Breaking the Commitment Device:

The Effect of Home Equity Withdrawal on Consumption, Saving, and Welfare

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August 20, 2021

Motivation

Housing is the largest asset owned by most households

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- Benefit: easier to smooth consumption & self-insure against shocks
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Many countries have prohibited equity withdrawal

- Germany, Singapore, and Japan (IMF, 2008)

This Paper

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Key mechanism:

- Difficult to save in liquid assets due to problems of self-control
- Housing helps “lock away” wealth due to its illiquidity

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"One nice thing about investing in a house is that you're committed to a mortgage payment...

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"One nice thing about investing in a house is that you're committed to a mortgage payment...

so if you don't take out a home equity line of credit [...], you will accumulate wealth."

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Contribution

- **Model:** Capture both the positive and negative effects of greater access to home equity
  - Consumption smoothing – easier to self-insure against risk
  - Weakened commitment – temptation to extract & consume home equity

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  - Estimate preference parameters, using data on consumption growth to pin down temptation
  - Validate model estimates using a policy change in Texas that legalized equity withdrawal in 1998

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  - Weakened commitment – temptation to extract & consume home equity

- **Model → Data:** Disentangle the relative importance of these two channels
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  - Validate model estimates using a policy change in Texas that legalized equity withdrawal in 1998

- **Welfare & Policy:** To what extent is greater liquidity beneficial?
  - Evaluate welfare trade-off to legalizing home equity withdrawal
  - Consider alternative policy that may better balance this trade-off

Results

- Home equity withdrawal weakens the commitment benefit of housing
  - In both the model and the data, access to home equity increases consumption by 3%
  - Weakened commitment explains half, consumption smoothing explains half

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  - Equity withdrawal makes it more difficult to save for retirement and precautionary purposes
  - Substantial heterogeneity: two thirds of households harmed, one third of households benefit

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  - Equity withdrawal makes it more difficult to save for retirement and precautionary purposes
  - Substantial heterogeneity: two thirds of households harmed, one third of households benefit
- Policy should better balance the trade-off between commitment and flexibility
  - Welfare improving to force repayment during good times, but provide flexibility during bad times
  - Lends support to mortgage forbearance policies during the covid-19 crisis

Model

Estimation

Model Fit

Model Validation

Welfare

Policy

Model

Life-cycle model of consumption, housing, and mortgages

- Utility from consumption and housing
- Save in liquid assets or illiquid housing
- Borrow using long-term, fixed-rate mortgages
- Home equity withdrawal permitted with a fee

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Novel features

- Temptation preferences may make it costly to hold assets
- Housing may act as a commitment device that can reduce temptation

Preferences

Temptation preferences (Gul and Pesendorfer, 2001, 2004):

- Tempting, feasible alternative that is not chosen
- This tempting alternative impacts your utility
- Commitment: reduce temptation by locking away wealth

▸ Alternative: Hyperbolic discounting

Preferences

$$\max_{\{c_t, h_t\}_{t=0,..,T}} \mathbb{E}_0 \sum_{t=0}^{T} \beta^t U(c_t, h_t, \tilde{c}_t, \tilde{h}_t)$$

- c_t : nondurable consumption
- h_t : housing status

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Utility function:

$$U(c_t, h_t, \tilde{c}_t, \tilde{h}_t) = u(c_t, h_t) - \underbrace{\lambda \Big[u(\tilde{c}_t, \tilde{h}_t) - u(c_t, h_t) \Big]}_{\text{utility cost of self-control}}$$

- λ: degree of temptation

Preferences

$$\max_{\{c_t, h_t, m_t\}_{t=0,..,T}} \mathbb{E}_0 \sum_{t=0}^{T} \beta^t U(c_t, h_t, \tilde{c}_t, \tilde{h}_t)$$

- c_t : nondurable consumption
- h_t : housing status
- m_t : mortgage debt
- $\tilde{c}_t$: most tempting consumption
- $\tilde{h}_t$: most tempting housing status
- $\tilde{m}_t$: most tempting mortgage choice

Most tempting alternative: maximize current period felicity

$$\tilde{c}_t, \tilde{h}_t, \tilde{m}_t = \underset{c_t, h_t, m_t}{\operatorname{argmax}}\, u(c_t, h_t)$$

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   - Discrete asset with N different sizes (flat, house, mansion, etc.)
   - Allowed to own or rent any unit, where rent $= \eta p_t$
   - Transaction costs: fraction f_1 of the house price and utility cost κ

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3. Mortgages (m_t)
   - Maximum loan to value: $\bar{\psi}$ percent of the house price
   - Fixed repayment each period until retirement or house sale (fully amortizing)
   - Possible to extract equity for a multiplicative cost f_2 and additive cost f_3

Additional Model Features

Necessary so that the model has a chance at fitting the data:

- Housing provides a utility flow
- Exogenous income & unemployment risk Income
- Progressive income tax, housing subsidy, social security Tax MITD SS
- Household composition varies over life-cycle Kids

Housing Options Budget Constraint Mortgage Details

Model Estimation

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- Calibrate institutional parameters (income risk, asset returns, refi costs, etc.) Calibration
- Estimate preference parameters using the Method of Simulated Moments:
  - Temptation (λ)
  - Time Preference (β)
  - Risk Aversion (γ)
  - Utility Cost of Moving (κ)
  - Housing Utility Additive (μ)
  - Housing Utility Multiplicative (θ)
  - Disutility of Renting (ζ)
- Main challenge: differentiate between temptation (λ) and impatience (β) Literature

Targeted Moments

Life-cycle moments (mean value for each age between 25 and 60):

- Log Nondurable Consumption
- Log Liquid Assets
- Log Net Housing Wealth

Aggregate moments:

- Share of Homeowners
- Share of Homeowners who Extract Equity
- Share of Movers
- Loan-to-Value Ratio
- Relationship between Δc and a

Consumption Growth

Key Insight: Temptation alters the relationship between consumption growth and assets

