

# Household Debt and the Effects of Fiscal Policy

Sami Alpanda<sup>1</sup>   Melissa Song<sup>2</sup>   Sarah Zubairy<sup>2</sup>

<sup>1</sup>University of Central Florida

<sup>2</sup>Texas A&M University

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# Motivation

1. Household debt and fiscal policy after the Great recession
  - | Household debt in the transmission of macroeconomic shocks
  - | Importance of the fiscal policy to stabilize the economy
2. Empirical link between consumption, income, and debt
  - | Debtors are more likely to face different constraints
    - | Adjust consumption in response to exogenous income changes (Eggertsson and Krugman 2012; Kaplan and Violante 2014)
  - | Not net wealth *per se* that determines the consumption response to fiscal policy (Cloyne and Surico 2016)
3. **This paper:** how the transmission of government spending shocks depend on the households' balance-sheet position

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3. **This paper:** how the transmission of government spending shocks depend on the households' balance-sheet position

# What we do

## 1. Empirical analysis

- | Basic idea: Housing tenure status as a proxy
  - | Mortgagors, Outright homeowners, Renters
- | **Q: Does the effect of fiscal shocks on key macroeconomic variables vary across household's debt position? Yes**

## 2. Theoretical analysis

- | Three agent New-Keynesian model with housing
- | **Q: What is the transmission mechanism behind the heterogeneity? Liquidity constraints, Wealth effects**

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# Related literature

- | Understanding consumption dynamics
  - | Two types of households: [Gali, Lopez-Salido and Valles \(2007\)](#)
  - | Heterogeneous effects based on income, age/demographics: [Ma \(2019\)](#), [Basso and Rachedii \(2021\)](#)
  - | Wealthy hand-to-mouth households: [Kaplan and Violante \(2014\)](#)
- | Time and space variation in household indebtedness
  - | Higher fiscal multipliers with higher consumer indebtedness: [Demyanyk et al. \(2016\)](#), [Bernardini and Peersman \(2018\)](#)

# Empirical analysis

# Econometric framework

1. Government spending shock identification
  - | SPF (Survey of Professional Forecasters) approach
2. Vector auto-regression (VAR) approach ▶ VAR specification
  - | Sample period: 1981:Q4 to 2007:Q1
  - | SPF shock, GOV, GDP, CON & group-specific variables
  - | Household Survey data for the U.S.
3. Analyze the effects of govt spending shocks
  - | **CASE 1: Aggregate** macroeconomic variables
  - | **CASE 2: Disaggregate** results by housing tenure group
    - | **Mortgagors, Outright homeowners, Renters**
    - | Control for demographic features
    - | No compositional changes



# Empirical estimation results

## CASE 1: Aggregate effects

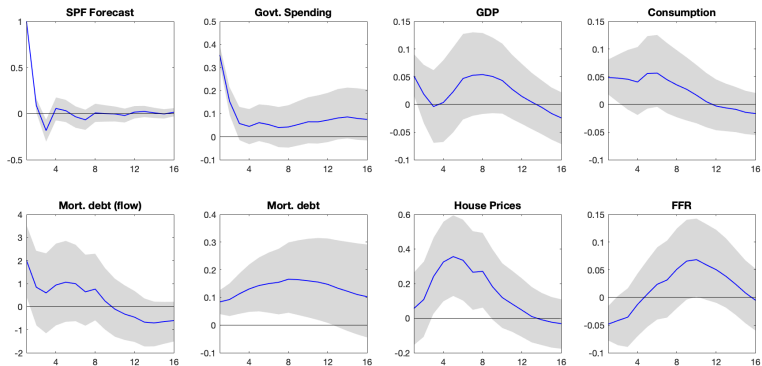


Figure 1: IRFs to a positive SPF shock (agg)

- | Govt spending, GDP, and Consumption all rise
- | Real house prices increase on impact

