How Firms respond to Business Cycles: The Role of Firm Age and Firm Size

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Motivation and Result

Motivation:

- Debate in differences in cyclical dynamics of firm size/age
- Different results come from different cyclical indicators

Result:

- Young, small firms encounter large declines in employment rate
- Housing price is critical in impact on young, small firms

Literature

Small firms have disproportionate response:

- Gertler and Gilchrist (1994)
- Chari, Christiano and Kehoe (2007)

Large firms have disproportionate response:

- Moscarini and Postel-Vinay (2012)

Key factor missing: distinction between firm size and firm age

"Up or out" dynamic of young firms with selection/learning effects:

- Differentiated products (Melitz 2003)
- Uncertainty to be resolved from learning (Jovanovic 1982)

Data Source

Business Dynamics Statistics: based on Longitudinal Business Database

Unemployment rate:

- national: CPS from BLS, 1979-2010
- state-level: BLS regional

Real GDP and Real Personal Income: BEA

Housing Prices: FHFA House Price Index

- Mortgage transactions on single-family properties
- through Fannie Mae or Freddie Mac, starting 1975

Measurement

Firm size: total employment at enterprise level
Firm age:

- M & A: initiated at oldest establishment
- startups: set to 0

Two firm age groups:

- young: firms less than 5 years old
- older: firms 5 years old or older

Three firm size groups:

- small: less than 20
- medium: 20-499
- large: 500+

Measurement

"s": combinations of firm age and size groups
Net growth rate for size and age class "s" is given by

$$g_{st} = \frac{E_{st} - E_{st-1}}{X_{st}}$$

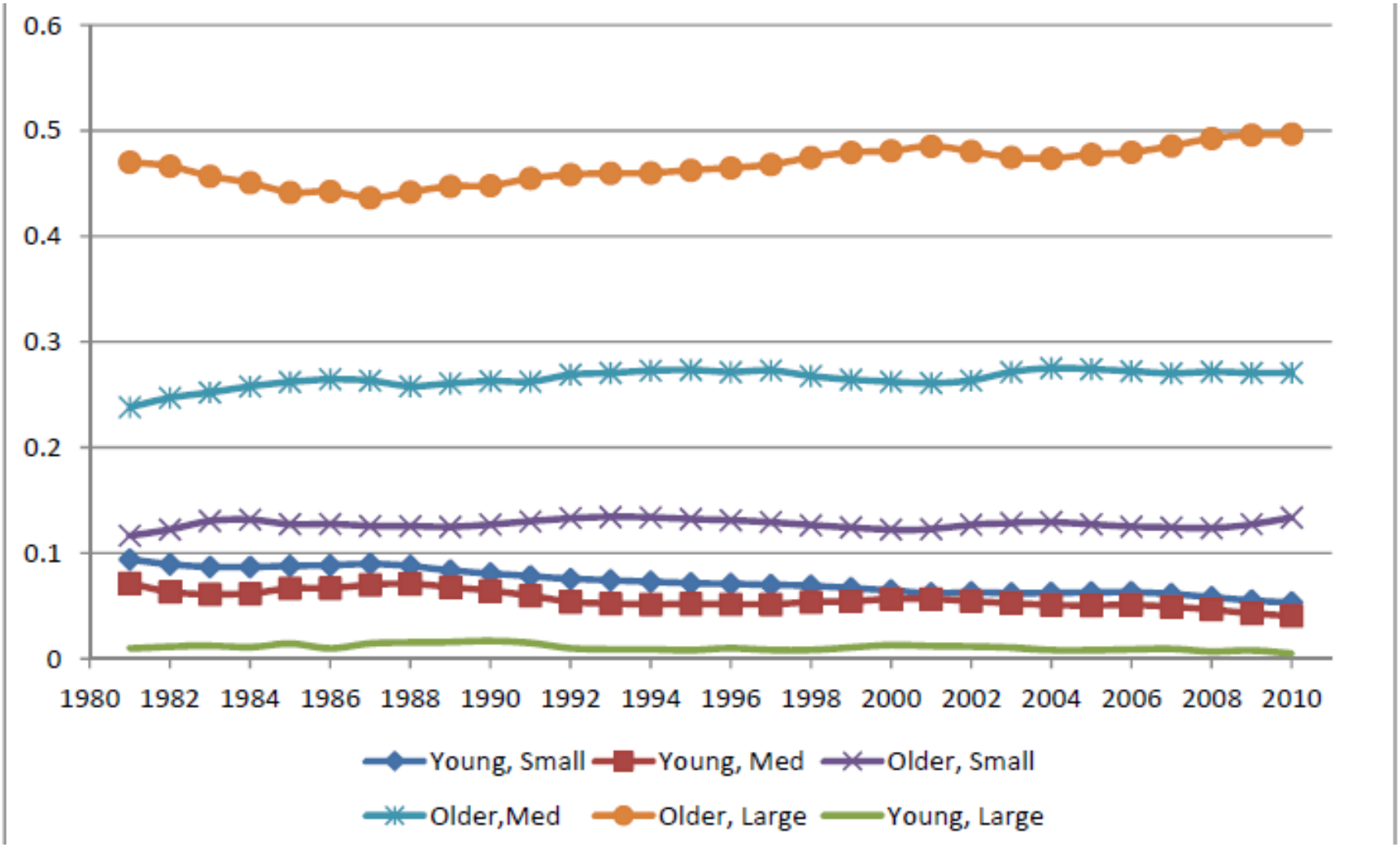
where $X_{st} = \frac{E_{st}+E_{st-1}}{2}$
E_{st-1} includes employment in $t-1$ of all establishments in "s" at time t

