The Effect of Housing on Portfolio Choice

Raj Chetty
Harvard

Adam Szeidl
UC-Berkeley

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Introduction

- How does homeownership affect financial portfolios?
  - Linkages between housing and financial markets important for understanding macro fluctuations and asset pricing

- Theory and evidence reach conflicting conclusions
  - Theory predicts that housing lowers demand for risky assets (Grossman and Laroque 1990, Flavin and Yamashita 2003, Chetty and Szeidl 2007)
  - Empirical studies find no systematic relationship between housing and portfolios (Fratantoni 1998, Heaton and Lucas 2000, Yamashita 2003)

Overview

- We identify two factors that reconcile theory and evidence

1. It is critical to separate effects of mortgage debt and home equity to characterize effect of housing on portfolios
    - Mortgage debt reduces demand for stocks; home equity raises it

2. Endogeneity of housing choice biases previous empirical estimates
    - Ex: those who buy bigger houses may face less labor income risk
    - We use variation across states in house prices and land supply to generate exogenous variation in mortgages and home equity

→ We find large impacts of housing on portfolios

- Same order of magnitude as variation in income and wealth

Outline

1. Model and Estimating Equation
2. Identification Strategy
3. Results: Effect of Housing on Portfolios
4. Home Price Risk vs. Commitments

Stylized Model of Housing and Portfolio Choice

- Two period Merton-style portfolio model with housing
- Key features of housing: risk + illiquidity
  - Risk: σ_{PR} = covariance between home price and stock return
  - Illiquidity: with probability θ, housing cannot be adjusted in second period: $H_1 = H_0$
    - Parameter θ measures degree of illiquidity
    - If $\theta = 1$, housing is a pure commitment; if $\theta = 0$, fully adjustable

Stylized Model of Housing and Portfolio Choice

- At $t = 1$ agent chooses C_1 and H_1 to maximize utility

$$\frac{[C_1^{1-\mu} H_1^{\mu}]^{1-\gamma}}{1-\gamma}$$

subject to:

(1) budget constraint (which depends on realized returns)

(2) commitment constraint $H_1 = H_0$ (which binds with probability θ)

- At $t = 0$ agent has exogenous housing endowment H_0 and chooses stock share α to maximize expected utility:

$$E_0 \frac{\left[C_1^{1-\mu} H_1^{\mu} \right]^{1-\gamma}}{1-\gamma}$$

Portfolio Choice Rule

The optimal share of stocks out of liquid wealth at $t = 0$ is approximately

$$\alpha^* = C_1 \cdot \frac{\textit{liquid wealth} + \textit{labor income} + \textit{home equity}}{\textit{liquid wealth}} - [\theta C_2 + (1-\theta)\sigma_{PR} C_3] \cdot \frac{\textit{property value}}{\textit{liquid wealth}}$$

with constants $C_1, C_2, C_3, \geq 0$.

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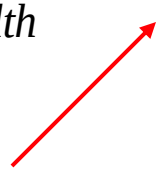


- Home equity affects portfolios through a wealth effect
  - Higher total wealth increases stock share of liquid wealth with power utility

Portfolio Choice Rule

The optimal share of stocks out of liquid wealth at $t = 0$ is approximately

$$\alpha^* = C_1 \cdot \frac{liquid\ wealth + labor\ income + home\ equity}{liquid\ wealth} - [\theta C_2 + (1-\theta)\sigma_{PR} C_3] \cdot \frac{property\ value}{liquid\ wealth}$$

- Home price risk ($\sigma_{PR} > 0$) and commitments ($\theta > 0$) reduce stock share
  - Home price risk ($\sigma_{PR} \uparrow$) : each dollar of housing leads to greater exposure to risk → take less risk in financial portfolio
  - Commitments ($\theta \uparrow$) : more likely that money is tied up in fixed housing payments → greater risk aversion → take less risk

Estimating Equation

$$\text{stock share}_i = \alpha + \beta_1 \text{property value}_i + \beta_2 \text{home equity}_i + \gamma X_i + \varepsilon_i$$

- β_1 = effect of property value holding fixed home equity wealth
- β_2 = effect of home equity wealth holding fixed property value