Consumption Growth

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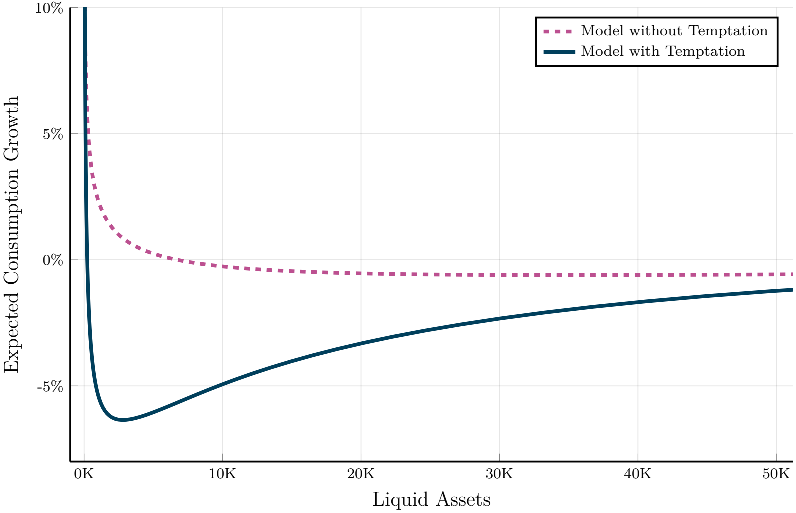
- Consumption dynamics governed by the following Euler equation:

$$c_t^{-\gamma} = \beta R \mathbb{E}_t \left[c_{t+1}^{-\gamma} - \frac{\lambda}{1+\lambda} \tilde{c}_{t+1}^{-\gamma} \right] \quad \text{if} \;\; a_{t+1} > 0$$

where $\tilde{c}_{t+1}$ is the most tempting consumption alternative

Analytical Monte Carlo

Consumption Growth



Consumption Growth

Consumption growth regression:

$$\Delta \ln c_{i,t} = \psi \ln a_{i,t} + \sum_{j=25}^{60} \alpha_j Age_{i,t}^j + \epsilon_{i,t}$$

- In the model with temptation: $\psi > 0$
- More temptation implies larger ψ, ceteris paribus
- In the model without temptation: $\psi \leq 0$

Alternative Specifications Monte Carlo Results

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Alternative Specifications Monte Carlo Results

One challenge: must deal with credit constraints

- Baseline: restrict sample to households with $a > \$500$ (in both the model and the data)
- Results robust to alternatives constraints ($1K, $10K, Non-HtM, etc.)

Model

Estimation

Model Fit

Model Validation

Welfare

Policy

Model Fit: Life-Cycle Moments

Model Fit: Consumption Growth Dynamics

Consumption Growth Dynamics

Moment	PSID	Full Model	Restricted Model
Relationship between Δc and a ($\hat{\psi}$)	0.0039^{***}		

Note: PSID waves 1999-2015. We restrict our sample to married households with $a >$ \$500 aged 25 to 60.

Model Fit: Consumption Growth Dynamics

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Note: PSID waves 1999-2015. We restrict our sample to married households with $a > \$500$ aged 25 to 60.

- In the data, $\hat{\psi} > 0$ robust to HH FEs, year FEs, family size, habits, returns, inheritances Robustness

Model Fit: Consumption Growth Dynamics

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Relationship between Δc and a ($\hat{\psi}$)	0.0039^{***}	0.0039	

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- Full model with temptation obtains a good fit of the data

Model Fit: Consumption Growth Dynamics

Consumption Growth Dynamics

Moment	PSID	Full Model	Restricted Model
Relationship between Δc and a ($\hat{\psi}$)	0.0039***	0.0039	-0.0017

Note: PSID waves 1999-2015. We restrict our sample to married households with $a > \$500$ aged 25 to 60.

- Restricted model without temptation ($\lambda = 0$) unable to generate $\psi > 0$

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- **Model Validation**
- Welfare
- Policy

Validation

Policy Change in Texas: home equity withdrawal legalized in 1998

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Document the effect of this policy change on consumption and mortgage behavior

- Use data from the Consumer Expenditure Survey (1995 - 2003)
- Estimate treatment effect using difference in differences specification

Details ▸ Placebo Test: Renters ▸ Event Study: Parallel Trends

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Implement a similar policy change in our model to assess predictive power

Texas Experiment

Response to the Legalization of Home Equity Withdrawal

	Data	Model
Homeowners:		
Change in Log Consumption	0.030**	0.026
Change in Log Mortgage Balances	0.162*	0.134
Change in Share of Mortgagors	0.036*	0.012
Renters:		
Change in Consumption	-0.017	0.002

Note: Data comes from the Consumer Expenditure Survey (1995 - 2003). Consumption and mortgage response are measured between 1998 and 2003, relative to baseline between 1995 and 1997.

Expenditure Categories Employment Status Age Group Equity Extraction

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Welfare

Effect of Legalizing Home Equity Withdrawal

	Baseline Model	Consumption Smoothing Channel	Weakened Commitment Channel
Welfare Effect (CEV)	-1.45	1.90	-3.35
Welfare Effect (CEV ignoring psychic cost)			
Savings Rate			
Net Wealth at Retirement			

Note: All variables are relative to a counterfactual where home equity withdrawal is prohibited.

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Savings Rate	-2.55	-1.22	-1.33
Net Wealth at Retirement	-15.08	-6.24	-8.84

Note: All variables are relative to a counterfactual where home equity withdrawal is prohibited.

Policy

How should we design and regulate mortgage contracts?

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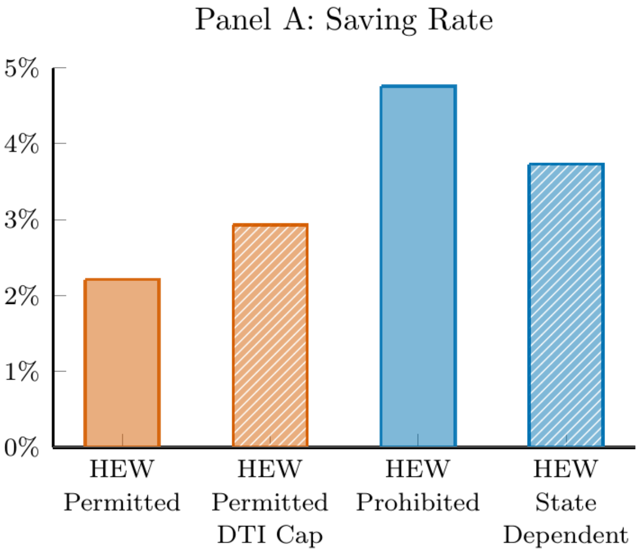
We evaluate four potential policies:

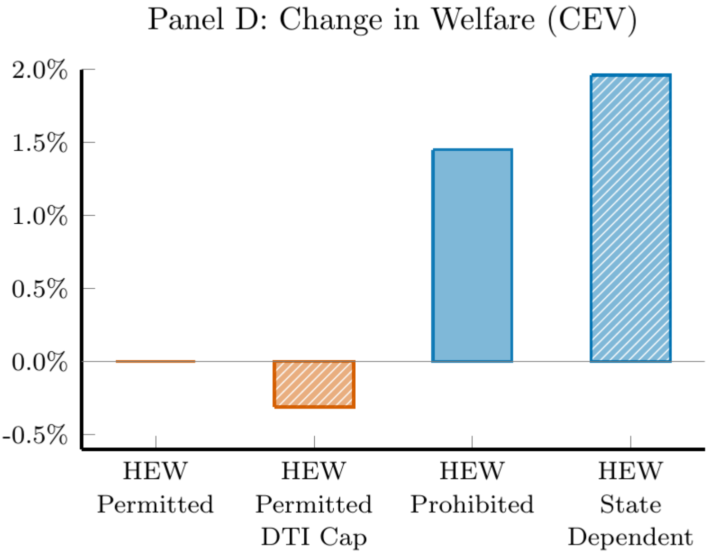
1. Equity withdrawal permitted
2. Equity withdrawal permitted, with DTI cap
3. Equity withdrawal prohibited
4. Equity withdrawal prohibited in normal times, with option to extract if unemployed