$$g_{st} = \sum_{e \in s} \frac{X_{est}}{X_{st}} \left(\frac{E_{est} - E_{est-1}}{X_{est}} \right) = \sum_{e \in s} \frac{X_{est}}{X_{st}} g_{est}$$

Net growth rates to aggregate is

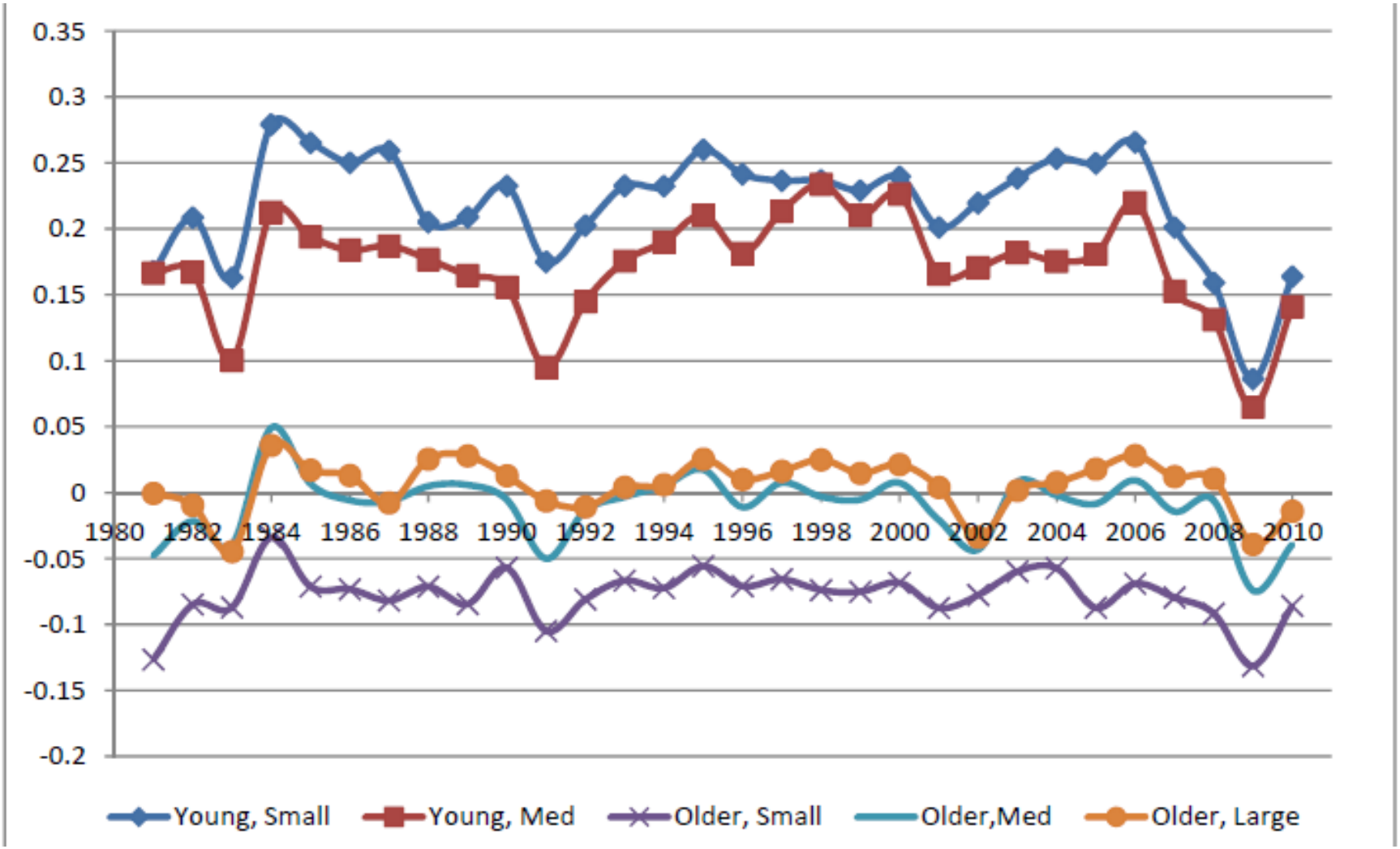
$$g_t = \sum_{s} \frac{X_{st}}{X_t} g_{st}$$

