

# The Effect of Housing on Portfolio Choice

Raj Chetty  
Harvard Univ.

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
- Why is housing of particular interest? Because it is both a consumption good and an illiquid, risky asset:
  - House price risk → hold less stocks (Brueckner 1997, Flavin and Yamashita 2002)
  - Housing consumption hard to adjust → hold less stocks (Grossman and Laroque 1990, Chetty and Szeidl 2007)
  - Cocco (2005) simulation: housing reduces stock market participation rates from 76% to 33%

## Introduction

- Previous empirical studies find mixed results depending on specification using cross-sectional OLS regressions
    - Fratantoni (1998): 10% increase in mortgage debt → 1.5% reduction in stock share (no property value control)
    - Heaton and Lucas (2000), Cocco (2005): higher mortgage debt → *more* stockholding when controlling for property value
    - Yamashita (2003): 10% increase in property value → 1% reduction in stock share (no mortgage control)
  - Problem: housing and portfolios are both endogenous choices
  - This paper: use fluctuations in local home price indices to address endogeneity problem
- More robust estimates of causal effect of housing on portfolios

## 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

- Discrete time with periods  $t = 0, 1, \dots, T$
- Agent consumes in periods  $t = 1, \dots, T$  only to maximize utility

$$\sum_{t=1}^T \frac{c_t^{1-\gamma}}{1-\gamma}$$

where  $c_t$  is a composite of food ( $f$ ) and housing ( $h$ ):

$$c = f^\mu h^{1-\mu}$$

and housing is composite of commitments ( $x$ ) and adjustables ( $y$ ):

$$h = \left(\frac{x}{\theta}\right)^\theta \left(\frac{y}{1-\theta}\right)^{1-\theta}$$

- Commitments unadjustable:  $x_t = x_0$  for all  $t$ .
- Parameter  $\theta$  measures share of housing that cannot be adjusted
- If  $\theta = 1$ , housing is fully committed; if  $\theta = 0$ , fully adjustable.

- Two risky assets: housing and stocks
  - Perfectly correlated:  $R_H = \kappa R_S$
  - Riskfree rate normalized to zero.
  - All uncertainty realized between periods  $t = 0$  and  $t = 1$
- Agent chooses only financial portfolio at  $t=0$ ; house  $h_0$  exogenous
- Let  $\alpha$  = stock share,  $L_0$  = liquid wealth,  $Y$  = labor income,  $M$  = mortgage and  $p_1/T$  = rental price of housing.
- Then agent's budget constraint at  $t=1$  is

$$(1 + \alpha R)L_0 + Y + (p_1 h_0 - M) = \sum_{t=1}^T (f_t + a_t \cdot p_1 / T + x_0 \cdot p_1 / T)$$

## Portfolio Choice Rule


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

$$\alpha^* = C_1 \cdot \frac{\text{liquid wealth} + \text{labor income} + \text{home equity}}{\text{liquid wealth}} - [\theta C_1 + \kappa C_2] \cdot \frac{\text{property value}}{\text{liquid wealth}}$$

with constants  $C_1, C_2 \geq 0$

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- Home price risk ( $\kappa > 0$ ) or commitments ( $\theta > 0$ ) create a negative effect of housing on portfolios.
- Home price risk ( $\kappa \uparrow$ ): each dollar of housing leads to greater exposure to risk  $\rightarrow$  take less risk in financial portfolio
- Commitments ( $\theta \uparrow$ ): more money tied up in fixed housing payments  $\rightarrow$  greater risk aversion  $\rightarrow$  take less risk

## Estimating Equation

$$\text{stock share} = \alpha + \beta_1 \text{liquid wealth} + \beta_2 \text{labor income} \\ + \beta_3 \text{property value} + \beta_4 \text{home equity} + \varepsilon$$