Saving Rate Welfare

Policy Results: Savings Rate



Policy Results: Welfare



Policy Results: Summary

Welfare improving to provide commitment during good times, but flexibility during bad times

- Commitment during good times helps households accumulate wealth
- Flexibility during bad times helps households smooth consumption

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Multiple ways to design mortgage contracts to provide flexibility

- Enable equity withdrawal when unemployed (Mortgage Assistance Programs in PA and CT)
- Provide forbearance when economy in recession (similar to Campbell, Clara and Cocco, 2020)

Conclusion

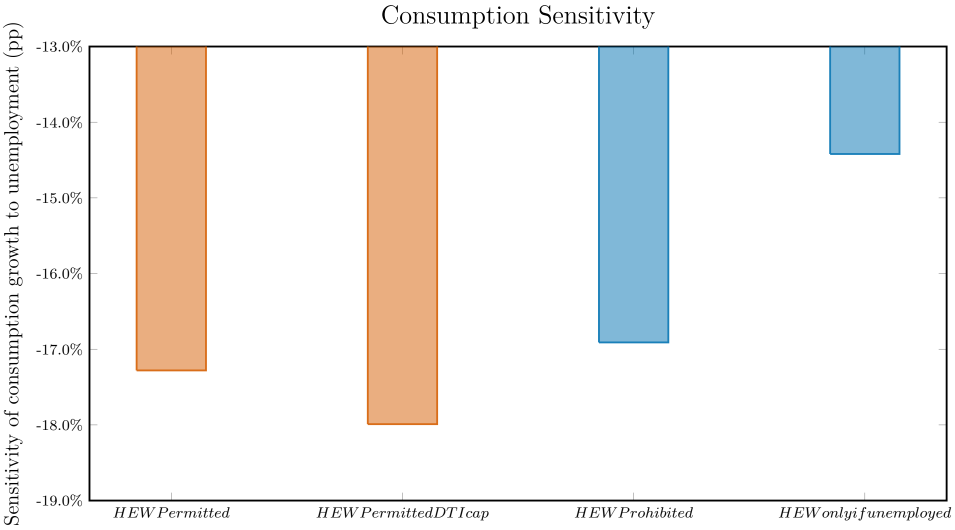
Main Findings:

- Greater liquidity has weakened the commitment benefit of housing
- Welfare has declined due to the introduction of home equity withdrawal
- Policy should better balance trade-off between commitment and flexibility

Thank you!

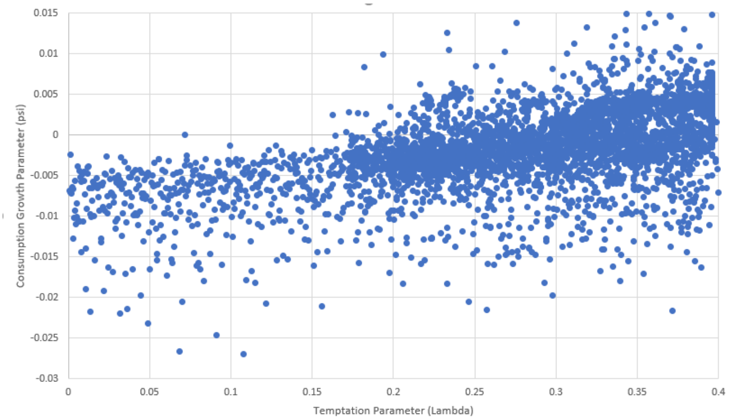
Thank You

Policy Results: Consumption Sensitivity



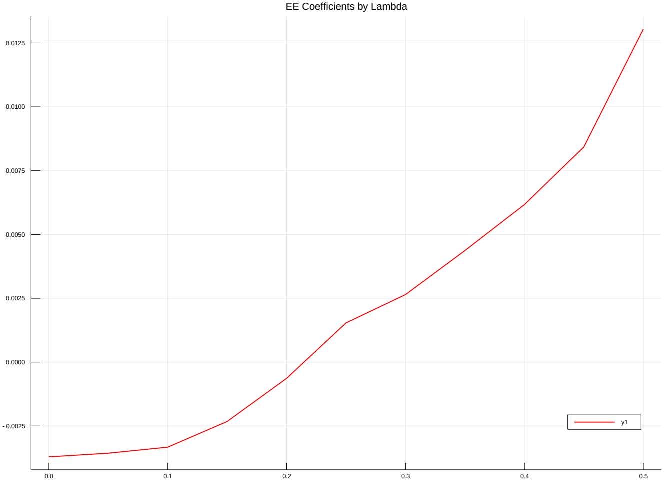
Identification (Extra Details for Appendix)

Relationship between ψ and λ (searching over entire parameter space)



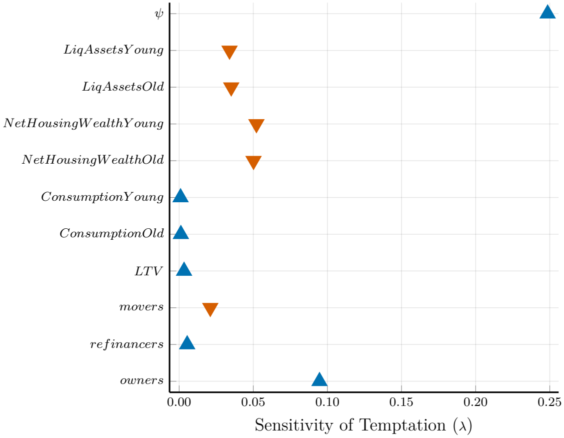
Identification (Extra Details for Appendix)

Relationship between ψ and λ (holding other parameters constant)



Identification (Extra Details for Appendix)

Sensitivity of λ to targeted moments (Andrews, Gentzkow, Shapiro)



Motivation: Quasi-Experiment

Motivation: Quasi-Experimental Evidence

Model

Model Estimation

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Quasi-Experiment

- Prior to 1998, Texas prohibited most forms of home equity withdrawal
  - Due to “homestead protection” clause in Texas Constitution of 1876
  - Banks not allowed to foreclosure, except for debt used to purchase or renovate a house
  - Home equity withdrawal prohibited, except for home improvement

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- To study the impact, will use data from the Consumer Expenditure Survey