Share of Employment



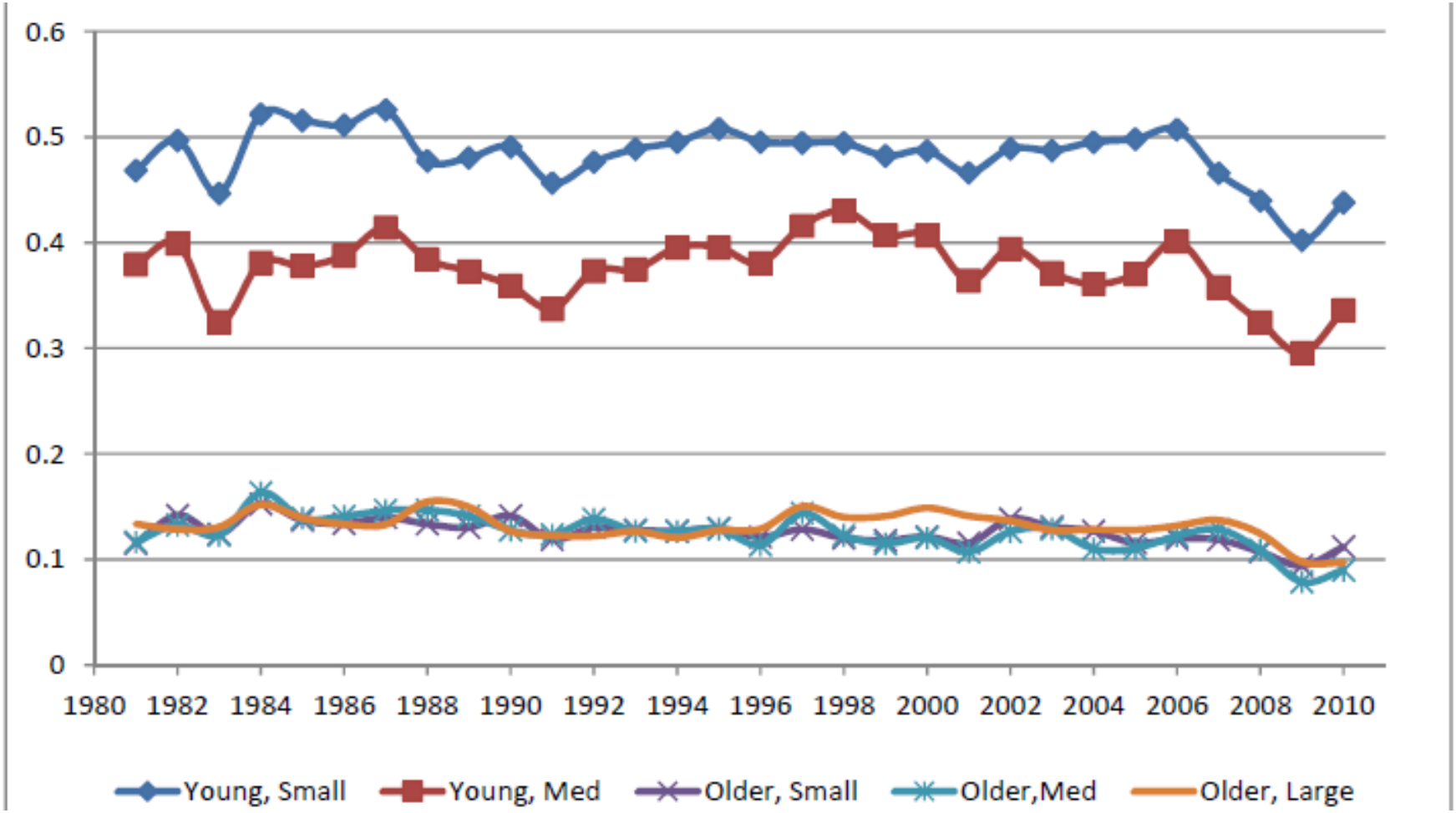
Young and large firms count less than 1%. Exclude from analysis.