# Estimation results

## CASE 2.1: Consumption responses by housing tenure groups

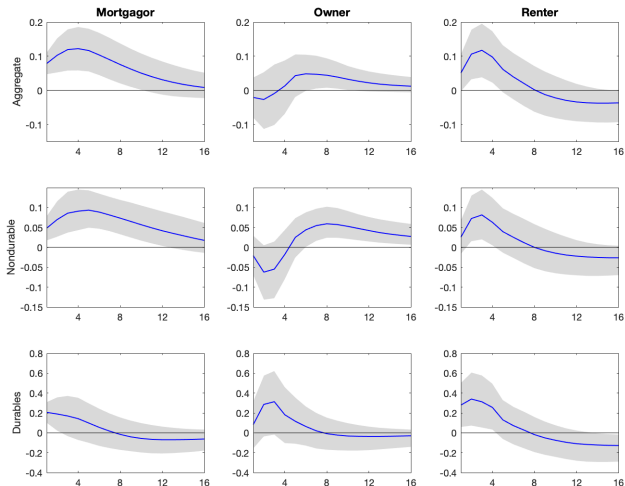


Figure 2: IRFs to a positive SPF shock (three housing tenure groups)

# Estimation results

## CASE 2.2: Income responses by housing tenure groups

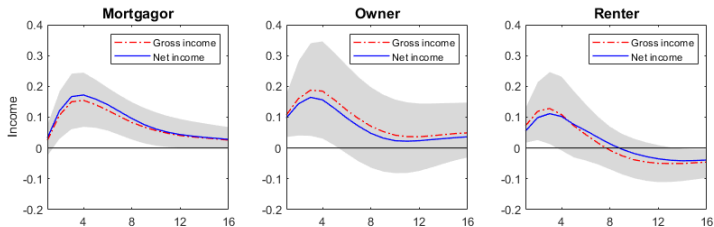


Figure 3: IRFs to a positive SPF shock (three housing tenure groups)

# Estimation results

## CASE 2: Key stylized findings

### | Expenditure responses

1. Larger and statistically significant expenditure responses for *Mortgagors*
2. *Renters* behave similar to mortgagors
3. *Outright home-owners* have insignificant responses

### | Income responses

1. Net and Gross income rise for all housing tenure groups at a similar magnitude
2. Majority of movement in net income is driven by gross income, *not* by taxes
3. Not net wealth *per se* affecting consumption responses (i.e. mortgagors own sizable illiquid assets)

# Robustness

1. Alternative econometric identification ▶ Appendix C.1
  - | Role of Moving average
  - | Trend specification: quadratic trend
  - | Different sample periods
2. Validity of econometric analysis ▶ Appendix C.2
  - | Compositional changes
    - | Housing tenure share responses
  - | Selection issue in grouping
    - | Controlling for demographic features: mid-age group responses

# Theoretical analysis

# From empirics to theory

## Empirical findings:

- | Most empirical literature find increase in consumption following a positive government spending shock
- | **This paper:** true at an aggregate level but  $\vartheta$  heterogeneity across households with different balance sheet positions

## Theoretical explanation:

- | RBC model: G shock ! Forward looking agents expect higher taxes ! Negative WE ) Consume less & work more )  $Y_t$  "
- | NK model: Seeks to explain increase in consumption (e.g. rule of thumb consumers)
- | **This paper:** adds household debt position into a Three Agent New Keynesian (ThANK) model with housing

# From empirics to theory

## Empirical findings:

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# A Three Agent New-Keynesian (ThANK) Model

## 1. Households:

- | Savers (P - patient households)
- | Borrowers (I - impatient households)
- | Renters (R)

## 2. Firms: intermediate and final goods

- | Non-residential & Residential investment
- | Rental services and non-housing producers
- | Rotemberg type with quadratic adjustment costs

## 3. Government: fiscal and monetary authorities

- | Fiscal: government spending financed by debt and taxes
- | Monetary: Taylor rule

# Households

Each household  $H \in \{P, I, R\}$  indexed by  $i$  maximizes utility

$$\max E_0 \sum_{t=0}^T \beta^t \left[ \log x_{H;t}(i) + h \log h_{H;t}(i) - n \frac{n_{H;t}(i)^{1+\#}}{1+\#} \right] \quad (1)$$

where  $\beta$ : preference shock following AR(1),  $x_t$ : consumption,  $h_t$ : housing,  $n_t$ : labor,  $h, n$  determine the relative importance of housing and labor in the utility, and  $\#$  is the inverse of the Frisch-elasticity of labor supply