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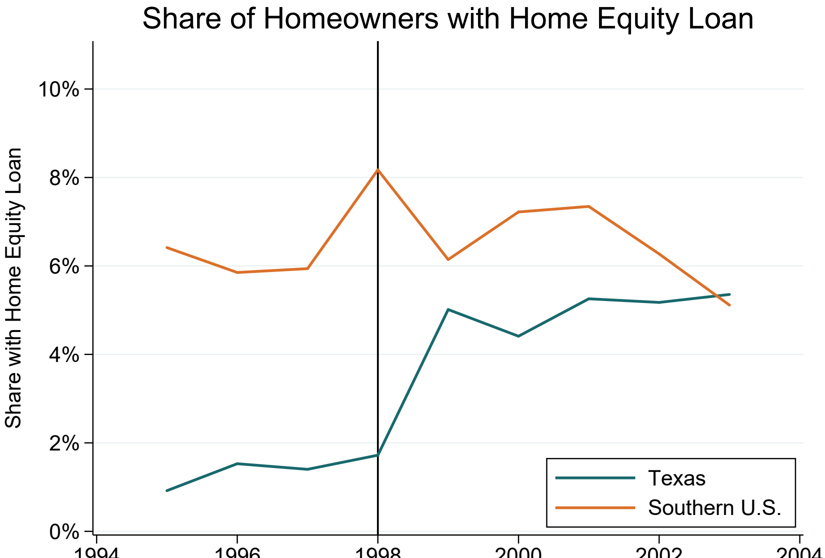

Quasi-Experiment

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- Estimate difference-in-differences specification

$$c_{i,s,t} = \beta_1 + \beta_2 \text{Post1998}_{s,t} * \text{Texas}_{s,t} + \gamma_1 \mathbf{X}_{i,t} + \gamma_2 \mathbf{Z}_{s,t} + \eta_s + \phi_t + \epsilon_{i,s,t}$$

  $\mathbf{X}_{i,t}$ includes household demographics, employment status, and income

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- β_2 identified by changes in c before and after reform, in Texas vs control

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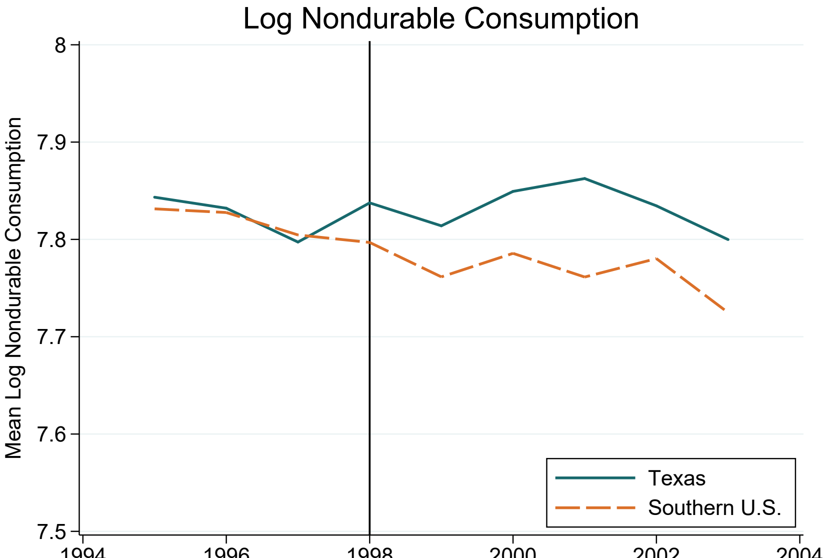

Quasi-Experiment

	(1) Mortgage > 0	(2) Log Consumption
Post1998 * Texas	0.036**	0.030**
	(0.0129)	(0.010)
Observations	36,766	36,766
Adjusted R^2	0.15	0.28
Time FE	Yes	Yes
State FE	Yes	Yes

Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1.

▸ More Info

Quasi-Experiment

Back to Model Validation

Experimental Design

- Placebo Test: no significant response for renters Placebo Test
- Event Study: test assumption of parallel trends Event Study

Quasi-Experiment

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Heterogeneity

- Lots of interesting findings – but will have to skip due to time

▸ Expenditure Categories ▸ Employment Status ▸ Age Group ▸ Equity Extraction

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Expenditure Categories | Employment Status | Age Group | Equity Extraction

Implications for Savings

- Implies 2.7 pp decline in the working-age personal savings rate
- To evaluate welfare, will need a model of household behavior

Quasi-Experimental Evidence

Model Validation: Empirical Strategy

Back

How does the introduction of home equity withdrawal affect household spending?

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- Estimate difference-in-differences specification

$$c_{i,s,t} = \beta_1 + \beta_2 \text{Post1998}_{s,t} * \text{Texas}_{s,t} + \gamma_1 \mathbf{X}_{i,t} + \gamma_2 \mathbf{Z}_{s,t} + \eta_s + \phi_t + \epsilon_{i,s,t}$$

$\mathbf{X}_{i,t}$ includes household demographics, employment status, and income

$\mathbf{Z}_{s,t}$ includes state-month unemployment rate, oil prices, and house prices

- Sample: homeowners age 25-60 in southern U.S. 1995-2003

- β_2 identified by changes in c before and after reform, in Texas vs control

Placebo Test: Renters | Event Study: Parallel Trends | Expenditure Categories | Employment Status | Age Group | Equity Extraction

Placebo Test

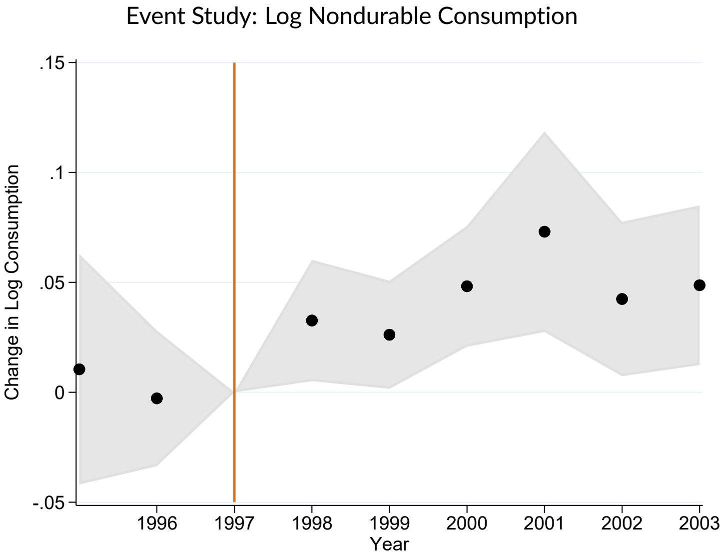
Consumption Response by Housing Status

VARIABLES	(1) All Households	(2) Homeowners	(3) Renters
Post1998 * Texas	0.0108	0.0301**	-0.0178
	(0.0106)	(0.0104)	(0.0121)
Observations	53,947	36,766	17,181
Adjusted R^2	0.334	0.276	0.318
Time FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1

Back

Event Study


Event Study: Log Nondurable Consumption
.15
.1
.05
0
-.05
Change in Log Consumption
1996
1997
1998
1999
2000
2001
2002
2003
Year

Quasi-Experiment

	(1) Mortgage > 0	(2) Mortgage IHS	(3) Log Consumption
Post1998 * Texas	0.036**	0.321**	0.030**
	(0.0129)	(0.128)	(0.010)
Observations	36,766	36,766	36,766
Adjusted R^2	0.15	0.16	0.28
Time FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1.