Net Growth Rates

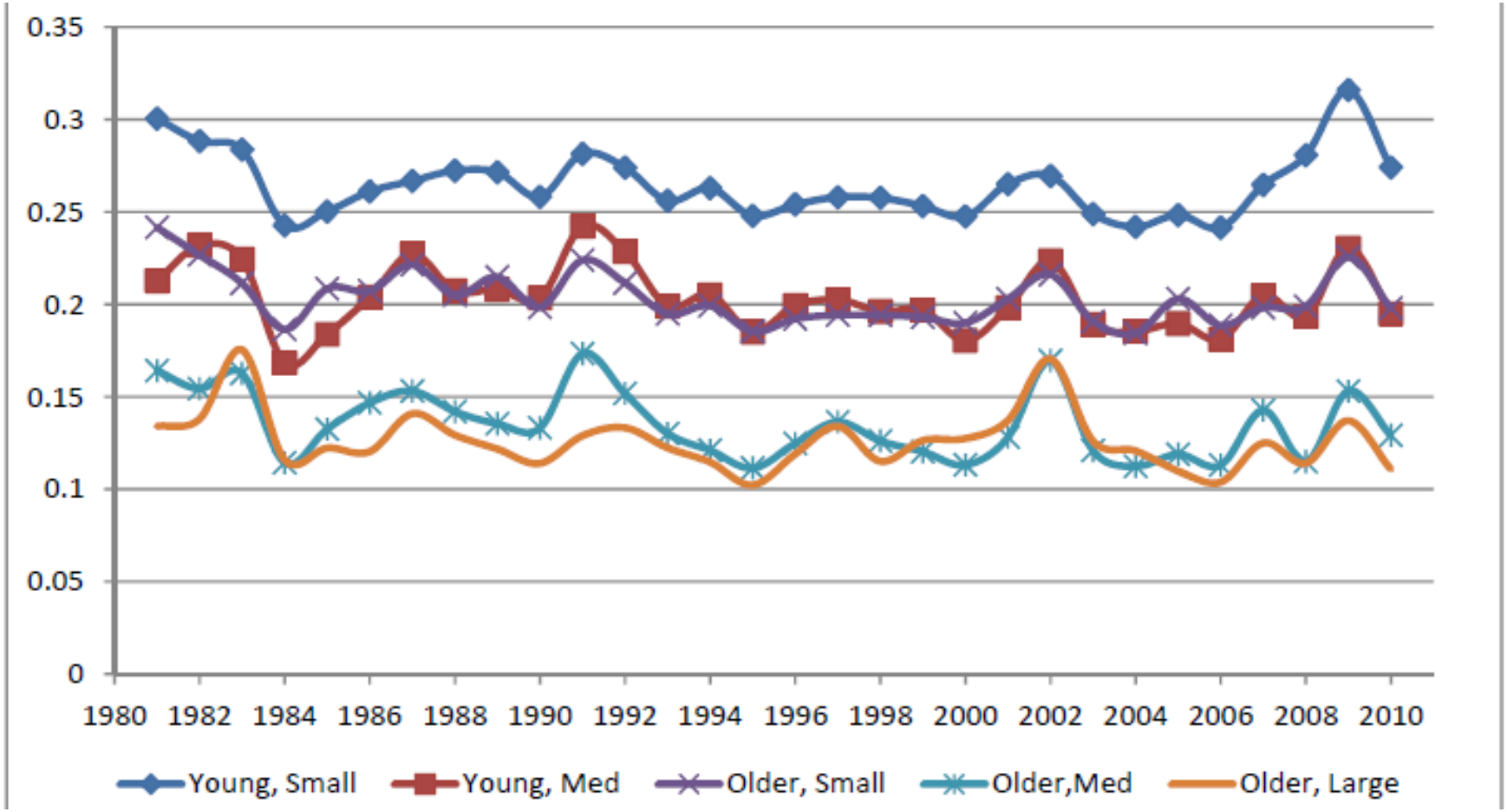


Young firms decline sharply during Great Recession.

