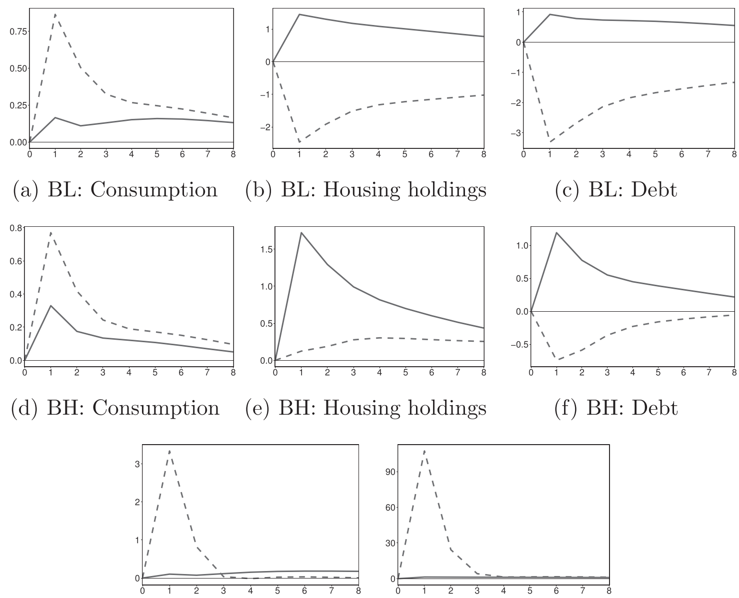
duction and opening more vacancies, which are now cheaper. These new vacancies are filled by new workers, hence increasing employment.

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

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-á-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 that some nonzero level of housing holdings are needed in order to keep the same aggregate volume of financial assets and their distribution among households.

Figure 9 reports the responses of aggregate variables to a government spending shock in the baseline—solid lines—and the counterfactual economy— dashed lines. 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.



(a) BL: Consumption (b) BL: Housing holdings (c) BL: Debt

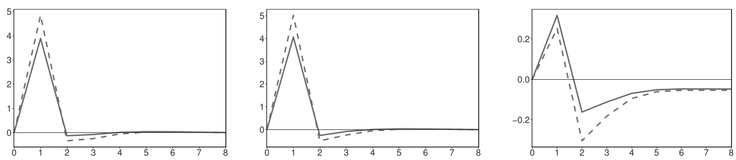
(d) BH: Consumption (e) BH: Housing holdings (f) BH: Debt

(g) HH: Consumption (h) HH: Housing holdings

Fig 10. Closing the Housing Mechanism: Impatient Homeowners.

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

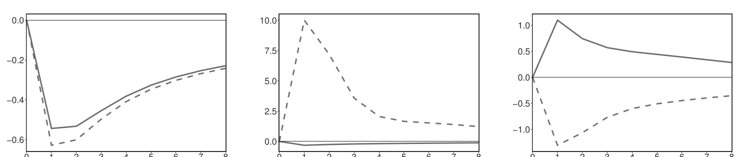
Let us analyze the household-specific impulse responses. Conversely to the baseline economy, a positive government spending shock triggers a contraction of private credit in the counterfactual economy as shown in the panels to the right in Figure 10. Consequently, the fresh credit channel for impatient 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 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,



(a) HNH: Consumption (b) EK: Consumption (c) EK: Debt

Fig 11. Closing the Housing Mechanism: Impatient Homeowners without Assets.

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



(a) Consumption (b) Housing holdings (c) Financial assets

Fig 12. Closing the Housing Mechanism: Ricardians.

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

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, 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.

5. GOVERNMENT SPENDING MULTIPLIERS, WEALTH DISTRIBUTION, AND WELFARE

5.1 *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 18 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

TABLE 18

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 subsample we consider in the analysis.

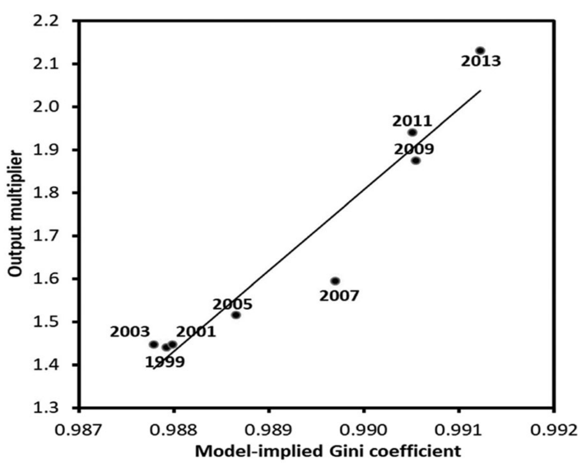


Fig 13. Output Multiplier and Inequality Implied by the Model.

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 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.

In Figure 14, we compare the between-groups coefficient—the second column in Table 18—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,

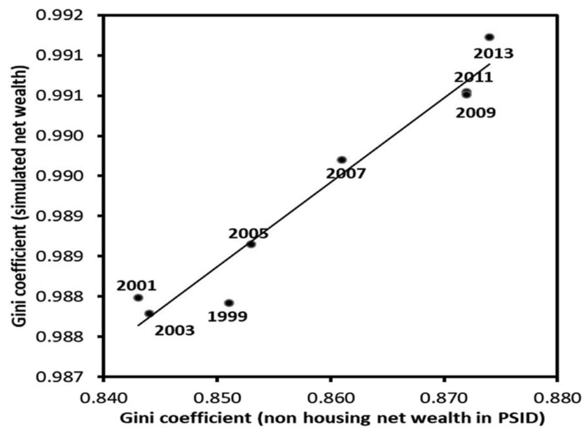


Fig 14. Gini Coefficient.

