

The Effect of Housing on Portfolio Choice

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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:

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

Portfolio Choice Rule


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

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

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

Portfolio Choice Rule


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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

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- 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 \rightarrow take less risk in financial portfolio
 - Commitments ($\theta \uparrow$): more likely that money is tied up in fixed housing payments \rightarrow greater risk aversion \rightarrow 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 \rightarrow OLS estimates biased
- \rightarrow Consistent estimation of β_1 and β_2 requires instruments for property value and home equity

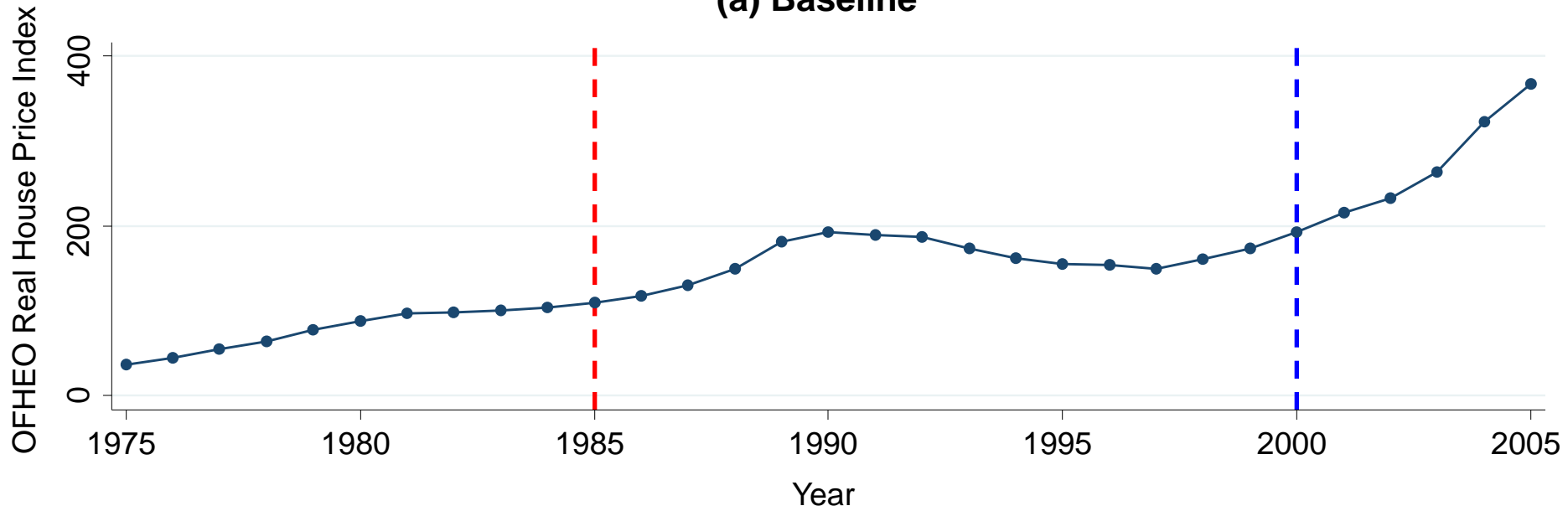
2. Identification Strategy

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

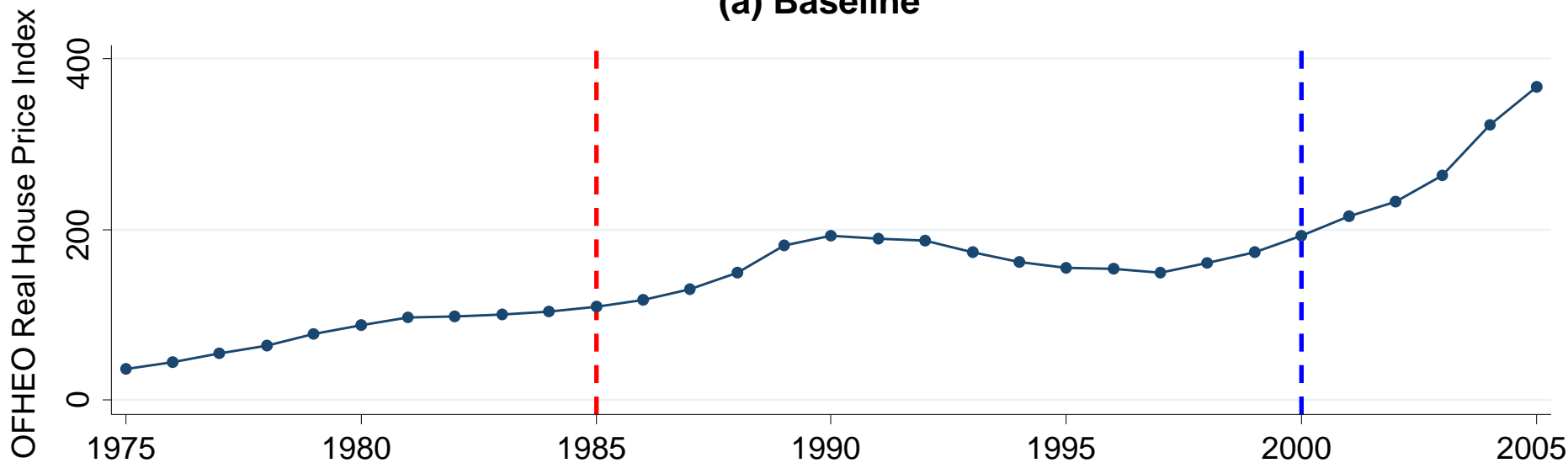
Real Housing Prices in California, 1975-2005