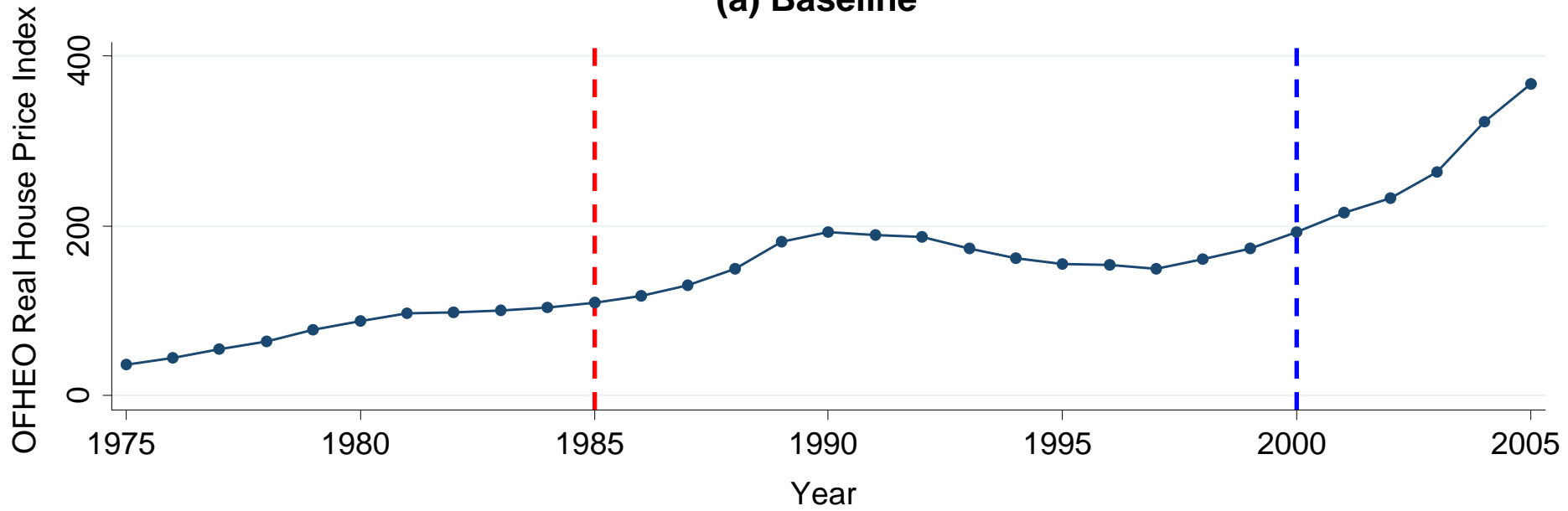
- $\beta_3$  – effect of property value holding fixed home equity wealth
  - $\beta_4$  – effect of home equity wealth holding fixed property value
  - Error term  $\varepsilon$  captures unobserved determinants of portfolios
    - Ex: future labor income, heterogeneous background risk
    - May be correlated with housing  $\rightarrow$  OLS estimates biased
- $\rightarrow$  Consistent estimation requires instruments for property value *and* home equity wealth