Job Creation Rates

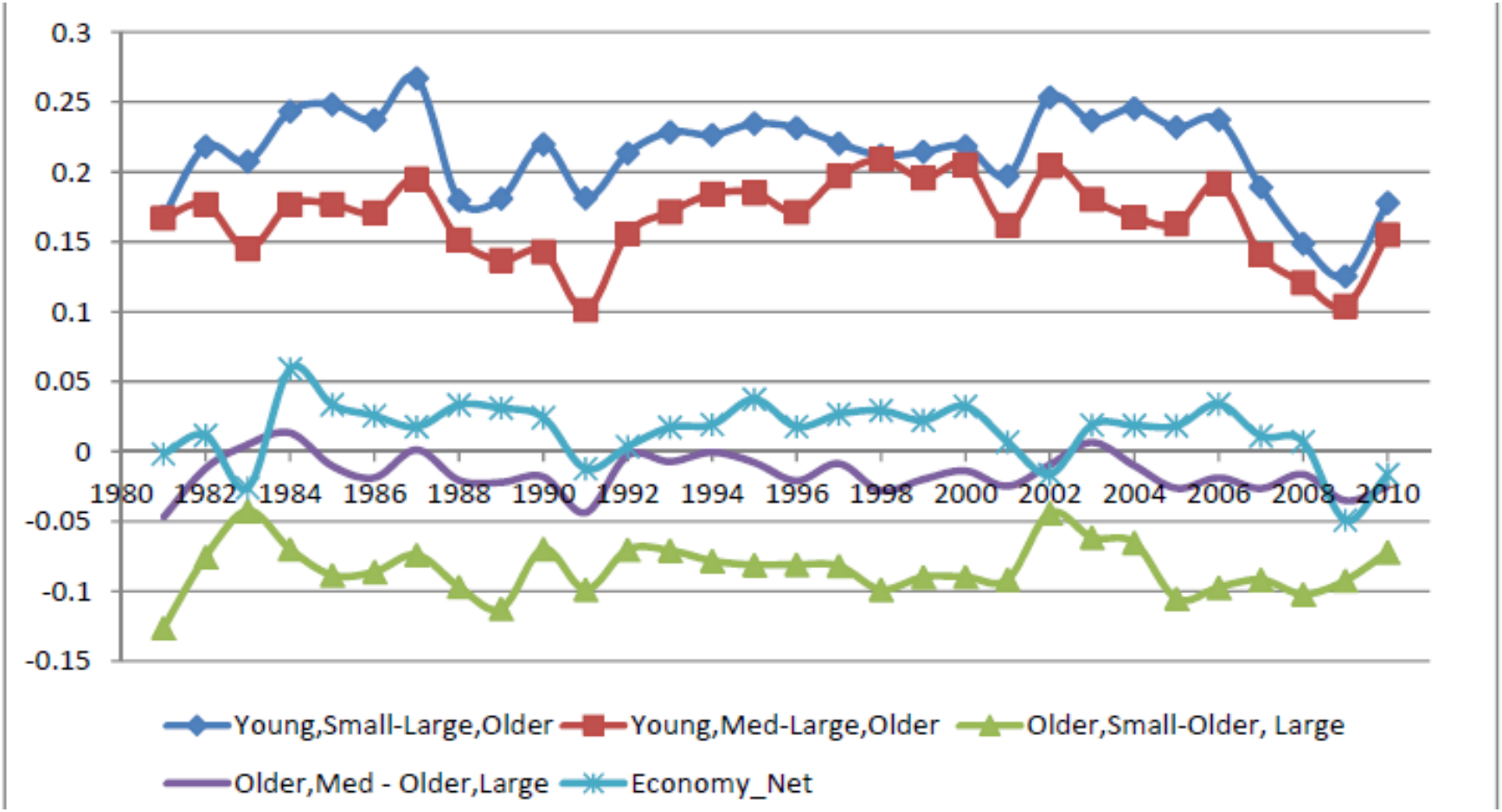


Job Destruction Rates



Young firms exhibit more variation over old firms.