## Three types of households

- Savers ( $P$ )** own capital and housing, lend long-term/fixed-rate to borrowers, and rent some housing to renters [▶ Constraints](#)

- Borrowers ( $I$ )** own housing and are subject to a LTV constraint on borrowing [▶ Constraints](#)

  - Borrowing constraints:  $\frac{L_t(i)}{P_t} = q_{h,t} \bar{h}_{h,t}(i)$

- Renters ( $R$ )** are hand-to-mouth households [▶ Constraints](#)

## Taxes: consumption, capital and interest income, property

# Calibration

Table 1: Key Calibrated Structural Parameters

Description	Symbol	value
Discount factor	$\beta, \beta_I, \beta_R$	0.9916, 0.9852, 0.9852
LTV ratio on new regular mortgages		0.85
Labor shares in production	$\psi_P, \psi_I, \psi_R$	0.26, 0.47, 0.27
Tax rates		
Consumption tax rate	$c$	0.05
Capital income tax rate		0.40
Interest income tax rate	$b$	0.15
Property tax rate	$p$	0.0035
Income tax rate	$\gamma_P, \gamma_I, \gamma_R$	0.30, 0.30, 0.20
AR(1) Government spending shock	$g$	0.85
Taylor rule for inflation response	$a$	1.50
Taylor rule for output gap	$a_y$	0.01

- | Matching the key statistics in the U.S. macroeconomic and financial data
- | Following [Alpanda and Zubairy 2014, 2017](#); [Gali et al 2007](#); [Guerrieri and Iacoviello 2017](#); [Iacoviello 2005](#); [Mertens and Ravn 2011](#)

# Model simulation Results (Aggregate)

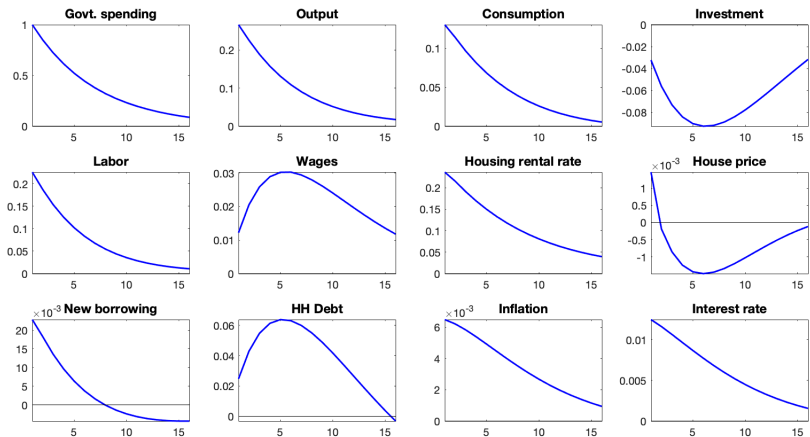


Figure 4: Effects of a positive govt spending shock (agg)

# Model simulation Results (Disaggregate)

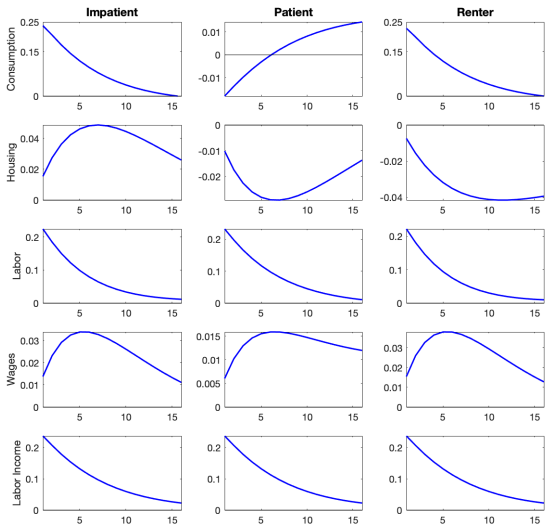


Figure 5: Effects of a positive govt spending shock (three agents)