## Identification Strategy

- Use OFHEO 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

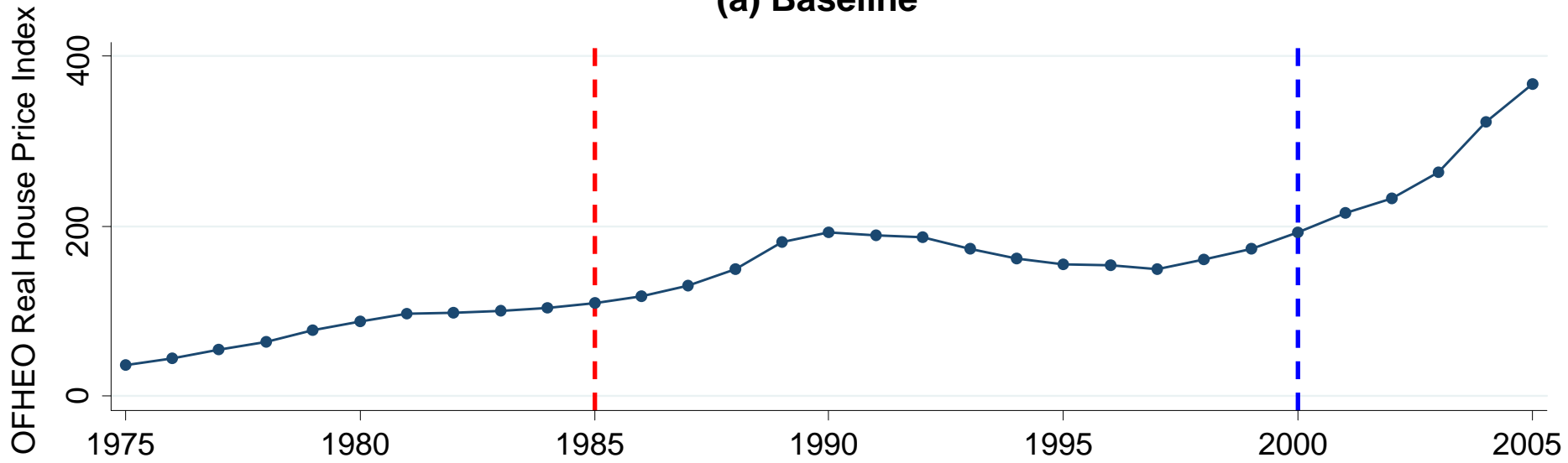
# Real Housing Prices in California, 1975-2005

