

# The Effect of Housing Wealth on College Choice

## Evidence from the Housing Boom

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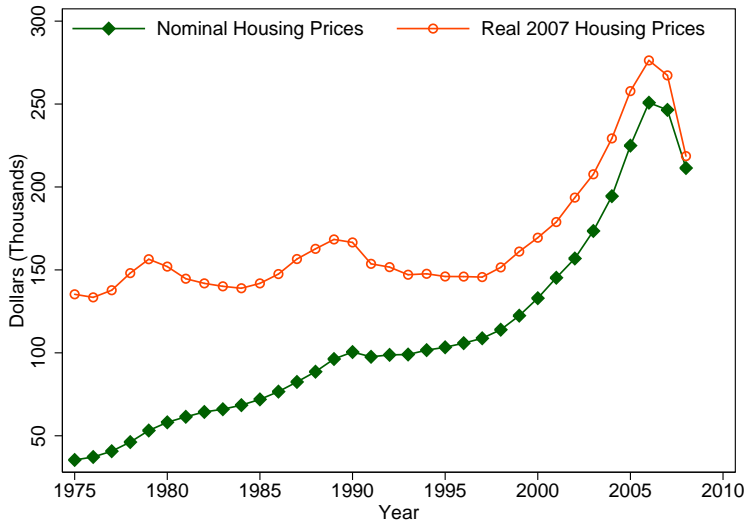
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- Growing literature showing labor market and educational returns to college quality.
- Labor Market Returns:
  - Brewer, Eide and Ehrenberg (1999): 20-25% higher wages from attending an elite public or private university.
  - Black and Smith (2006): Sizeable wage returns to graduating from a higher quality school.
  - Hoekstra (Forthcoming): 24% increase in earnings from attending the state flagship.
  - Dale and Krueger (2002): Large return to attending a school with higher tuition, but weaker evidence on SAT scores.
  - Reynolds (2010) and Rouse (1995): Negative labor market and educational attainment effects of beginning at a two-year college.

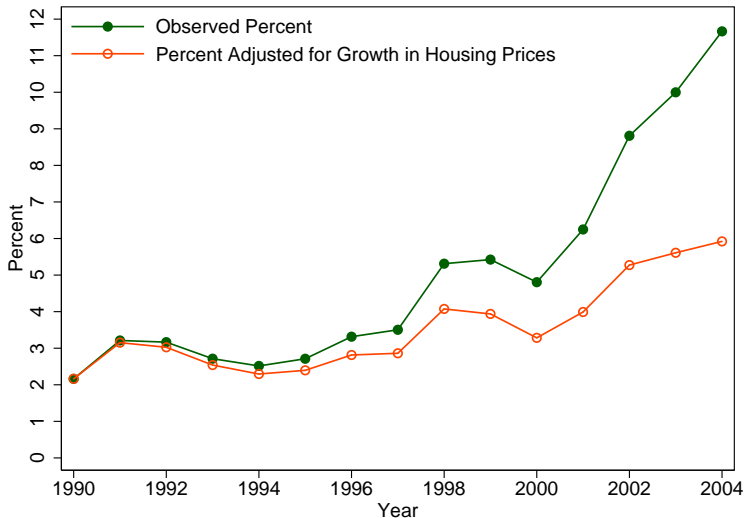
- Educational Attainment:
  - Bound, Lovenheim and Turner (Forthcoming, 2010): Attending a selective public or private school increases likelihood of completing and reduces time to degree.
  - Kurlaender and Long (2009): Students who initially attend a community college are 14.5% less likely to obtain a BA.
- Little is known about how students select colleges and how much financial constraints matter.
- Identifying causal effect of college cost or family financial resources on college choices is difficult due to selection.
- We propose to overcome this problem using housing wealth variation supplied by the recent housing boom.

- Is the selection of college quality responsive to short-run variation in family housing wealth?
  - 85-90% of college attendees come from homeowner households.
  - Housing wealth represents the largest asset for most households.
  - For many households the home is their only asset.
- The recent housing boom was characterized by two important aggregate trends:
  - Higher prices
  - More liquidity

# Trends in National Housing Prices



# Trends in Equity Extraction as a Percent of Real Income



# Preview of Results

- We estimate multinomial logit models of college choice, examining how variation in individual home prices affect the likelihood of enrolling in a state flagship, a four-year private, or a community college relative to a non-flagship four-year school.
  - A \$10,000 increase in home prices in the 4 years prior to turning 18 leads to a 0.0021 percentage point increase in the likelihood of attending a state flagship and a 0.0064 percentage point decline in the likelihood of attending a community college.
  - Estimates are stronger for relatively lower-income households.
- We then estimate how home price variation affects the resources students experience through their choice of college.
  - 4-year home price increases are associated with attending schools with higher SAT scores, faculty-student ratios, per-student expenditures and graduation rates.
  - Again, effects are most prevalent for the lower-income families.