- Error term ε captures unobserved determinants of portfolios
  - Ex: unobserved labor income risk
  - May be correlated with housing → OLS estimates biased

→ Consistent estimation of β_1 and β_2 requires instruments for property value and home equity

2. Identification Strategy

Identification Strategy

- Three strategies to generate variation in mortgages and home equity

- **Strategy 1:** Use state-level repeat-sale home price indices as instruments for property values and home equity wealth

  - Two instruments:

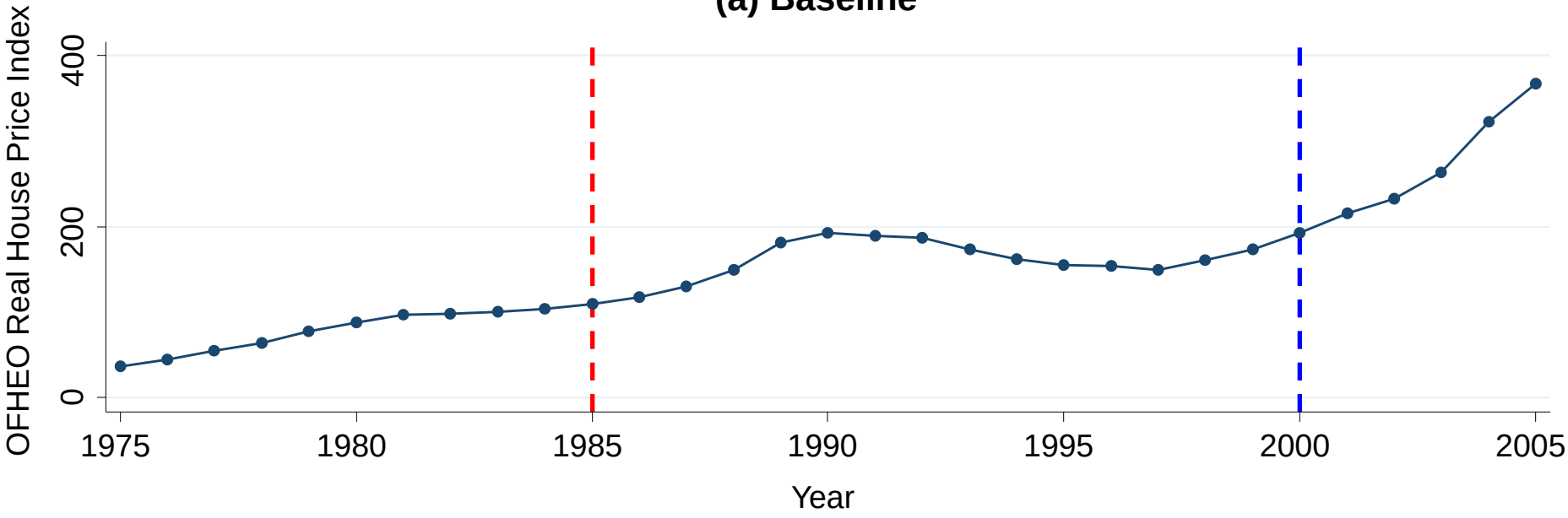
    1. Average state house price in year in which portfolio is observed ("current year")