(a) Baseline

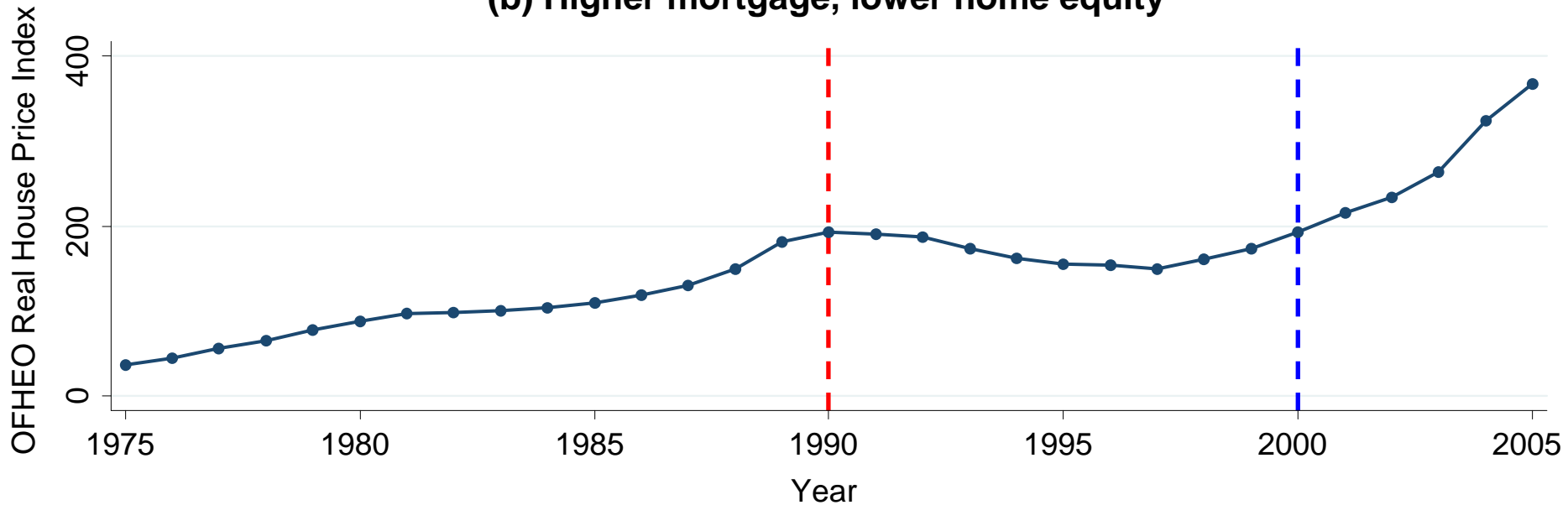


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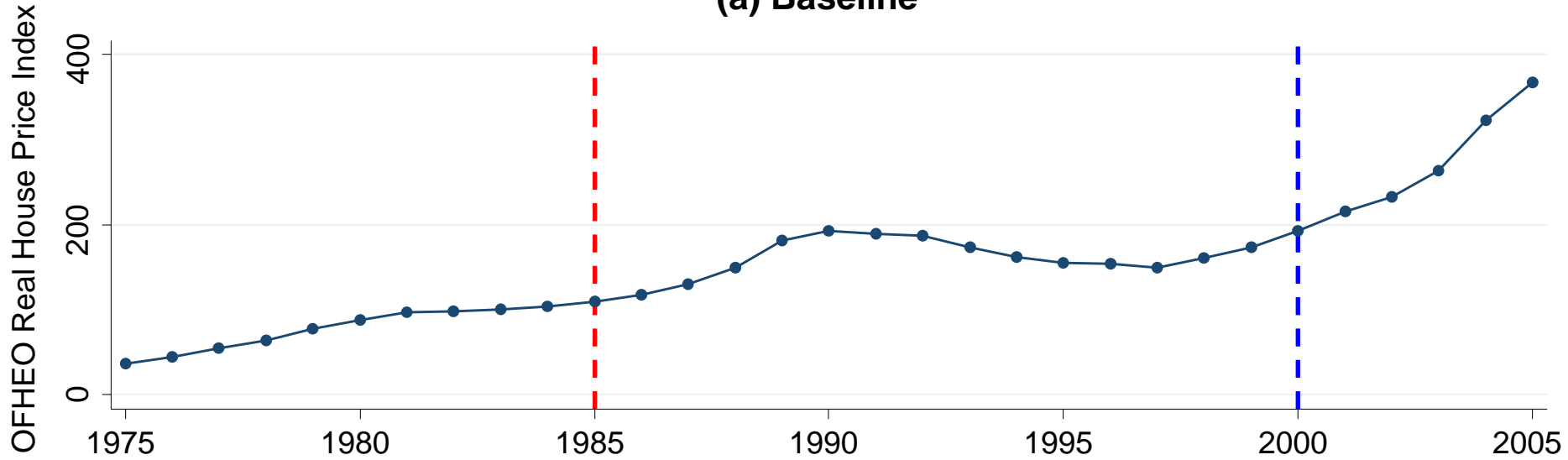