# Data: Restricted-use NLSY97 and Home Prices

- The restricted-use NLSY97 data contain colleges attended, MSA respondents lived in in 1997, and detailed demographic information, including AFQT scores.
  - Sample of 2,764 students aged 12-17 in 1997 who attend college within 2 years of turning 18 and who have valid AFQT scores.
  - Categorize first higher education institution attended into 4 categories: four-year non-flagship public, flagship public, private 4-year and community college.
- Individual home prices reported in 1997 and changes calculated at MSA-level:
  - The home price of homeowner  $i$  in MSA  $j$  in year  $t$  is calculated as:  $\hat{P}_{ijt} = P_{ij1997} * \frac{CMHPI_{jt}}{CMHPI_{j1997}}$ .
  - We calculate the four-year change in home price for each homeowner in 1997 as  $\hat{P}_{ijt} - \hat{P}_{ijt-4}$



# Resource Differences Across School Types

	Non-flagship Public	Flagship Public	Private Four-year	Two Year
25 <sup>th</sup> Percentile Math SAT	455.31	525.14	494.66	
75 <sup>th</sup> Percentile Math SAT	569.52	640.72	607.52	
Fac.-Stu. Ratio	0.041	0.063	0.045	0.020
Expend./ Student	18337	41350	25482	7698
Instruc. Expend./ Student	5649	10188	8434	2796
Graduation Rate	0.461	0.674	0.560	
In-state Tuition	4536	5746	18161	2805
Out-of-state Tuition	12072	16176	18170	6017

# Descriptive Statistics - NLSY97

Variable	Full Sample		Low	Middle	High
	Mean	S.D.	Income Mean	Income Mean	Income Mean
4 Yr. $\Delta$ Home Price (\$10,000)	5.246	6.130	3.216	4.961	8.547
Home Owner Dummy	0.791	0.407	0.646	0.937	0.941
Real Family Income (\$10,000)	9.023	6.781	4.500	9.566	19.95
AFQT Score	63.08	25.93	57.80	67.01	72.95
Non-Flagship Public	0.322	0.467	0.291	0.377	0.326
Flagship Public	0.086	0.280	0.050	0.084	0.193
Private 4-Year	0.189	0.392	0.163	0.187	0.256
Community College	0.402	0.490	0.496	0.352	0.226
25 <sup>th</sup> %tile Math SAT	482.60	67.61	464.08	477.83	517.13
75 <sup>th</sup> %tile Math SAT	594.46	64.50	577.20	591.37	626.56
Faculty-Student Ratio	0.037	0.024	0.033	0.037	0.048
Expenditures/Student	15792	18372	12896	14972	24740
Instructional Exp./Student	5786	5330	4920	5503	8603
Graduation Rate	0.560	0.175	0.512	0.553	0.647
In-state Tuition	6848	7316	5788	6906	9288
Out-of-state Tuition	11479	6802	9988	11741	14828

Low Income:  $Y < \$75,000$ , Middle Income:  $\$75,000 < Y < \$125,000$ , High Income:  $Y > \$125,000$

# Empirical Methodology: Multinomial Logit

$$P(j_{isc}^* = j_{isc}) = \beta_0 + \beta_1 \text{Own}_i + \beta_2 \Delta P_i^h + \gamma X_i + \alpha Z_{sc} + \theta_s + \psi_c + \epsilon_{isc}$$

- $j$  is school type selected by individual  $i$  in state  $s$  in cohort  $c$ .
- $\text{Own}$  = homeowner dummy in 1997
- $\Delta P_i^h$  = real 4-year change in home price prior to individual turning 18 (conditional on owning a home)
- $X_i$  = vector of individual demographic characteristics – including AFQT score, family income, mother and father education and respondent sex and race
- $Z_{sc}$  = vector of state macroeconomic and higher education provision measures – real income per capita, unemployment rate, 4 and 2 year schools per 18-22 year olds, state aid per 18-22 year old, BA/AA state wage ratio, and BA/HS state wage ratio.
- $\theta_s$  = state fixed effects;  $\psi_c$  = cohort fixed effects.