(a) Baseline

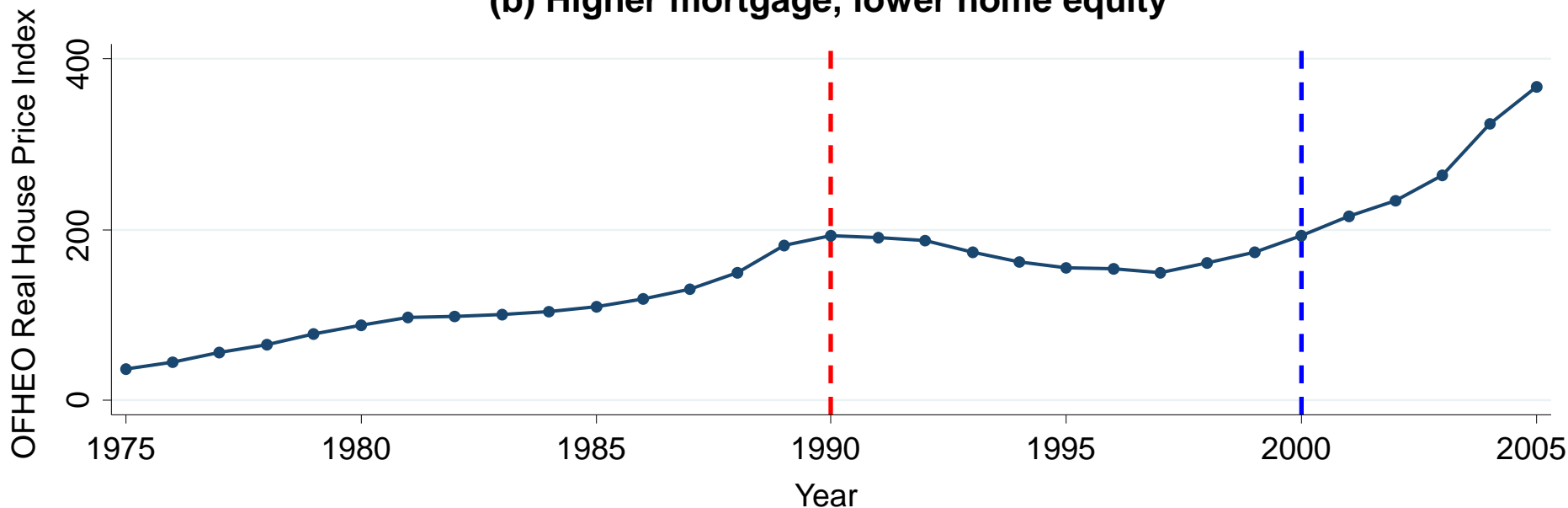


Real Housing Prices in California, 1975-2005

(a) Baseline

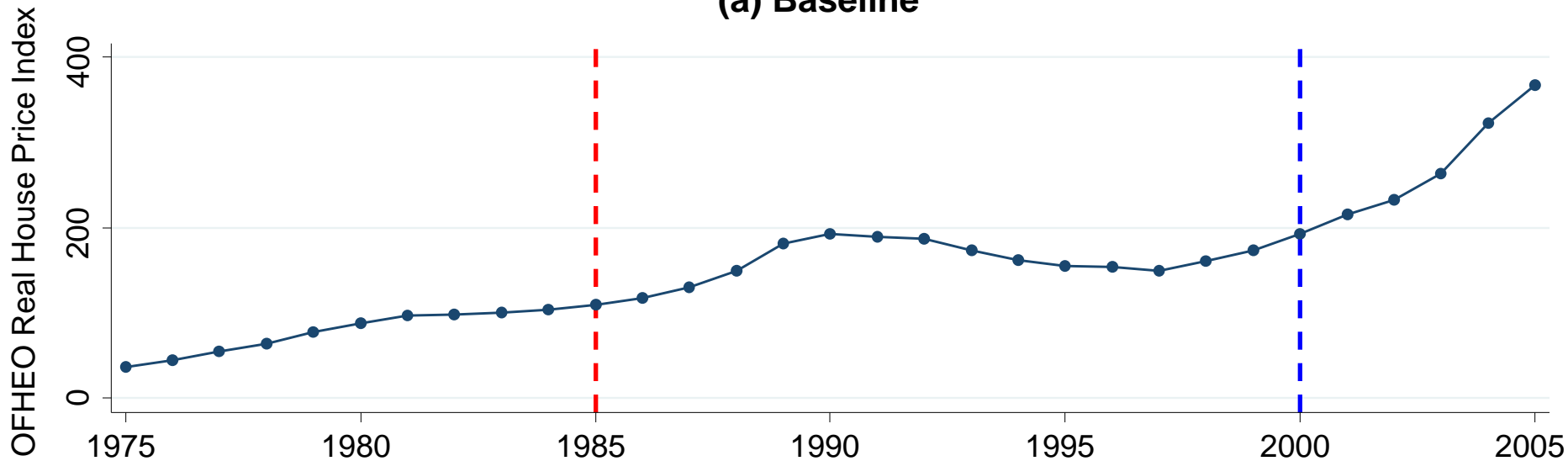


(b) Higher mortgage, lower home equity

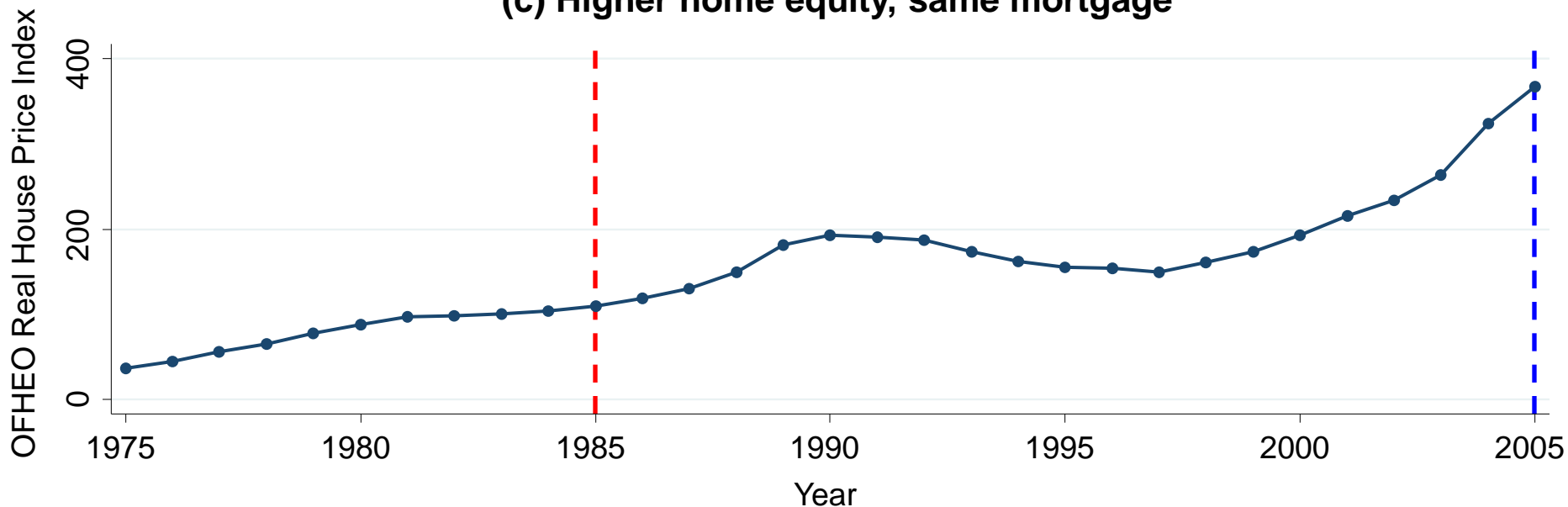


Real Housing Prices in California, 1975-2005

(a) Baseline



(c) Higher home equity, same mortgage



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 (1)	Median (2)	Std. Deviation (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 (9.49) [39.81]	\$329.8 (7.98) [41.32]	\$47.87 (5.21) [9.19]
OFHEO state house price index in year of purchase	-\$58.01 (12.26) [-4.73]	-\$184.3 (10.31) [-17.87]	\$126.3 (6.73) [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
(1)

Shares
(2)

Wealth > \$100K
(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

Dependent Variable:	First Stage (OLS)		
	Prop Val (1)	Home Eq (2)	Mortgage (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

Dependent Variable:	Two-Stage Least Squares		
	Stock Share		Stock Holder
	(1)	(2)	(3)
Property value (x \$100K)	-11.7% (4.08)	-8.02% (3.75)	-16.2% (5.38)
Home Equity (x \$100K)	13.9% (4.85)	7.03% (4.60)	13.8% (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 (x \$100K)	-3.02% (0.81)	-2.79% (0.87)	-\$28,955 (1528)	-\$26,505 (1438)	-\$2,451 (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

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