## (b) Higher mortgage, lower home equity

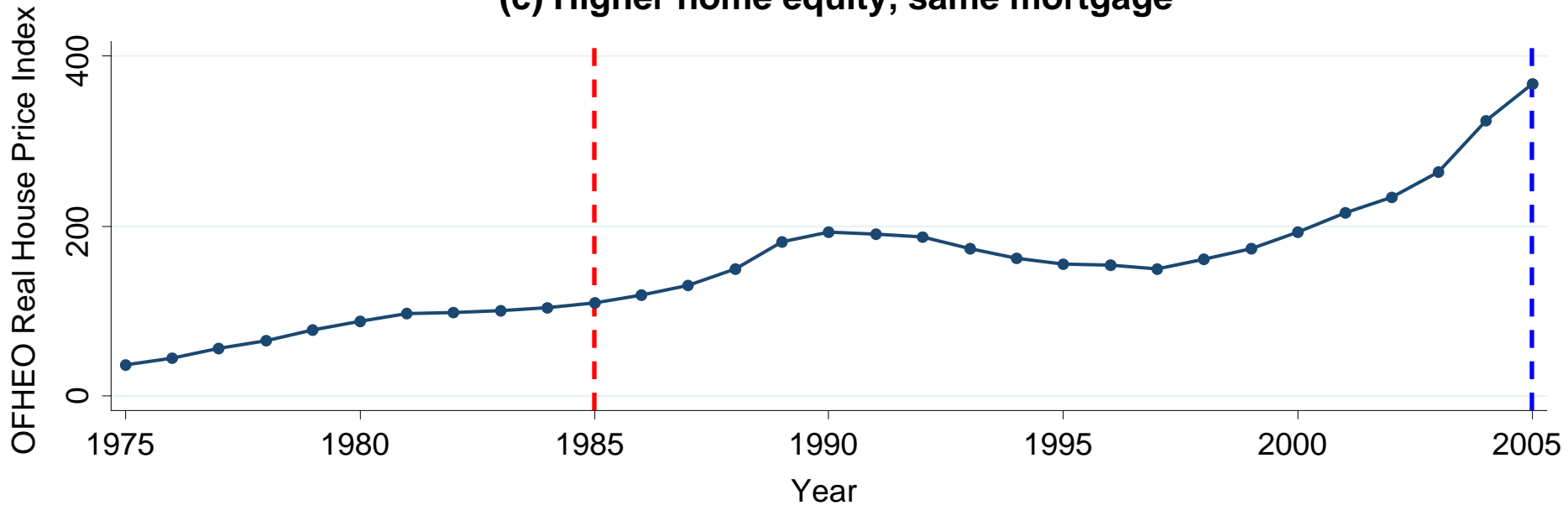


# Real Housing Prices in California, 1975-2005

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

## Two Threats to Identification

### 1. Omitted variables

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

### 2. Selection effects

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

## 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 price data available starting in 1975; only include households who bought current house after 1975
- Sample size: 69,164 households

## Summary Statistics for SIPP Analysis Sample

Variable	Mean (1)	Median (2)	Standard Deviation (3)
Property value	\$122,682.40	\$96,860.94	\$90,622.69
Home equity	\$71,226.95	\$48,430.47	\$73,352.17
Mortgage	\$51,455.43	\$41,511.83	\$51,130.21
Liquid wealth	\$62,602.71	\$12,210.73	\$535,341.10
Total wealth	\$166,517.40	\$89,932.08	\$567,910.20
Households holding stock	27.22%	0.00%	44.51%
Stock share (% of liq wlth)	10.62%	0.00%	23.76%

## First Stage Regression Estimates

Dep. Var.:	Property Value	Home Equity	Mortgage
	(1)	(2)	(3)
OFHEO state house price index in current year	\$377.52 (9.06) [41.68]	\$326.01 (7.61) [42.84]	\$51.50 (4.97) [10.36]
OFHEO state house price index in year of purchase	-\$54.89 (11.76) [-4.67]	-\$187.05 (9.88) [-18.92]	\$132.16 (6.46) [20.46]

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

# Effect of Housing on Portfolios: Instrumental Variable Estimates

	Two-Stage Least Squares			Two-step Tobit
Dep. Var.:	Stock Share	Stock Share	Stockholder	Stock Share
Controls:	FE's only (1)	Full (2)	Full (3)	Full (4)
Property value (x \$100K)	-6.52% (2.19)	-6.86% (2.14)	-14.86% (3.75)	-16.68% (7.38)
Home equity (x \$100K)	6.89% (2.53)	4.74% (2.51)	10.62% (4.40)	18.75% (8.53)

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

Full controls: F.E., 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 → 6.5 pp lower stock share
  - Mean mortgage debt: \$50K, mean stock share: 10%
  - 10% increase in mortgage → 3.25% reduction in stock share
- Elasticity of stock share w.r.t. mortgage debt = -0.33
- Elasticity of stock share w.r.t. home equity = 0.47

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## Robustness Checks

Dependent Variable:

Stock Share of Liquid Wealth

Specification:

Logs  
(1)

Shares  
(2)

Wealth > \$100K  
(3)

Log prop value (x \$100K)

-21.78%  
(8.67)

Log home equity (x \$100K)

8.56%  
(4.48)

Prop val/liq wealth (x \$100K)

-4.00%  
(1.91)

Home eq/liq wealth (x \$100K)

3.14%  
(1.63)

Property value (x \$100K)

-6.79%  
(4.19)

Home equity (x \$100K)

9.93%  
(5.38)

Column 2 includes state and year F.E.; columns 1 and 3 include full set of controls

## Threats to Identification

- Two reduced-form relationships drive TSLS estimates:
  1. People who buy houses when local prices are relatively high hold less stocks ten years later
  2. Stock shares do not vary with current house prices
- Finding #1: more mortgage debt, less home equity → less stocks
- Finding #2: home equity has no effect on stockholding
- Leads us to conclude that mortgage debt reduces stockholding holding fixed home equity wealth
- Could these two reduced-form relationships be generated by omitted variables or selection?