# Model simulation Results

## Key findings

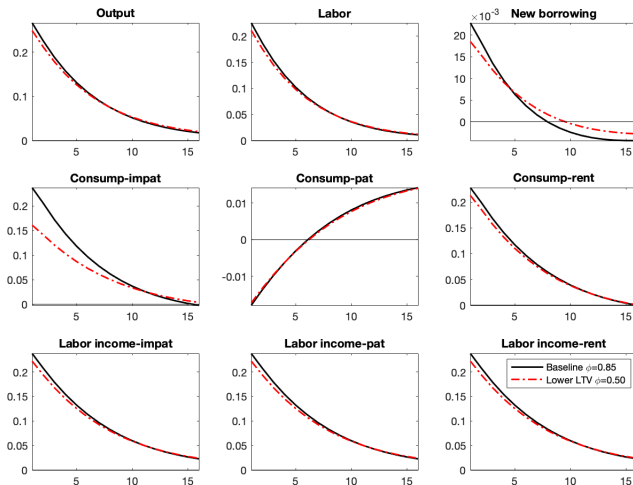
### 1. Qualitatively matching the empirical findings

- | Aggregate responses - output, consumption, house price, household debt (both stock, flow) all increase
- | **Heterogeneous expenditure responses across households**
  - | Borrowers ( $I$ ) respond the most
  - | Savers ( $P$ ) likely to have negative expenditure responses
  - | Renters ( $R$ ) behave similar to borrowers
- | **Labor income increase and are relatively similar across households**

### 2. All agents face negative wealth effects from a positive government spending shock

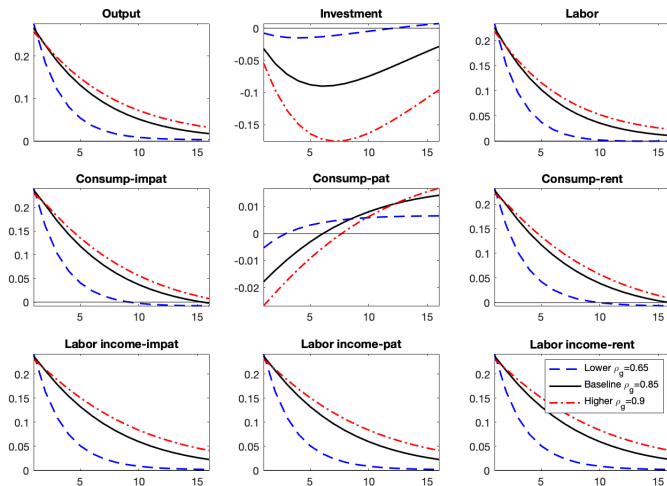
- | All agents work more & earn more labor income
- | Expenditure responses are heterogeneous (possible role of borrowing constraints for borrowers, hand-to-mouth renters)

# Role of borrowing constraints



- | Change LTV ratio ( : 0.85 to 0.50; lower borrowing limit)
- | As borrowing constraints assumption is relaxed, positive effects on consumption for Borrowers ( $I$ ) go away

# Shock persistence and negative wealth effects

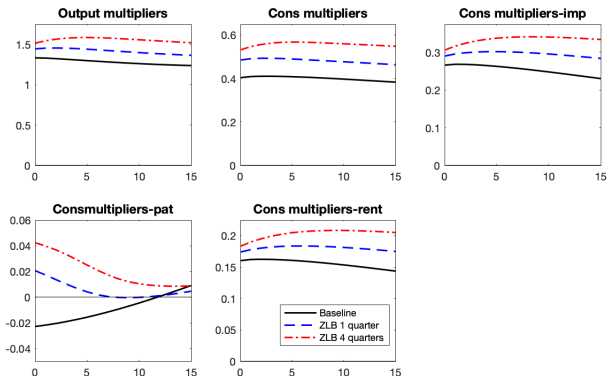


- | Change shock persistence ( $\rho_g$ : 0.85 to 0.65 & 0.9)
- | Larger and more persistent impact on expenditures for Borrowers (I) and renters (R) as shocks become more persistent