# Identification Assumptions: Selection Across Space

- The home price variation comes from three main sources:
  - 1 1997 home price levels
  - 2 Differences across cities in home prices within states
  - 3 Changes within cities in the magnitude of home price changes between 1997 and 2003.
- We find no relationship between 1997 home prices and college selection.
- Using MSA instead of state fixed effects increases the magnitude of the direct resource effects, suggesting selection across cities within states is not driving our results.
- Because no post-1997 mobility is allowed in our data, any selection must be based on families with higher unobserved preferences for or access to higher quality schools sorting into MSAs pre-1997 that will have the highest housing price growth when their children are in high school.

# Identification Assumptions: Selection Into Homeownership and Into College

- Is homeownership in 1997 endogenous?
  - It would have to be the case that families with higher unobserved likelihood of attending a higher quality school are more likely to own a home in 1997 in the MSAs in which home prices will rise more when their kids are in high school.
  - 79% of college-goers are from homeowner families, and 94% from middle and high income families are homeowners.
- Lovenheim (2009) shows the extensive margin of college enrollment was responsive to housing wealth variation during the housing boom using the PSID.
  - Finds a marginal effect of 0.004 percentage points.
  - Including non-attendance as its own category in the multinomial logits yields similar results. The other estimates are largely unchanged - we focus on the sample of college-goers for parsimony.

# Identification Assumptions: Spurious Macroeconomic Trends

- It could be the case high skilled labor demand shocks cause both the changes in housing prices and the changes in schooling quality decisions.
- During the housing boom, there was a *negative* relationship between MSA-level real income per capita and home price changes (Mian and Sufi, 2010).
- High-skilled labor demand is not highly localized within states within the country (Bound, Groen, Kezdi and Turner, 2004).
- We control for several state-by-year level macroeconomic variables that are correlated with high-skilled labor demand.
- Selection would have to be occurring prior to 1997 based on future high skilled labor demand shocks.

# Multinomial Logit Results (Marginal Effects Reported)

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change (\$10,000)	0.0021** (0.0007)	0.0002 (0.0019)	-0.0064** (0.0034)
Home Ownership Dummy	0.0003 (0.0080)	0.0086 (0.0217)	-0.0256 (0.0340)
Real Family Income	0.0014** (0.0005)	0.0029* (0.0017)	-0.0079** (0.0026)
Missing Income	0.0072 (0.0115)	0.0138 (0.0329)	-0.0471 (0.0425)
AFQT Score	0.0012** (0.0002)	0.0021** (0.0004)	-0.0073** (0.0005)

Standard errors clustered at the MSA-level. Excluded category:  
non-flagship public universities.

# How Large Are These Estimates?

- Marginal effect = 0.0021 for flagships and -0.0064 for community colleges for each \$10,000 increase in home prices.
  - Baseline attendance rates = 8.6% and 40.2%, respectively.
- This implies a \$10,000 increase in 4-year home prices causes:
  - 2.4% attendance increase at state flagships
  - 1.5% attendance decrease at community colleges
- Average 4-year home price change was \$52,460  $\Rightarrow$  12.4% increase in flagship and 8.4% decrease in community college attendance.
- Average 4-year home price change for 12-year old sample was \$71,088  $\Rightarrow$  16.8% increase in flagship and 11.3% decrease in community college attendance.



# Multinomial Logit Results by Income

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change (\$10,000)* I(Low Income)	0.0033** (0.0007)	0.0034 (0.0028)	-0.0202** (0.0084)
4 Year Home Price Change (\$10,000)* I(Middle Income)	0.0023** (0.0007)	-0.0026 (0.0030)	-0.0041 (0.0040)
4 Year Home Price Change (\$10,000)* I(High Income)	0.0012 (0.0007)	-0.0010 (0.0024)	0.0011 (0.0043)
Home Ownership Dummy* I(Low Income)	0.0012 (0.0081)	0.0112 (0.0239)	0.0157 (0.0558)
Home Ownership Dummy* I(Middle Income)	-0.0086 (0.0162)	0.0848 (0.0590)	-0.1211 (0.0787)
Home Ownership Dummy* I(High Income)	-0.0053 (0.0221)	0.0814 (0.0815)	-0.0889 (0.1321)
AFQT Score	0.0008** (0.0001)	0.0020** (0.0003)	-0.0075* (0.0046)

Low Income:  $Y < \$75,000$ , Middle Income:  $\$75,000 < Y < \$125,000$ , High Income:  $Y > \$125,000$ .