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 MPC documented by Brinca et al. (2016), Carroll, Slacalek, and Tokuoka (2014), and Krueger, Mitman, and Perri (2016).

5.2 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

$$\bar{V}^i = \sum_{t=0}^{\infty} (\beta^i)^t \begin{bmatrix} \ln\left(\bar{c}_t^i\right) + \phi_x^i \ln\left(\bar{x}_t^i\right) + \bar{n}_{t-1}\phi_1 \frac{(1-\bar{l}_{1t})^{1-\eta}}{1-\eta} \\ +(1-\bar{n}_{t-1})\phi_2 \frac{(1-\bar{l}_2)^{1-\eta}}{1-\eta} \end{bmatrix},$$

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

$$V^{i,s} = \sum_{t=0}^{\infty} (\beta^i)^t \begin{bmatrix} \ln\left(c_t^{i,s}\right) + \phi_x^i \ln\left(x_t^{i,s}\right) + n_{t-1}^s\phi_1 \frac{(1-l_{1t}^s)^{1-\eta}}{1-\eta} \\ +(1-n_{t-1}^s)\phi_2 \frac{(1-l_2)^{1-\eta}}{1-\eta} \end{bmatrix}, \qquad (26)$$

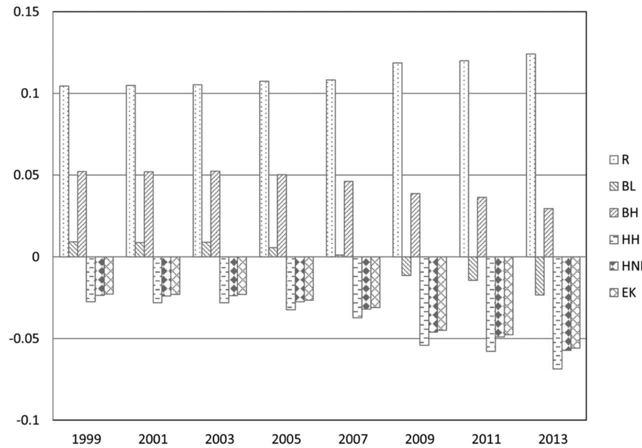


Fig 15. Welfare Effects across Time, by Household Types.

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,

$$V^{i,s} = \sum_{t=0}^{\infty} (\beta^i)^t \left[\begin{array}{c} \ln\left[\bar{c}_t^i\left(1-\Delta^i\right)\right] + \phi_x^i \ln\left(\bar{x}_t^i\right) + \bar{n}_{t-1}\phi_1 \frac{(1-\bar{l}_{1t})^{1-\eta}}{1-\eta} \\ +(1-\bar{n}_{t-1})\phi_2 \frac{(1-\bar{l}_2)^{1-\eta}}{1-\eta} \end{array} \right]. \tag{27}$$

Thus, from (26) and (27),

$$\Delta^i = 1 - \exp\{\left(V^{i,s} - \bar{V}^i\right)\left(1-\beta^i\right)\}, \tag{28}$$

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 nonnegligible 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 toward 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).

6. CONCLUSION

We explore the macroeconomic implications of government spending shocks in an economy populated by six representative agents that differ in their attitude toward 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.

APPENDIX A

A.1 Comparison with Kaplan, Violante, and Weidner (2014)

Kaplan, Violante, and Weidner (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, Violante, and Weidner (2014) incorporate households with positive wealth to the hand-to-mouth pool, they exclude households with negative wealth. Kaplan, Violante, and Weidner (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, Violante, and Weidner (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.[22] A hand-to-mouth household is wealthy hand-to-mouth, *W-HtM*, if she holds positive net illiquid wealth and poor hand-to-mouth, *W-HtM*, if she holds a non-positive net illiquid wealth.

Table A1 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, Violante, and Weidner (2014). For example, the first row in Table A1 shows that of the Ricardian households we identify in the PSID, 86% would be classified as *N-HtM* by Kaplan, Violante, and Weidner (2014), 6% would have been classified as *W-HtM*, and 9% as *P-HtM*. Among the impatient homeowners, those without liabilities, *HH*, are mostly classified as intertemporally optimizing agents by Kaplan, Violante, and Weidner (2014). Note that the definition of wealth in Kaplan, Violante, and Weidner (2014) includes the net 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% of those with low loan-to-value ratio, *BL*,

22. Kaplan, Violante, and Weidner (2014) restrict wealth for households in their sample to be nonnegative, but net worth can be negative.

TABLE A1

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

TABLE A2

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

are considered to be *N-HtM*, while only 38% 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, Violante, and Weidner (2014)'s identification strategy.

In Table A2, we report which percentage of households classified as *N-HtM*, *W-HtM*, or *P-HtM* by Kaplan, Violante, and Weidner (2014) would be classified in each of our types. For example, out of the *N-HtM* consumers, only 67% would be considered Ricardians, while 31% 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.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table 1: Transition Probabilities 2001 Wave to 2003 Wave
Table 2: Transition Probabilities 2003 Wave to 2005 Wave
Table 3: Transition Probabilities 2005 Wave to 2007 Wave
Table 4: Transition Probabilities 2007 Wave to 2009 Wave
Table 5: Transition Probabilities 2009 Wave to 2011 Wave
Table 6: Transition Probabilities 2011 Wave to 2013 Wave
Table 7: Steady-State Values
Table 8: Impact Multipliers. Different Counterfactuals
Table 9: Sensitivity Analysis: Multipliers for 1999 and 2013
Table 10: Multipliers at Different Horizons
Data S1