# Extensions

1. Model with durable goods and habit formation ▶ Model simulation results
2. Robustness checks with alternative parameters ▶ Robustness checks
3. ZLB effects ▶ Impulse responses for ZLB



- | With ZLB, output and consumption responses are amplified by more
- | Patient households are better off during ZLB compared to normal times

## Concluding remark

1. Investigate how household indebtedness amplifies the transmission of fiscal shocks
2. Using aggregate variables constructed by micro data, this paper finds heterogeneous consumption responses across households with different financial positions
  - | Mortgagors have significantly large consumption responses while outright home-owners have insignificant responses
3. A Three Agent New Keynesian (ThANK) model with borrowing constraints suggests the importance of borrowing constraints and wealth effects as potential transmission mechanisms



# Appendix A.2

## VAR specification

### 1. VAR specification with aggregate macroeconomic variables

|  $X_t$  [  $SPFshock_t$ ;  $\log(rGOV_t)$ ;  $\log(rGDP_t)$ ;  $\log(rCON_t)$  ]

| [  $X_t$ ;  $\log(rdbt_t^{ow})$ ;  $\log(rdbt_t^{stock})$ ;  $\log(hpi_t^{mdsales})$ ;  $FFR$  ]<sup>0</sup>

| Robustness check: i) Quadratic trend, ii) No moving average,  
iii) Different sample periods: 1985:Q1-2005:Q1

### 2. VAR specification for different housing tenure groups

$$y_t = \begin{pmatrix} SPF\ Shock_t \\ \log\ rGOV_t \\ \log\ rGDP_t \\ \log\ rCON_t^i \end{pmatrix} \quad (2)$$

where  $i = \overline{f}$ mort, outright owners, rentersg

Note: For net and gross income,  $rCON_t^i$  is replaced with  $rNI_t^i$  or  $rGI_t^i$

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# Appendix B.1

## Data source

Table B.2: Data description

Data	Description	Source
NGDP	Nominal GDP	BEA
PGDP	GDP deflator	BEA
GOV	Nominal government purchases	BEA
NCONS	Nominal personal consumption expenditure	BEA
NCDUR	Personal consumption expenditures: Durable goods	BEA
NCDC	Personal consumption expenditures: Nondurable goods	BEA
NCSV	Personal consumption expenditures: Service goods	BEA
Population	Population, thousands (POPTHM)	FRED
Hours	Total hours worked	BLS
PBUS	Nonfarm business Sector: Implicit price deflator	BLS
Wages	Nonfarm business sector: Compensation per hour	BLS
Tbill3	3-month Treasury bill (TB3MS)	FRED
HHDEBT	Households and nonprofit organizations; debt securities and loans; liability (CMDEBT)	FRED
HPI	House price index; Median sales price for new houses sold (MSPNHSUS)	FRED
Recession	NBER recession periods	FRED
SPF shock	Survey of Professional Forecasters forecast error shock	Ramey (2011)

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# Appendix B.2

## Constructing the aggregate variables from CEX

- | Define cohorts (including housing, age, etc) and use the short panel dimension to drop household who change tenure within 5 quarters
- | Exclude households i) that do not report income, ii) report negative net income, iii) top or bottom 1% of consumption expenditure, iv) whose head is <25 or >74
- | Expenditure for non-durable and durable goods
  - | Non-durable gds and services: food, alcohol, tobacco, fuel, light and power, clothing, personal gds and services, fares, leisure services, household services
  - | Durable gds: durable household gds, motor vehicles, durable leisure gds
- | Labor-related earnings and total disposable income
  - | Wages and salaries, income from farm and non-farm business, self-employment
  - | State and local income taxes, federal income tax, state/federal refunds