# How Large Are These Estimates for the Low Income Sample?

- Marginal effect = 0.0033 for flagships and -0.0202 for community colleges for each \$10,000 increase in home prices.
  - Baseline attendance rates = 5.0% and 49.6%, respectively.
- This implies a \$10,000 increase in 4-year home prices causes:
  - 6.6% attendance increase at state flagships
  - 4.1% attendance decrease at community colleges
- Average 4-year home price change was \$32,160  $\Rightarrow$  21.2% increase in flagship and 13.1% decrease in community college attendance.
- Average 4-year home price change for 12-year old sample was \$40,245  $\Rightarrow$  26.6% increase in flagship and 16.4% decrease in community college attendance.

# Home Price Effects on Aggregate State Enrollment

$$\ln(\text{Enroll})_{jst} = \beta_0 + \beta_1 \ln(\text{CMHPI})_{st} + \beta_2 \text{unemp}_{st} + \beta_3 \text{rinc}_{st} + \delta_j + \gamma_t + \epsilon_{jst}$$

Sector	First-year Enrollment	Applications	Admissions	Yield
Flagship	-0.022 (0.073)	0.108 (0.184)	0.048 (0.129)	-0.039 (0.122)
Other public four-year	0.428** (0.138)	0.548** (0.203)	0.494* (0.249)	-0.243 (0.152)
Two-year	0.371** (0.157)			

Standard errors clustered at the state level. Sample period: 1997-2007.

# Empirical Methodology: Direct Resource Effects

$$Q_{imsc} = \beta_0 + \beta_1 Own_i + \beta_2 \Delta P_i^h + \gamma X_i + \alpha Z_{sc} + \theta_m + \psi_c + \epsilon_{imsc}$$

- Q is school quality measure for individual  $i$  in state  $s$  and MSA  $m$  in cohort  $c$ .
- Quality measures are averages across years for each institution - assumes institutional resources do not respond to home prices.
- The main identification assumptions are almost identical to the multinomial logit model.
- The MSA fixed effects eliminate all cross-city variation within states in home prices.
- Comparing these estimates to those using state fixed effects tell us something about the cross-city selection.

# School Quality Results

	Home Price Change (\$10,000)			
	All Colleges	Four Year	Public Four Year	Two Year
25 <sup>th</sup> %tile Math SAT	1.528** (0.601)	1.189** (0.560)	0.840 (0.699)	. .
75 <sup>th</sup> %tile Math SAT	1.226** (0.562)	0.914* (0.522)	0.578 (0.652)	. .
Faculty-Student Ratio	0.0004** (0.0002)	0.0005* (0.0003)	0.0003 (0.0002)	-0.0001 (0.0001)
Expend./Student	440.635** (160.767)	650.164** (284.793)	349.913 (267.622)	3.335 (13.533)
Inst. Expend./Student	80.355** (37.528)	104.406* (60.617)	55.130 (49.527)	4.991 (8.266)
Graduation Rate	0.0031** (0.0014)	0.0025** (0.0013)	0.0030* (0.0017)	. .
In-state Tuition	-15.952 (44.761)	-88.872 (82.300)	32.899* (17.287)	. .
Out-of-state Tuition	89.669** (44.415)	64.893 (54.385)	94.802** (43.468)	. .

# Results: Effects in the Four-year Sector by Family Income

	Home Price Change (\$10,000)		
	Low Income	Middle Income	High Income
25 <sup>th</sup> %tile Math SAT	1.407** (0.689)	1.437** (0.619)	0.832 (0.650)
75 <sup>th</sup> %tile Math SAT	1.210** (0.610)	1.088* (0.569)	0.589 (0.627)
Faculty-Student Ratio	0.0005** (0.0002)	0.0002 (0.0002)	0.0002 (0.0002)
Expend./Student	525.252** (197.898)	183.479 (179.502)	322.236 (247.190)
Inst. Expend./Student	107.053** (51.441)	2.228 (55.626)	37.229 (62.597)
Graduation Rate	0.0028* (0.0015)	0.0030* (0.0017)	0.0012 (0.0015)
In-state Tuition	-28.646 (64.199)	-81.270 (74.737)	-24.106 (72.719)
Out-of-state Tuition	116.235* (63.480)	31.651 (59.838)	36.224 (64.443)

Low Income:  $Y < \$75,000$ , Middle Income:  $\$75,000 < Y < \$125,000$ , High Income:  $Y > \$125,000$