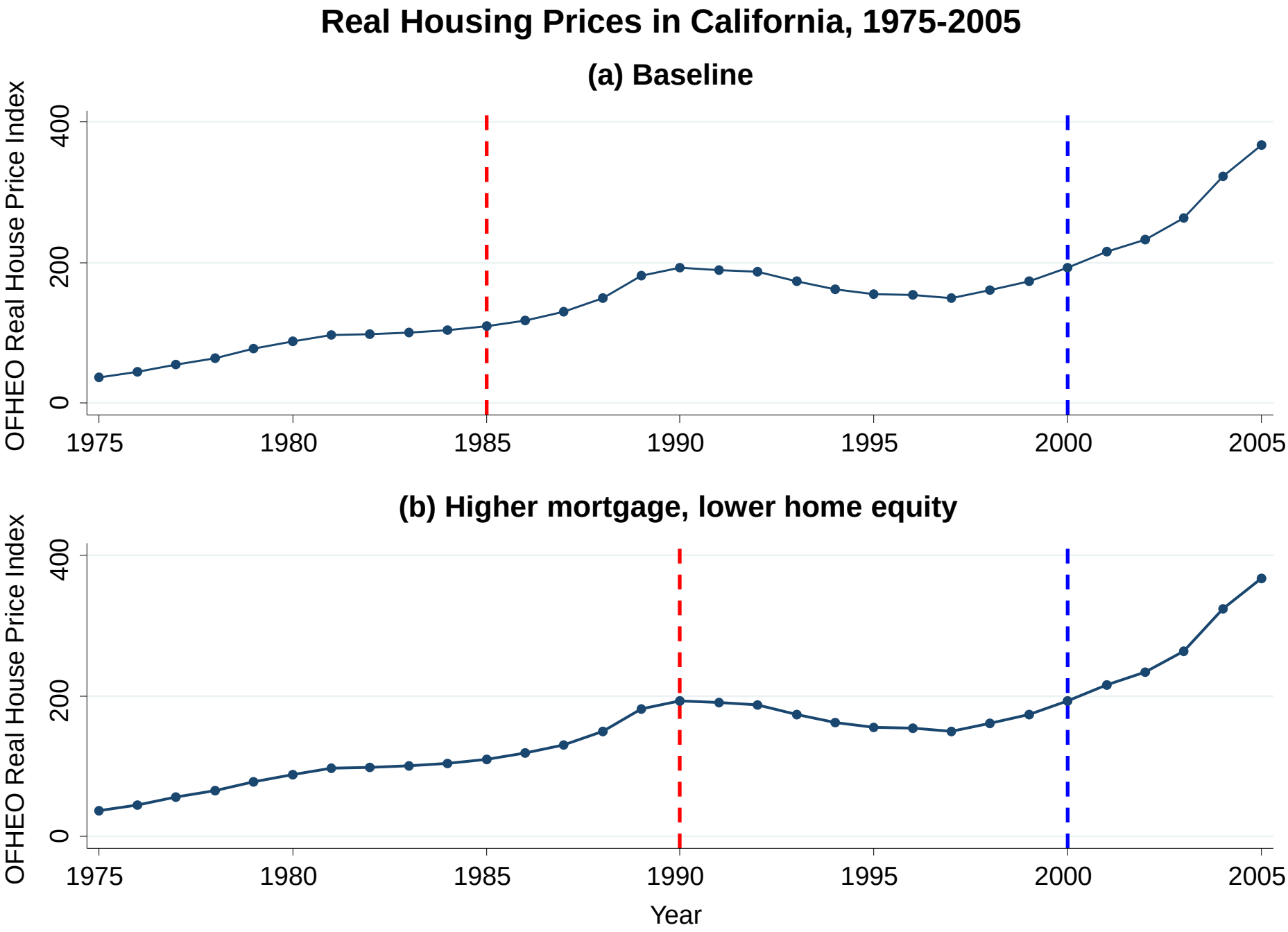
    2. Average state house price in year of home purchase