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# Appendix B.3

## Summary Statistics

Table B.3: Consumption, income, and share by housing tenure group

Housing tenure group	Non-durable cons.	Durable cons.	Gross inc.	Net inc.	Share (%)
Mortgagors	2,860	480	3,412	3,052	46.4%
Outright owners	2,799	394	2,617	2,454	19.8%
Renters	2,324	301	2,394	2,149	33.8%

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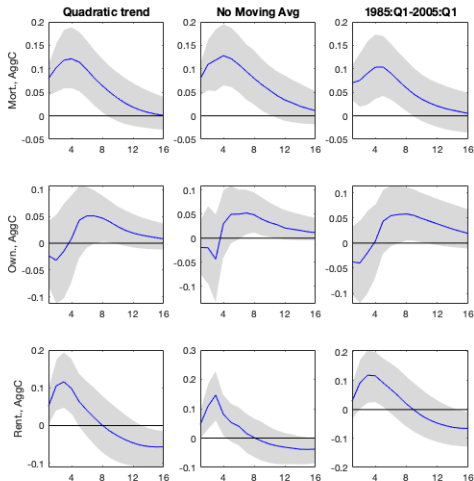




# Appendix C.1

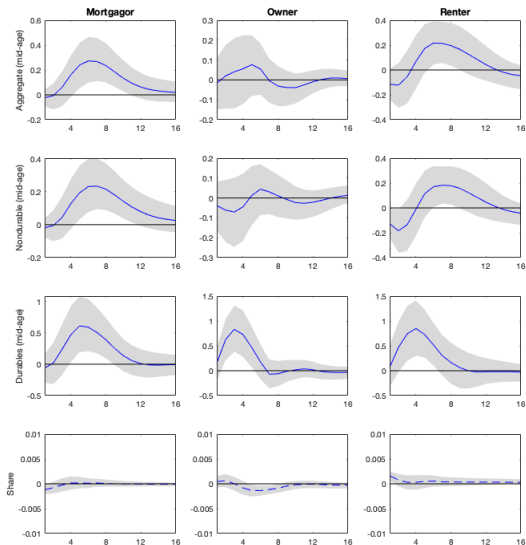
## Alternative econometric identification

Figure C.1: Robustness checks



# Appendix C.2

Figure C.2: Robustness checks



# Appendix D.1

## Saver (P)'s budget constraints

$$\begin{aligned}
 x_{P;t}(i) + q_{h;t} \left[ \tilde{h}_{P;t}(i) + \tilde{h}_{R;t}(i) \right] + q_{k;t} \tilde{k}_{k;t}(i) + \frac{B_t(i)}{P_t} + \frac{L_t(i)}{P_t} \\
 + \frac{W_{P;t}(i)}{P_t} n_{P;t}(i) + r_{h;t} h_{R;t}(i) + r_{k;t} k_{t-1}(i) + (1 + R_{t-1}) \frac{B_{t-1}(i)}{P_t} \\
 + \left[ R_{t-1}^M(i) + \right] \frac{D_{t-1}(i)}{P_t} + \frac{\Pi_t}{P_t} + tr_{P;t} \quad tax_{P;t} \quad adj: costs
 \end{aligned} \tag{P.1}$$

$$n_{P;t}(i) = \left( \frac{W_{P;t}(i)}{W_{P;t}} \right)^w n_{P;t} \tag{P.2}$$

$$h_{P;t}(i) = (1 - h) h_{P;t-1}(i) + \tilde{h}_{P;t}(i) \tag{P.3}$$

$$h_{R;t}(i) = (1 - h) h_{R;t-1}(i) + \tilde{h}_{R;t}(i) \tag{P.4}$$

$$k_t(i) = (1 - k) k_{t-1}(i) + \tilde{k}_{k;t}(i) \tag{P.5}$$

$$\frac{D_t(i)}{P_t} = (1 - ) \frac{D_{t-1}(i)}{P_t} + \frac{L_t(i)}{P_t} \tag{P.6}$$

$$R_t^M(i) = \left( 1 - \frac{L_t(i)}{D_t(i)} \right) R_{t-1}^M(i) + \frac{L_t(i)}{D_t(i)} R_t^F \tag{P.7}$$