Back

Consumption Heterogeneity

Heterogeneity across Expenditure Categories (Part 1)

VARIABLES	(1) Food In	(2) Food Away	(3) HH Services	(4) Entertainment	(5) Apparel
Post1998 x Texas	-0.006	0.038**	0.015**	0.020*	0.009
	(0.006)	(0.007)	(0.004)	(0.008)	(0.00711)
Observations	36,766	36,766	36,766	36,766	36,766
Adjusted R^2	0.309	0.118	0.037	0.105	0.117
Time FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

HH Services includes cleaning, babysitting, repairs, rentals, elderly care. Entertainment includes tickets, pets, lessons, recreation, etc. Clustered standard errors in parentheses. ** p<0.01, * p<0.05

▸ Age ▸ Home Equity Loan ▸ Back

Consumption Heterogeneity

Heterogeneity across Expenditure Categories (Part 2)

VARIABLES	(6) Alcohol	(7) Public Utilities	(8) Gasoline	(9) Durables	(10) Vehicle
Post1998 x Texas	0.002	0.011**	-0.001	0.042*	0.032*
	(0.003)	(0.002)	(0.003)	(0.015)	(0.012)
Observations	36,766	36,766	36,766	36,766	36,766
Adjusted R^2	0.070	0.155	0.196	0.090	0.059
Time FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

HH Services includes cleaning, babysitting, repairs, rentals, elderly care

Entertainment includes tickets, pets, lessons, recreation, etc

Clustered standard errors in parentheses. ** $p<0.01$, * $p<0.05$

Age Home Equity Loan Back

Heterogeneity by Employment Status

	Log Consumption
Post1998 * Texas * Unemployed	0.0112
	(0.0185)
Post1998 * Texas * Employed	0.0410***
	(0.00817)
Observations	36,766
Adjusted R^2	0.264
Time FE	Yes
State FE	Yes

Standard errors clustered by state. *** p<0.01, ** p<0.05, * p<0.1.

▸ Age ▸ Home Equity Loan ▸ Back

Heterogeneity by Age

	Log Consumption
Post1998 * Texas * Young	0.000198
	(0.0102)
Post1998 * Texas * Middle	0.0665***
	(0.0112)
Post1998 * Texas * Old	0.0224
	(0.0148)
Observations	36,766
Adjusted R^2	0.277
Time FE	Yes
State FE	Yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Home Equity Loan Back

Heterogeneity by Extraction Status

	Log Consumption
Post1998 * Texas	0.0242**
	(0.0103)
Post1998 * Texas * Home Equity Loan	0.143***
	(0.00607)
Observations	36,766
Adjusted R^2	0.277
Time FE	Yes
State FE	Yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Age Back

Model

Model

Life-cycle model of consumption, housing, and mortgages

- Utility from consumption and housing
- Save in liquid assets or illiquid housing
- Borrow using long-term, fixed-rate mortgages

Model

Life-cycle model of consumption, housing, and mortgages

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- Save in liquid assets or illiquid housing
- Borrow using long-term, fixed-rate mortgages

Novel features

- Temptation preferences may make it costly to hold assets
- Housing acts as a commitment device that can reduce temptation

Preferences

$$\max_{\{c_t, h_t\}_{t=0,..,T}} \mathbb{E}_0 \sum_{t=0}^{T} \beta^t U(c_t, h_t, \tilde{c}_t, \tilde{h}_t)$$

- c_t : nondurable consumption
- h_t : housing status

Preferences

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Most tempting alternative: maximize current period felicity

$$\tilde{c}_t, \tilde{h}_t \quad = \quad \arg \max_{c_t, h_t} \; u(c_t, h_t)$$

Preferences

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$$\tilde{c}_t, \tilde{h}_t = \arg\max_{c_t, h_t} u(c_t, h_t)$$

Utility function:

$$U(c_t, h_t, \tilde{c}_t, \tilde{h}_t) = u(c_t, h_t) - \underbrace{\lambda\Big[u(\tilde{c}_t, \tilde{h}_t) - u(c_t, h_t)\Big]}_{\text{utility cost of self-control}}$$

- λ: degree of temptation

Preferences

$$\max_{\{c_t, h_t, m_t\}_{t=0,..,T}} \mathbb{E}_0 \sum_{t=0}^{T} \beta^t U(c_t, h_t, \tilde{c}_t, \tilde{h}_t)$$

- c_t : nondurable consumption
- h_t : housing status
- m_t : mortgage debt

- $\tilde{c}_t$: most tempting consumption
- $\tilde{h}_t$: most tempting housing status
- $\tilde{m}_t$: most tempting mortgage choice

Most tempting alternative: maximize current period felicity

$$\tilde{c}_t, \tilde{h}_t, \tilde{m}_t = \quad \arg \max_{c_t, h_t, m_t} u(c_t, h_t)$$

Utility function:

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   - Discrete asset with N different sizes (flat, house, mansion, etc.)
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   - Allowed to own or rent any unit, where rent $= \eta p_t$
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   - Transaction costs generate commitment benefit

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   - Certain return, r^H
   - Allowed to own or rent any unit, where rent $= \eta p_t$
   - Transaction costs: fraction f_1 of the house price and utility cost κ
   - Transaction costs generate commitment benefit
3. Mortgages (m_t)
   - Maximum loan to value: $\bar{\psi}$ percent of the house price
   - Fixed-rate mortgage, r^M
   - Fixed repayment each period until retirement or house sale (fully amortizing)
   - Possible to cash-out refinance: multiplicative cost f_2 and additive cost f_3

Housing Preferences

Functional form follows Attanasio et al (2012)

$$u(c_t, h_t) = \underbrace{\frac{c_t^{1-\gamma}}{1-\gamma}}_{\text{consumption utility}} \underbrace{e^{\theta\phi(h_t)}}_{\text{multip housing utility}} + \underbrace{\mu\phi(h_t)}_{\text{additive housing utility}} - \underbrace{\kappa\mathbb{I}_{h_t \neq h_{t-1}}}_{\text{utility cost of moving}}$$

- γ: coefficient of relative risk aversion
- θ and μ: housing preference parameters
- κ: utility cost of housing adjustment (only applies if $h_t \neq h_{t-1}$)

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- ϕ: relative utility of house choice h_t

$$\phi(h) = \begin{cases} \log(h) & \text{if owner} \\ \log(\zeta h) & \text{if renter} \end{cases}$$

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$$\phi(h) = \begin{cases} \log(h) & \text{if owner} \\ \log(\zeta h) & \text{if renter} \end{cases}$$