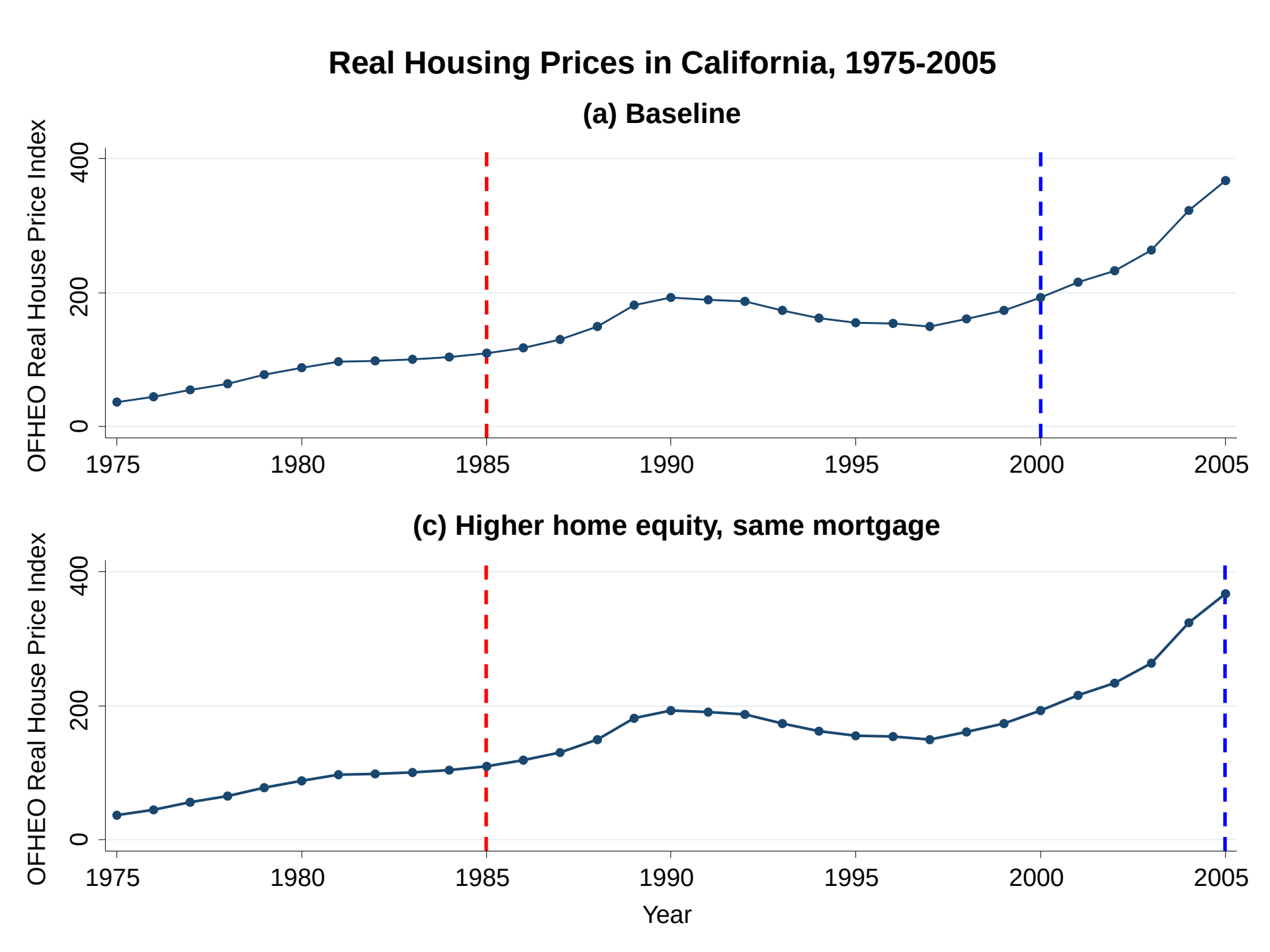
  - Consider hypothetical experiment with individuals who buy identical houses and only pay the interest on their mortgage

Real Housing Prices in California, 1975-2005

(a) Baseline




Real Housing Prices in California, 1975-2005
(a) Baseline
OFHEO Real House Price Index
0
200
400
1975
1980
1985
1990
1995
2000
2005
(b) Higher mortgage, lower home equity
OFHEO Real House Price Index
0
200
400
1975
1980
1985
1990
1995
2000
2005
Year


Real Housing Prices in California, 1975-2005
(a) Baseline
OFHEO Real House Price Index
0
200
400
1975
1980
1985
1990
1995
2000
2005
(c) Higher home equity, same mortgage
OFHEO Real House Price Index
0
200
400
1975
1980
1985
1990
1995
2000
2005
Year

Identification Strategy

- In practice, our implementation differs from hypothetical experiment in two ways:

  1. Include state, year of home purchase, current year, and age fixed effects in all specifications

     - Identify purely from **within-state** price fluctuations → comparing people in similar markets

  2. Individuals buy smaller houses when prices are high and pay mortgage off → first-stage coeffs differ from 1-1 effects in example

Threats to Identification

1. Omitted variables

   - Fluctuations in house prices correlated with fluctuation in labor market conditions, which directly affect portfolios?