$$\begin{aligned}
 tax_{P;t} = & c x_{P;t}(i) + y_P \left[ \frac{W_{P;t}(i)}{P_t} n_{P;t}(i) + r_{h;t} h_{R;t}(i) - h h_{R;t-1}(i) - p q_{h;t} [h_{P;t}(i) + h_{R;t}(i)] \right] \\
 & + k (r_{k;t} - k) k_{t-1}(i) + b \left( R_{t-1} \frac{B_{t-1}(i)}{P_t} + R_{t-1}^M(i) \frac{D_{t-1}(i)}{P_t} \right) + p q_{h;t} [h_{P;t}(i) + h_{R;t}(i)]
 \end{aligned}$$



## Appendix D.3

### Renter (R)'s budget constraints

$$(1 + c)X_{R;t}(i) + \frac{P_{h;t}}{P_t}h_{R;t}(i) = (1 - \gamma_R) \frac{W_{R;t}(i)}{P_t}n_{R;t}(i) + tr_{R;t} \quad \text{adj:costs} \quad (\text{R.1})$$

$$n_{R;t}(i) = \left( \frac{W_{R;t}(i)}{W_{R;t}} \right)^w n_{R;t} \quad (\text{R.2})$$

- | Quadratic adjustment costs for capital investment:  $\frac{k}{2} \left( \frac{k_t(i)}{k_t} - 1 \right)^2 q_{k;t}k_t$
- | Quadratic adjustment costs for housing investment:  $\frac{h}{2} \left( \frac{h_{P;t}(i)}{h_{P;t}} - 1 \right)^2 q_{h;t}h_{P;t}$
- | Quadratic adjustment costs for rental housing:  $\frac{h}{2} \left( \frac{h_{R;t}(i)}{h_{R;t}} - 1 \right)^2 q_{h;t}h_{R;t}$
- | Wage adjustment costs:  $\frac{w}{2} \left( \frac{W_{P;t}(i)}{W_{P;t}} - 1 \right)^2 \frac{W_{P;t}}{P_t} n_{P;t}$

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# Appendix E

## Producers' problem

- Non-residential investment producers

$$\max E_0 \sum_{t=0}^T \frac{P_t}{P_0} \left[ q_{k;t} \tilde{I}_{k;t} - q_{k;t} \frac{ik}{2} \left( \frac{I_{k;t}}{I_{k;t-1}} - 1 \right)^2 \tilde{I}_{k;t} - I_{k;t} \right] \quad (\text{E.1})$$

- Residential investment producers

$$\max E_0 \sum_{t=0}^T \frac{P_t}{P_0} \left[ q_{h;t} Z_{h;t} I_{h;t} - q_{h;t} \frac{ih}{2} \left( \frac{I_{h;t}}{I_{h;t-1}} - 1 \right)^2 \tilde{I}_{h;t} - I_{h;t} \right] \quad (\text{E.2})$$

- Rental services producers

$$\max E_0 \sum_{t=0}^T \frac{P_t}{P_0} \frac{\Pi_{h;t}(i)}{P_t} \quad (\text{E.3})$$

$$\text{s.t. } \frac{\Pi_{h;t}(i)}{P_t} = \frac{P_{h;t}(i)}{P_t} h_{R;t}(i) - r_{h;t} h_{R;t}(i) - \frac{ph}{2} \left( \frac{P_{h;t}(i)}{P_{h;t-1}(i)} - 1 \right)^2 \frac{P_{h;t}}{P_t} h_{R;t}$$

$$\text{s.t. } h_{R;t}(i) = \left( \frac{P_{h;t}(i)}{P_{h;t}} \right)^h h_{R;t}$$

# Appendix E

## Producers' problem

### Non-housing goods producers

$$\max E_0 \sum_{t=0}^T \beta^t \frac{P_t}{P_0} \frac{\Pi_{n;t}(J)}{P_t} \quad (\text{E.4})$$

s.t.