- ζ: disutility of renting

Additional Model Features

Necessary so that the model has a chance at fitting the data:

- Exogenous income risk — Income
- Household composition varies over life-cycle — Kids
- Progressive income taxation — Taxes
- Progressive social security & pensions — Pensions
- Housing subsidy through the mortgage interest tax deduction — MITD

Housing Options | Budget Constraint | Mortgage Details

Model Estimation

Identification

- Many papers simply calibrate temptation

  Krusell, Kuruscu, and Smith 2010; Nakajima 2012; Schlafmann 2016

- Some papers estimate temptation semi-structurally using Euler equation

  Bucciol 2012; Kovacs and Low 2019

  Problem: may be biased due to credit constraints

- Few papers estimate self-control problems fully-structurally

  Fang and Silverman 2009; Laibson, Maxted, Repetto, and Tobacman 2018

  Problem: require unreasonable assumptions on other parameters (e.g. low housing taste)

Back

Consumption Growth

- In the PSID, $\hat{\psi} > 0$ and significant

Consumption Growth

- In the PSID, $\hat{\psi} > 0$ and significant

Consumption Growth Regression (PSID)

	(1) Baseline	(2) Non Hand to Mouth
Liquid Assets (a)	0.0045***	0.0056***
	(0.0017)	(0.0019)
Age controls	✓	✓
Observations	15780	14171

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back to Model Estimation | Alternative Specifications

Alternative Modeling Assumptions

- In our model, $\psi > 0$ can only be reconciled by temptation

Back to Estimation Back to Fit

- But many potential alternative modeling assumptions...

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  - Asset shocks
  - Habit formation in consumption

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Back to Estimation Back to Fit

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- But many potential alternative modeling assumptions...
  - Persistent heterogeneity in β or R $\rightarrow$ household fixed effects
  - Aggregate shocks $\rightarrow$ year fixed effects
  - Asset shocks $\rightarrow$ instrument with lagged assets
  - Habit formation in consumption $\rightarrow$ control for lagged Δc

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Back to Estimation Back to Fit

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    - Persistent heterogeneity in β or R $\rightarrow$ household fixed effects
    - Aggregate shocks $\rightarrow$ year fixed effects
    - Asset shocks $\rightarrow$ instrument with lagged assets
    - Habit formation in consumption $\rightarrow$ control for lagged Δc
- In all cases, $\hat{\psi} > 0$ even when controlling for these possibilities in the data

Results

Alternative Specifications

Consumption Growth Regression (PSID)

	(1) Baseline	(2) Year FE	(3) IV	(4) HH FE	(5) Habits
Liquid Assets	0.0045***	0.0042**	0.0057***	0.0125***	0.0064***
	(0.0017)	(0.0017)	(0.0017)	(0.0040)	(0.0018)
Age controls	✓	✓	✓	✓	✓
Observations	15780	15780	12087	15780	12098

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back to Estimation Back to Model Fit

Dynamic Moments

Model Fit: Consumption Growth Regression

	PSID	Temptation Model	Non-Temptation Model
Liquid Assets (*a*)	0.0045	0.0037	-0.0040
Age 25	0.0416	0.0587	0.1706
Age 30	0.0352	0.0150	0.1197
Age 35	0.0328	-0.0116	0.0878
Age 40	0.0200	-0.0367	0.0679
Age 45	0.0072	-0.0516	0.0551
Age 50	-0.0498	-0.0712	0.0238
Age 55	-0.0511	-0.0634	0.0095
Age 60	-0.0523	-0.0702	0.0032

Estimation

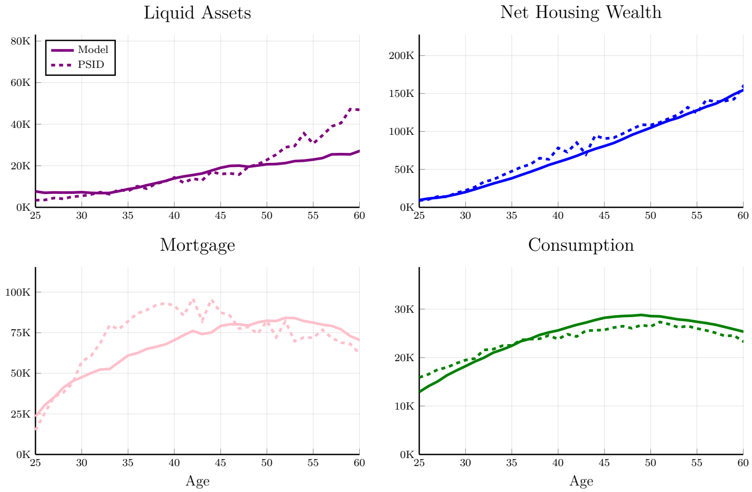
Consumption Growth Regression: Alternative Specifications (PSID)

	(1) Baseline	(2) HH FE	(3) Habits
Liquid Assets (a)	0.00447*** (0.00170)	0.01217*** (0.00400)	0.00619*** (0.00176)
Δc_{-2}			-0.35118*** (0.00832)
Age controls	Yes	Yes	Yes
ΔFamily size	No	Yes	Yes
Year FE	No	Yes	Yes
Observations	15780	15780	12098

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

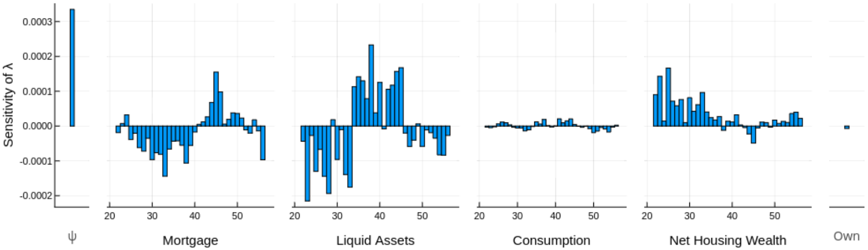
Life-Cycle Moments: Standard Model



Back

Sensitivity

Sensitivity of Temptation to Targeted Moments



Note: This figure shows the sensitivity of λ to targeted moments, based on the sensitivity matrix defined by Andrews et al. (2017). Sensitivity values are rescaled to reflect a 1 percentage point increase in each moment.