   → **Strategy 2:** Use national house prices interacted with variation in land availability across states

2. Selection effects

   - People who buy houses when local house prices are high may have different risk preferences?

   → **Strategy 3:** Use panel data, tracking changes in portfolio for same household over time

3. Results: Effect of Housing on Portfolios

Data

- Repeated cross-sections from Survey of Income and Program Participation spanning 1990 to 2004
- Observe portfolios, property value, mortgage debt, demographics, labor market variables
- OFHEO house price index data available starting in 1975; only include households who bought current house after 1975
- Sample size: 64,191 households

Summary Statistics for SIPP Analysis Sample

Variable	Mean	Median	Std. Deviation
	(1)	(2)	(3)
Property value	$125,154	$99,664	$91,035
Home equity	$72,264	$48,860	$73,887
Mortgage debt	$52,890	$42,937	$51,490
Liquid wealth	$39,642	$5,574	$543,523
Total wealth	$173,094	$94,643	$588,136
Households holding stock	29.42%	0.00%	45.57%
Stock share (% of liq wlth)	16.09%	0.00%	30.47%

First Stage Regression Estimates

Dep. Var.:	Property Value	Home Equity	Mortgage Debt
	(1)	(2)	(3)
OFHEO state house price index in current year	$377.7	$329.8	$47.87
	(9.49)	(7.98)	(5.21)
	[39.81]	[41.32]	[9.19]
OFHEO state house price index in year of purchase	-$58.01	-$184.3	$126.3
	(12.26)	(10.31)	(6.73)
	[-4.73]	[-17.87]	[18.77]

All specs include state, current year, year of home purchase, and age fixed effects

Effect of Housing on Portfolios: Instrumental Variable Estimates

	OLS	Two-Stage Least Squares			Two-step Tobit
Dep. Var.:	Stock Share	Stock Share		Stock Holder	Stock Share
	(1)	(2)	(3)	(4)	(5)
Property val. (x $100K)	2.35% (0.26)	-8.89% (3.11)	-7.02% (2.89)	-14.0% (4.13)	-29.4% (9.48)
Home equity (x $100K)	-2.66% (0.29)	9.42% (3.55)	4.94% (3.33)	10.8% (4.76)	26.8% (10.8)
Fixed Effects	x	x	x	x	x
Full Controls	x		x	x	x
Observations	61,881	63,807	61,881	61,881	61,881

Fixed effects: state, current year, year of home purchase, and age

Full controls: liquid wealth spline, education, income, # of children, and the state unemployment rate in current year and in year of home purchase

Magnitudes

- \$100K increase in mortgage debt → 7 pp lower stock share
- Standard deviation of mortgage debt: \$51.5K

→ 1 std. dev. increase in mortgage reduces stock share by 3.5pp = 22%

- Comparisons:
  - 1 std dev. increase in wealth reduces stock share by 27%
  - Same order of magnitude as other factors considered e.g. by Calvet, Campbell, and Sodini (2007)

Robustness Checks

Dependent Variable:	Stock Share of Liquid Wealth		
Specification:	Logs	Shares	Wealth > $100K
	(1)	(2)	(3)
Log prop value (x $100K)	-30.5%		
	(13.8)		
Log home equity (x $100K)	12.33%		
	(6.98)		
Prop val/liq wealth (x $100K)		-7.59%	
		(4.19)	
Home eq/liq wealth (x $100K)		6.99%	
		(4.43)	
Property value (x $100K)			-12.7%
			(5.57)
Home equity (x $100K)			12.2%
			(6.95)

All specs include state, current year, year of home purchase, and age fixed effects, and full set of controls.