$$\frac{\Pi_{n;t}(J)}{P_t} = \frac{P_t(J)}{P_t} y_{n;t}(J) - w_{P;t} n_{P;t}(J) - w_{I;t} n_{I;t}(J) - w_{R;t} n_{R;t}(J) - r_{k;t} k_{t-1}(J) - \frac{u}{1+\delta} [u_t(J)^{1+\delta} - 1] k_{t-1}(J) - \frac{pn}{2} \left( \frac{P_t(J)}{P_{t-1}(J)} - 1 \right)^2 y_{n;t}$$

s.t.

$$y_{n;t}(J) = z_t [u_t(J) k_{t-1}(J)] \left[ n_{P;t}(J)^{\rho} n_{I;t}(J)^{\iota} n_{R;t}(J)^{\theta} \right]^{\frac{1}{\sigma}} f_n$$

$$\text{where } f_n = (\sigma - 1) y_n \text{ and } \rho + \iota + \theta = 1$$

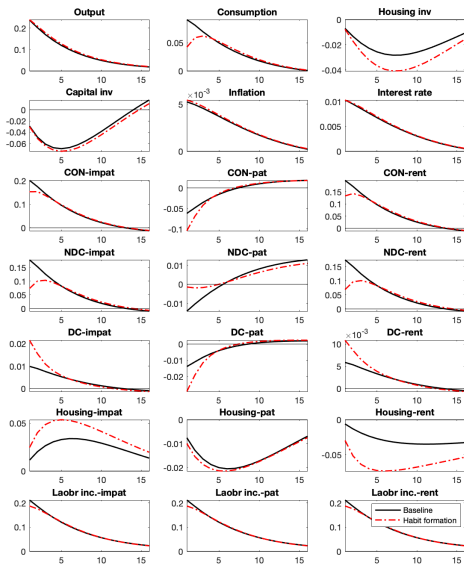
s.t.

$$y_{n;t}(J) = \left( \frac{P_t(J)}{P_t} \right)^{\eta} y_{n;t}$$

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# Appendix F.1

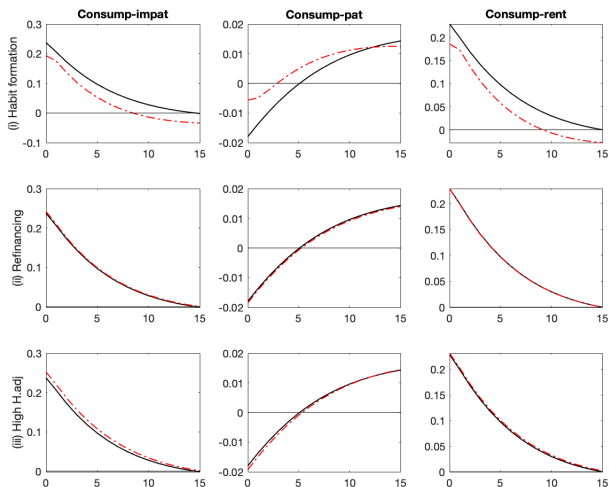
Figure F.1: Model simulation results with durable goods and habit formation





## Appendix F.2

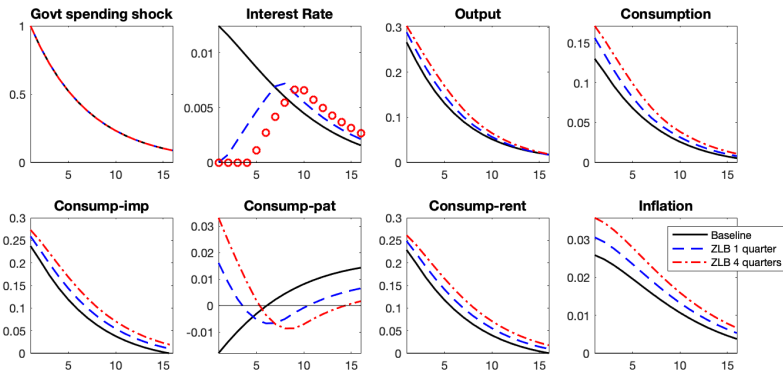
Figure F.2: Model simulation results with alternative parameters



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# Appendix F.3

Figure F.3: Impulse responses with ZLB periods



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