## Threats to Identification

- **Omitted variables:** local labor market conditions correlated with house prices
  - Controlling for local business cycle (state unemp rate) has no effect on estimates
  - Estimates similar when sample restricted to those above age 50
  - Most plausible omitted variable stories would bias estimated effect of current house price on portfolios *upward*

## Threats to Identification

- **Selection:** do people who buy when prices are high have different risk preferences?
  - Test: examine portfolios *prior* to home purchase
  - Portfolios observed twice for 6,145 households in sample
  - Placebo test: effect of home price index at time of home purchase on portfolio shares one year *before* purchase

## Selection Tests

Dependent Variable: Stock Share of Liquid Wealth

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Subgroup:	Future Homebuyers	Analysis Sample	Home Owned < 2 yrs
	(1)	(2)	(3)
Property value (x \$100K)	2.32%	-9.89%	-5.46%
	(3.00)	(3.83)	(2.51)
Observations	6,145	67,627	14,397

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Property value instrumented with home price in year of purchase.

All columns include controls for fixed effects (state, current year, year of home purchase, age), a liquid wealth spline, income, education, # of children, and the state unemployment rate in year of home purchase

## House Price Risk or Commitments?

- Examine heterogeneity of the housing effect
- **House price risk model:** effect of housing on portfolios greater in more volatile housing markets
  - Test: is effect larger in states with higher historical volatility in house prices?
- **Commitment model:** effect of housing on portfolios greater for individual with higher adjustment costs
  - Test: proxy for adjustment costs by predicting home tenures based on observables (income, state, education, age, etc.)
- Is effect larger for households with higher predicted home tenures?

## 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)	-8.93% (2.44)	-19.02% (4.53)	-4.48% (1.87)	-10.90% (3.28)
Home equity (x \$100K)	5.74% (2.93)	12.56% (5.14)	0.09% (2.46)	4.00% (4.32)
High risk x prop value (x \$100K)	1.52% (1.10)	3.05% (1.94)		
High risk x home equity (x \$100K)	-0.44% (1.22)	-0.81% (2.13)		
High adj cost x prop value (x \$100K)			-3.57% (1.78)	-8.56% (3.12)
High adj cost x home equity (x \$100K)			6.72% (2.45)	13.02% (4.29)

All columns include the full set of controls

## Conclusion

- Housing has a substantial effect on financial portfolios
- Our estimates imply that if all mortgage debt were forgiven, demand for stocks by households would rise by 33%
- Elasticities larger for households with high adjustment costs but similar across low and high-risk markets
- May be because most households are well hedged against house price risk (Sinai and Souleles 2005)

## Conclusion

- Interaction between housing and financial markets could have important macroeconomic consequences
- Recent trends in housing market: more mortgage debt, declining property values, greater illiquidity in housing market
- Results here imply that these changes reduced demand for stocks, potentially exacerbating decline in financial markets
- General equilibrium model needed to determine implications for fluctuations in asset and housing prices
- Elasticity estimates reported here could be used to calibrate such a model

## First Stage Regression Estimates with Full Controls

Dep. Var.:	Property Value	Home Equity	Mortgage
	(1)	(2)	(3)

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OFHEO state house price index in current year	\$345.49 (8.70) [39.70]	\$296.19 (7.73) [38.32]	\$49.30 (5.07) [9.73]
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OFHEO state house price index in year of purchase	-\$43.22 (10.93) [-3.96]	-\$172.20 (9.70) [-17.75]	\$128.98 (6.36) [20.27]
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Fixed effects: state, current year, year of home purchase, and age

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