Strategy 2: Land Supply Instruments

- Now address omitted variables correlated with local house prices
- Use measures of land supply elasticity by state predicted from land availability and use regulations (Saiz 2010)
- Interact state-level land supply elasticity with national house prices in year of purchase and current year to obtain instruments
  - Ex: California highly inelastic → house prices fluctuate highly with national demand
  - Kansas highly elastic → house prices relatively stable
  - Family that bought a house in CA when national prices were high has more mortgage debt than a comparable family in KS

Land Supply Instruments: First Stage

	First Stage (OLS)		
Dependent Variable:	Prop Val	Home Eq	Mortgage
	(1)	(2)	(3)
Land Supply Elasticity x	-$183	-$167	-$16.0
U.S. OFHEO in current year	(6.62)	(5.58)	(3.62)
	[-27.6]	[-29.8]	[-4.43]
Land Supply Elasticity x	$17.9	$74.0	-$56.1
U.S. OFHEO in year of purch.	(7.30)	(6.15)	(3.99)
	[2.45]	[12.0]	[-14.1]
Fixed Effects	x	x	x

All specs include state, current year, year of home purchase, and age fixed effects.

Effect of Housing on Portfolios: Land Supply IV Estimates

	Two-Stage Least Squares		
Dependent Variable:	Stock Share		Stock Holder
	(1)	(2)	(3)
Property value	-11.7%	-8.02%	-16.2%
(x $100K)	(4.08)	(3.75)	(5.38)
Home Equity	13.9%	7.03%	13.8%
(x $100K)	(4.85)	(4.60)	(6.60)
Fixed Effects	x	x	x
Full controls		x	x

Columns 1 includes state, current year, year of home purchase, and age FE's, column 2-3 includes full set of controls

Strategy 3: Panel Data

- Lastly, we address selection: do people who buy when prices are high have different risk preferences?
  - Examine *changes* in portfolios around home purchase
  - For 2,753 households in the sample, we observe portfolios one year before and one year after home purchase
  - Do individuals who buy bigger houses reduce stock share more?

Effect of Housing on Portfolios: Panel Estimates

Dependent Var.:	Δ stock share		Δ $ liq. wealth	Δ $ stocks	Δ $ safe assets
	(1)	(2)	(3)	(4)	(5)
Δ Property value	-3.02%	-2.79%	-$28,955	-$26,505	-$2,451
(x $100K)	(0.81)	(0.87)	(1528)	(1438)	(801)
Fixed Effects		x	x	x	x
Full Controls		x			
Observations	2,188	2,156	2,750	2,750	2,750

Columns 2-5 include state, age, and year FE's, column 2 includes full set of controls. All specs include control for change in total wealth.

4. House Price Risk vs. Commitments

House Price Risk or Commitments?

- **House price risk mechanism**: effect of housing on portfolios greater in more risky housing markets

  → Test: is effect larger in states with higher covariance of house prices with stock returns?

- **Commitment mechanism**: effect of housing on portfolios greater for individual with higher adjustment costs

  → Test: proxy for adjustment costs by mean home tenure in state

  - Is effect larger for households in states with higher than average home tenure?

House Price Risk vs. Commitment Effects

	Price Risk Interactions		Adj. Cost Interactions	
Dep. Var.:	Stock Share	Stockholder	Stock Share	Stockholder
	(1)	(2)	(3)	(4)
Property value (x $100K)	-7.34%	-14.2%	-5.06%	-10.6%
	(2.84)	(4.06)	(2.68)	(3.83)
Home equity (x $100K)	5.32%	11.1%	1.97%	5.99%
	(3.28)	(4.69)	(3.19)	(4.55)
High risk x prop value (x $100K)	-1.08%	-1.00%		
	(1.28)	(1.83)		
High risk x home equity (x $100K)	-0.01%	-0.68%		
	(1.46)	(2.08)		
High adj cost x prop value (x $100K)			-2.67%	-4.17%
			(1.41)	(2.01)
High adj cost x home equity (x $100K)			4.22%	6.74%
			(1.43)	(2.04)

All columns include the full set of controls and fixed effects

Conclusion

- Housing has a substantial effect on financial portfolios
  - One std. dev. reduction in mortgage debt → demand for stocks rises by roughly 20%
- Practical implications
  - Mortgage debt/committed consumption may be a useful predictor of fluctuations in demand for risky assets and asset prices
  - Households should hold more conservative portfolios when holding a lot of commitments
- Future work: use the empirical estimates here to calibrate macro-finance models and predict the dynamics of asset prices and macroeconomy