Back

Policy

Welfare: Semi-Flexible Mortgages

Welfare Effect (CEV) of Legalizing Home Equity Withdrawal

	Baseline Model	Semi-Flexible Mortgages
Welfare Effect (CEV)	-2.60	1.35
Young		
Consumption	3.60	3.06
Homeownership	-3.46	3.51
LTV	28.98	14.11
Interest Payments	12.65	3.37
Savings Rate	-7.73	-3.55
Old		
Wealth at Retirement	-28.83	-11.94
Consumption	-15.84	-6.34

Model Decomposition

- Baseline model: households suffer from temptation

$$\left[\tilde{c}_t, \tilde{h}_t, \tilde{m}_t\right] = \arg\max_{c_t, h_t, m_t} u(c_t, h_t)$$

- Counterfactual model: allow refi, not tempted to refi

$$\left[\tilde{c}_t, \tilde{h}_t\right] = \arg\max_{c_t, h_t} u(c_t, h_t)$$

Back

Identification: Monte Carlo Evidence

Nonlinear relationship between a_{t+1} and Δc_{t+1} due to liquidity constraints

	(1) Standard Model	(2) Temptation Model
Log Liq Assets (a < 1k)	-0.0076***	-0.0090***
	(0.0004)	(0.0004)
Log Liq Assets (1k < a < 10k)	-0.0086***	-0.0066*
	(0.0018)	(0.0029)
Log Liq Assets (10k < a < 50k)	-0.0054*	0.0182***
	(0.0022)	(0.0048)
Log Liq Assets (a > 50k)	0.0001	0.0057**
	(0.0010)	(0.0021)
Constant	0.0857***	0.0233***
	(0.0031)	(0.0039)
Dummy (1k < a < 10k)	0.0039	-0.0262
	(0.0149)	(0.0237)
Dummy (10k < a < 50k)	-0.0246	-0.2547***
	(0.0226)	(0.0487)
Dummy (a > 50k)	-0.0849***	-0.1134***
	(0.0123)	(0.0250)
Adjusted R^2	0.054	0.041

Heterogeneity in initial liquid assets

- Calibrate initial liquid asset distribution to match that in the PSID
- Target moments at age 22
  - fraction of households with zero liquid asset
  - mean log liquid assets, conditional on positive assets
  - standard deviation of log liquid assets, conditional on positive assets

Back

Budget Constraint

If the household stays in the same home:

$$\frac{a_{t+1}}{1+r} = a_t + \widetilde{y}_t - c_t - mp_t$$

If the household continues to rent:

$$\frac{a_{t+1}}{1+r} = a_t + \widetilde{y}_t - c_t - rent_t$$

If the household decides to change homes:

$$\frac{a_{t+1}}{1+r} = a_t + \widetilde{y}_t - c_t - \underbrace{\left[(1+F)P_t(h_t) - \frac{m_{t+1}}{(1+r^M)}\right]}_{\substack{\text{home equity} \\ \text{from purchase}}} + \underbrace{\left[(1-F)P_t(h_{t-1}) - m_t\right]}_{\substack{\text{home equity} \\ \text{from sale}}}$$

Back

Housing Options

- Owner Occupied Housing
  - House size: $h^n \in \{h^1, h^2, ..., h^N\}$
  - House price:

$$P_t(h^n) = \underbrace{p_t}_{\substack{\text{deterministic}\\ \text{time trend}\\ \text{in prices}}} \left[\underbrace{a}_{\substack{\text{price}\\ \text{per unit}}} \underbrace{h^n}_{\text{house size}} + \underbrace{b}_{\text{fixed cost}} \right]$$

- Rental Housing
  - Rental price:

$$\text{rent} = P_t(h) * \text{Rental Scale}$$

Back

Housing Preferences with Kids

An equivalence scale n_t captures the evolution of household composition

$$u(c_t, h_t, n_t) = n_t \left(\underbrace{\frac{\left(\frac{c_t}{n_t}\right)^{1-\gamma}}{1-\gamma}}_{\text{consumption utility}} \underbrace{e^{\theta\phi(h_t, n_t)}}_{\text{multip housing utility}} + \underbrace{\mu\phi(h_t, n_t)}_{\text{additive housing utility}} - \underbrace{\kappa \mathbb{I}_{h_t \neq h_{t-1}}}_{\text{utility cost of moving}} \right)$$

$$\phi(h_t, n_t) = \frac{\left(\frac{h_t}{n_t}\right)^{1-\alpha}}{1-\alpha}$$

Back

Income Taxation

Progressive Income Taxation following Keane and Wasi (2016)

- After tax income given by $\widetilde{y_t} = y_t - \tau(y_t)$
- Nonlinear tax function

$$\tau(y_t) = e^{\tau_1 + \tau_2 \log(y_t - \tau_d)}$$

  where τ_1 and τ_2 are estimated on CPS data and τ_d is the deduction
- $\tau_d = \max\Big[\text{Mortgage Interest Tax Deduction}, \quad \text{Standard Deduction}\Big]$

Back

Social Security

Following retirement at age $\overline{T}$, households receive income

$$\widetilde{y}_t = \max\left\{\text{SS Income Floor}, \quad \text{Annual PIA}(y_{\overline{T}})\right\} \quad \forall t > \overline{T}$$

- where Annual PIA$(y_{\overline{T}})$ is the annual social security benefit (the primary insurance amount) received upon retirement, based on average indexed monthly earnings (AIME), which we approximate based on last period income $y_{\overline{T}}$
- The PIA is computed as 90% of AIME up to breakpoint 1, 32% of AIME up to breakpoint 2, and 15% of AIME up to the SS wage base
- The SS Income Floor, PIA breakpoints, and SS wage base are taken from 2015

Mandatory retirement accounts pay fraction of final period income during retirement

Back

Mortgages

Households that purchase a new home:

- Choose m_{t+1} subject to Loan-to-Value constraint

$$m_{t+1} \leq (1-\psi)P_t(h_t)(1+r^M)$$

Mortgages

Households that purchase a new home:

- Choose m_{t+1} subject to Loan-to-Value constraint

$$m_{t+1} \leq (1-\psi)P_t(h_t)(1+r^M)$$

Households that stay in previous home:

- Mortgage balance evolves as follows

$$m_{t+1} = (m_t - mp_t)(1+r^M)$$

- Fully-amortizing mortgage payment *mp*

$$mp_t = \frac{(1+r^M)^k}{\sum_{j=1}^{k}(1+r^M)^j} m_t$$

where $k = \overline{T} - t + 1$ is the number of periods until retirement

Back

The Euler Equation - Estimable Form

Log-linearized Euler equation

$$\Delta \ln(C_{t+1}) = \omega_0 + \omega_1 \ln(R_{t+1}) + \omega_2 \ln\left(\frac{\tilde{C}_{t+1}}{C_{t+1}}\right) + \gamma' \Delta Z_{t+1} + \varepsilon_{t+1}$$

where

$$\omega_1 = \frac{1}{\kappa}$$

$$\omega_2 = \frac{\lambda}{(1+\lambda)\chi^{\kappa} - \lambda}$$

$$\kappa = 1 - \alpha(1-\rho)$$

$$\chi = \tilde{C}/C$$

time-series sample median

Back

Calibrated Parameters

Parameter	Symbol	Value	Source
Income Persistence	ρ	0.95	-
Std Dev Income Shocks	σ	0.217	-
Initial Income	σ_0	0.429	PSID 1999-2015
Income Constant	a_0	6.3910	PSID 1999-2015
Income *Age* Effect	a_1	0.2562	PSID 1999-2015
Income Age^2 Effect	a_2	-0.0456	PSID 1999-2015
Income Age^3 Effect	a_3	0.002639	PSID 1999-2015
Housing Transaction Cost	F	0.05	OECD (2011)
Down Payment Requirement	ψ	0.1	-
Additive Refi Cost	f_0	$5000	-
Multiplicative Refi Cost	f_1	0.05	-
Share with zero initial assets	a_0^{zero}	0.433	PSID 1999-2015
Cond. mean initial assets	μ_{a_0}	7.117	PSID 1999-2015
Cond. std dev initial assets	σ_{a_0}	1.972	PSID 1999-2015
Housing asset return	r_h	0.021	Case-Shiller
Mortgage rate	r_m	0.061	Case-Shiller
Liquid asset return	r_a	0.040	PSID 1999-2015
Rental scale	a_{rent}	0.03	PSID 1999-2015
Share of Consumption in PSID	c_{scale}	0.5	-
Taste Shocks Scale	σ_{taste}	0.1	-