# Descriptive Statistics - NLSY97 Outcome Variables

Variable	Full Sample		Low	Middle	High
	Mean	S.D.	Income	Income	Income
	Mean	S.D.	Mean	Mean	Mean
Time Between HS and College	0.204	0.425	0.266	0.177	0.084
BA	0.391	0.488	0.286	0.426	0.600
Time to Degree	4.703	1.025	4.889	4.660	4.529

# Results: Effects on Enrollment Timing and Collegiate Attainment

Panel A: Average Effects

	Time Between HS and College	BA
4 Year Home Price Change (\$10,000)	0.0010 (0.0034)	0.0028 (0.0024)

Panel B: Effects by Family Income

	Time Between HS and College	BA
4 Year Home Price Change* I(Low Income)	-0.0086* (0.0044)	0.0070** (0.0034)
4 Year Home Price Change* I(Middle Income)	0.0104 (0.0084)	0.0027 (0.0033)
4 Year Home Price Change* I(High Income)	0.0032 (0.0032)	-0.0012 (0.0027)

Low Income:  $Y < \$75,000$ , Middle Income:  $\$75,000 < Y < \$125,000$ , High Income:  $Y > \$125,000$



# Conclusion

- During housing boom, homeowners used their home wealth to finance a higher-quality college education for their children.
- Estimates largest for the lower-income sample, and for this group BA receipt increased as well with housing price growth.
- These results are suggestive of binding credit constraints affecting the intensive margin of college enrollment.
- Home prices have fallen by 32% since their peak in 2006.
  - Our results suggest that this decline could reduce the quality of schools attended by students, particularly those from lower-income families.
  - Indicate a need to think about policies that can help insulate these families from housing price fluctuations.

# Appendix: State Housing Prices and Institutional Resources

Sector	Independent Variable: Ln(Home Price Index)					
	Total Expend.	Inst. Expend.	Faculty/ Total	Faculty/ First-year	Faculty	In-state Tuition
Flagship	0.122** (0.061)	0.106 (0.088)	-0.008 (0.109)	-0.006 (0.132)	-0.015 (0.119)	-0.167* (0.091)
Other public four-year	0.032 (0.097)	0.144 (0.094)	-0.066 (0.090)	-0.234** (0.109)	0.024 (0.132)	-0.117 (0.115)
Two-year	0.115 (0.130)	0.187* (0.095)	0.169** (0.057)	-0.113 (0.131)	0.127* (0.071)	0.128 (0.172)

# Appendix: State Housing Prices and Financial Aid

	Any Aid	Federal Grants	State Grants	Institutional Grants	Loans
Dependent variable: percent of entering cohort receiving aid					
Flagship	-0.085 (0.080)	-0.226 (0.212)	-1.198** (0.539)	-0.210 (0.189)	-0.251** (0.118)
Other public four-year	-0.143** (0.057)	-0.285** (0.084)	0.164 (0.187)	-0.281 (0.196)	-0.511** (0.135)
Two-year	0.047 (0.075)	-0.098 (0.092)	-0.126 (0.183)	0.294** (0.124)	-0.302** (0.090)
Dependent variable: natural log of real average aid given					
Flagship		0.037 (0.144)	-0.366 (0.245)	-0.210 (0.189)	0.048 (0.168)
Other public four-year		-0.265* (0.054)	-0.281 (0.164)	-0.007 (0.196)	-0.216** (0.108)
Two-year		-0.082** (0.037)	0.155 (0.218)	0.294** (0.124)	-0.133** (0.039)

# Appendix: School Quality Results - State Fixed Effects

	Home Price Change (\$10,000)			
	All Colleges	Four Year	Public Four Year	Two Year
25 <sup>th</sup> %tile Math SAT	1.288** (0.415)	0.928** (0.356)	0.825** (0.402)	.
75 <sup>th</sup> %tile Math SAT	0.938** (0.371)	0.607* (0.314)	0.624 (0.385)	.
Faculty-Student Ratio	0.0004** (0.0001)	0.0003** (0.0002)	0.0003* (0.0002)	-0.00001 (0.00004)
Expend./ Per Student	420.351** (113.576)	451.243** (189.838)	342.076 (222.270)	11.655 (20.569)
Inst. Expend./Student	101.462** (23.930)	83.517** (31.874)	66.025* (39.678)	12.382 (11.052)
Graduation Rate	0.0023** (0.0008)	0.0018** (0.0008)	0.0023** (0.0010)	.
In-state Tuition	40.925 (36.970)	-34.501 (53.608)	29.134** (9.453)	.
Out-of-state Tuition	122.169** (31.888)	56.944* (33.701)	84.427** (26.426)	.