Back

Alternative Preferences

Hyperbolic discounting model (Strotz, 1956 and Laibson, 1997)

- Relaxes the assumption of standard model on discounting
- Different discount rates, time inconsistent
- Commitment: present self wants to restrict choice set for future self

Why not use hyperbolic discounting?

- Very difficult to estimate importance of β and δ

  Fang and Silverman 2009; Laibson, Maxted, Repetto, and Tobacman 2018

  Require unreasonable assumptions on other parameters (e.g. low housing taste)
- No testable implications in consumption growth
- Welfare analysis suffers from time inconsistency

Back

What Not to Do

- In hyperbolic discounting, no testable implications in euler equation

$$c_t^{-\gamma} = \beta\delta\mathbb{E}_t[c_{t+1}^{-\gamma} R_{t+1}] \qquad \text{if} \;\; a_{t+1} > 0$$

- Log-Linearized EE

$$\Delta \ln(c_{t+1}) = \frac{1}{\gamma} \ln(\beta\delta) + \frac{1}{\gamma} \ln(R_{t+1}) + \varepsilon_{t+1}$$

- Both β and δ show up in constant term – impossible to identify using EE

Back

Identification

Proposition 1

In our model, if no temptation ($\lambda = 0$) and no credit constraints, then

$$cov(\Delta \ln c, \ln a) = 0$$

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Proposition 1b

If no temptation, but credit constraints, then $cov(\Delta \ln c, \ln a) \leq 0$

Identification

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If there exists temptation ($\lambda > 0$) and no credit constraints, then

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Identification

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If there exists temptation ($\lambda > 0$) and no credit constraints, then

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- Intuition is that liquid assets enter the euler equation through $\tilde{c}$

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- Where we can log-linearize the euler equation and show that $\omega_1 > 0$

$$\Delta \ln(c_{t+1}) = \omega_0 + \omega_1 \ln \tilde{c}_{t+1} + \varepsilon_{t+1}$$

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Proposition 2b

If temptation and credit constraints, then $cov(\Delta \ln c, \ln a) \lesseqgtr 0$

Identification

- Key challenge – estimate importance of temptation
  - Many papers simply calibrate temptation

    Literature
  - Few papers estimate self-control problems using life-cycle moments
  - Impatience & temptation observationally equivalent in consumption levels

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- Our solution – identify temptation using a consumption growth regression

$$\Delta \ln c_{i,t} = \psi \ln a_{i,t} + \Sigma_{j=25}^{60} \alpha_j Age_{i,t}^j + \epsilon_{i,t}$$

  - In our model without temptation: $\psi \leq 0$
  - In our model with temptation: $\psi > 0$

Identification

Consumption Growth Regression (PSID)

	(1) Baseline	(2) Year FE	(3) Non HtM	(4) IV
Liquid Assets (a)	0.00447***	0.00393**	0.00561***	0.00563***
	(0.00170)	(0.00169)	(0.00189)	(0.00171)
Age controls	Yes	Yes	Yes	Yes
ΔFamily size	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Observations	15780	15780	14171	12087

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Alternative

Alternative Social Welfare Function

Welfare Effect (CEV) of Legalizing Home Equity Withdrawal

	Baseline Model
Baseline Social Welfare Function	-2.60
Alternative Social Welfare Function	-0.52

- In both cases, households suffer from temptation ($\lambda = 0.38$)
- Baseline: social planner values psychic cost of temptation ($\lambda^{SP} = 0.38$)
- Alternative: social planner ignores psychic cost of temptation ($\lambda^{SP} = 0.0$)

Next: Drivers of Welfare Effect Next: Distributional Effects

Drivers of Welfare Result

	Baseline Model
Welfare Effect (CEV)	-2.60
Young	
Consumption	3.60
LTV	28.98
Interest Payments	12.65
Savings Rate	-7.73
Old	
Wealth at Retirement	-28.83
Consumption	-15.84
Homeownership	-26.58

Next: Distributional Effects

Welfare

	Baseline Model	Consumption Smoothing Channel	Weakened Commitment Channel
Welfare Effect (CEV)	-2.60		
Young			
Consumption	3.60		
LTV	28.98		
Interest Payments	12.65		
Savings Rate	-7.73		
Old			
Wealth at Retirement	-28.83		
Consumption	-15.84		
Homeownership	-26.58		

Welfare

	Baseline Model	Consumption Smoothing Channel	Weakened Commitment Channel
Welfare Effect (CEV)	-2.60	2.61	
Young			
Consumption	3.60	0.13	
LTV	28.98	10.59	
Interest Payments	12.65	6.79	
Savings Rate	-7.73	-1.57	
Old			
Wealth at Retirement	-28.83	-7.10	
Consumption	-15.84	-4.41	
Homeownership	-26.58	-7.09	

Welfare

	Baseline Model	Consumption Smoothing Channel	Weakened Commitment Channel
Welfare Effect (CEV)	-2.60	2.61	-5.21
Young			
Consumption	3.60	0.13	3.47
LTV	28.98	10.59	18.39
Interest Payments	12.65	6.79	5.86
Savings Rate	-7.73	-1.57	-6.16
Old			
Wealth at Retirement	-28.83	-7.10	-21.73
Consumption	-15.84	-4.41	-11.43
Homeownership	-26.58	-7.09	-19.49

Income Process

$$lny_{i,t} = g_{i,t} + z_{i,t}$$

- g: Deterministic age profile for income (third order polynomial)
- z: Idiosyncratic and exogenous AR(1) process

$$z_{i,t} = \rho z_{i,t-1} + \varepsilon_{i,t}$$
$$\varepsilon_{i,t} \sim N(0, \sigma_\varepsilon^2)$$
$$z_{i,0} \sim N(0, \sigma_0^2)$$

Parameter		**Value**
Persistence of log income innovations	ρ	0.95
Standard deviation of innovations to log income	σ_ε	0.217
Standard deviation of initial log income	σ_0	0.429

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