Differences in Net Growth Rates



Net differential for young relative to large fell substantially.

Correlations with Net Growth Rates

	Change in Unemp Rate		Net Emp. Growth Rate		Real GDP Growth		HP Filtered Unemp Rate	
	1981-2010	1981-2006	1981-2010	1981-2006	1981-2010	1981-2006	1981-2010	1981-2006
Young/Small-Older/Large	-0.452	-0.292	0.551	0.279	0.527	0.305	0.239	0.215
	(0.012)	(0.148)	(0.002)	(0.168)	(0.003)	(0.130)	(0.203)	(0.292)
Young/Medium-Older/Large	-0.342	-0.263	0.507	0.329	0.475	0.344	0.125	-0.057
	(0.064)	(0.194)	(0.004)	(0.101)	(0.008)	(0.085)	(0.512)	(0.782)
Older/Small-Older/Large	0.283	0.342	0.146	-0.258	-0.171	-0.242	0.608	0.620
	(0.130)	(0.087)	(0.441)	(0.204)	(0.367)	(0.233)	(0.000)	(0.001)
Older/Medium-Older/Large	-0.218	-0.075	0.403	0.267	0.313	0.162	0.391	0.551
	(0.247)	(0.715)	(0.027)	(0.188)	(0.092)	(0.429)	(0.033)	(0.004)

Note: P-values in parentheses.

HP filtered unemp rate has different properties than cyclical indicators

Descriptive Regressions

	(1)	(2)	(3)	(4)
	diff_net_rate_11	diff_net_rate_21	diff_net_rate_12	diff_net_rate_22
Bivariate				
Chg_UR_st	−2.207***	−1.432***	−0.570***	−0.479***
	(0.212)	(0.248)	(0.142)	(0.140)
Multivariate				
Chg_UR_st	−1.916***	−1.347***	−0.484***	−0.437**
	(0.213)	(0.253)	(0.144)	(0.143)
GR_HPrice_st	0.183***	0.054	0.054**	0.026
	(0.027)	(0.032)	(0.018)	(0.018)
N	1,530	1,530	1,530	1,530

The dependent variable is the differential net employment growth rate for the group specified. Note 11 = Young/Small, 21 = Young/Medium, 12 = Old/Small, 22 = Old/Medium. All net differentials are with respect to Old/Large. Ch_UR_st is the state unemployment growth rate; GR_HPrice_st is the growth rate of the state's real FHFA housing price index. Standard errors in parentheses. *p<0.05, **p<0.01, ***p<0.00.

Control for both state and year effects

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Top panel: difference in net growth rate $\sim$ change in unemployment

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Lower panel: include housing price growth rates

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Result robust to alternative cyclical indicators

Descriptive Regressions

	(1)	(2)	(3)	(4)
	diff_net_rate_11	diff_net_rate_21	diff_net_rate_12	diff_net_rate_22
Bivariate				
HP_UR_st	–2.406***	–0.914*	–0.885***	–0.456*
	(0.347)	(0.401)	(0.227)	(0.225)
Multivariate				
HP_UR_st	–1.731***	–0.657	–0.708**	–0.353
	(0.355)	(0.417)	(0.236)	(0.234)
GR_HPrice_st	0.195***	0.074*	0.051**	0.030
	(0.028)	(0.033)	(0.019)	(0.019)
N	1,530	1,530	1,530	1,530

The dependent variable is the differential net employment growth rate for the group specified. Note 11 = Young/Small, 21 = Young/Medium, 12 = Old/Small, 22 = Old/Medium. All net differentials are with respect to Old/Large. HP_UR_st is the HP-filtered state unemployment rate; GR_HPrice_st is the growth rate of the state's real FHFA housing price index. Standard errors in parentheses. *$p<0.05$, **$p<0.01$, ***$p<0.001$.

With HP-filtered data: robust, opposite to Moscarini and Postel-Vinay

Specification

Specification in following form

$$Y_{s,t} = A(L) Y_{st} + \text{State}_s + \text{Year}_t + \varepsilon_{st}$$

After absorbing state and year effects, MA representation

$$\hat{Y}_{s,t} = D(L) \varepsilon_{st} = B(L) \eta_{st}$$

η_{st} represents structural innovations
Use a Cholesky causal ordering here, i.e.

$$B(L) = B_o D(L)$$

where B_o is a simple lower triangular matrix

Identification

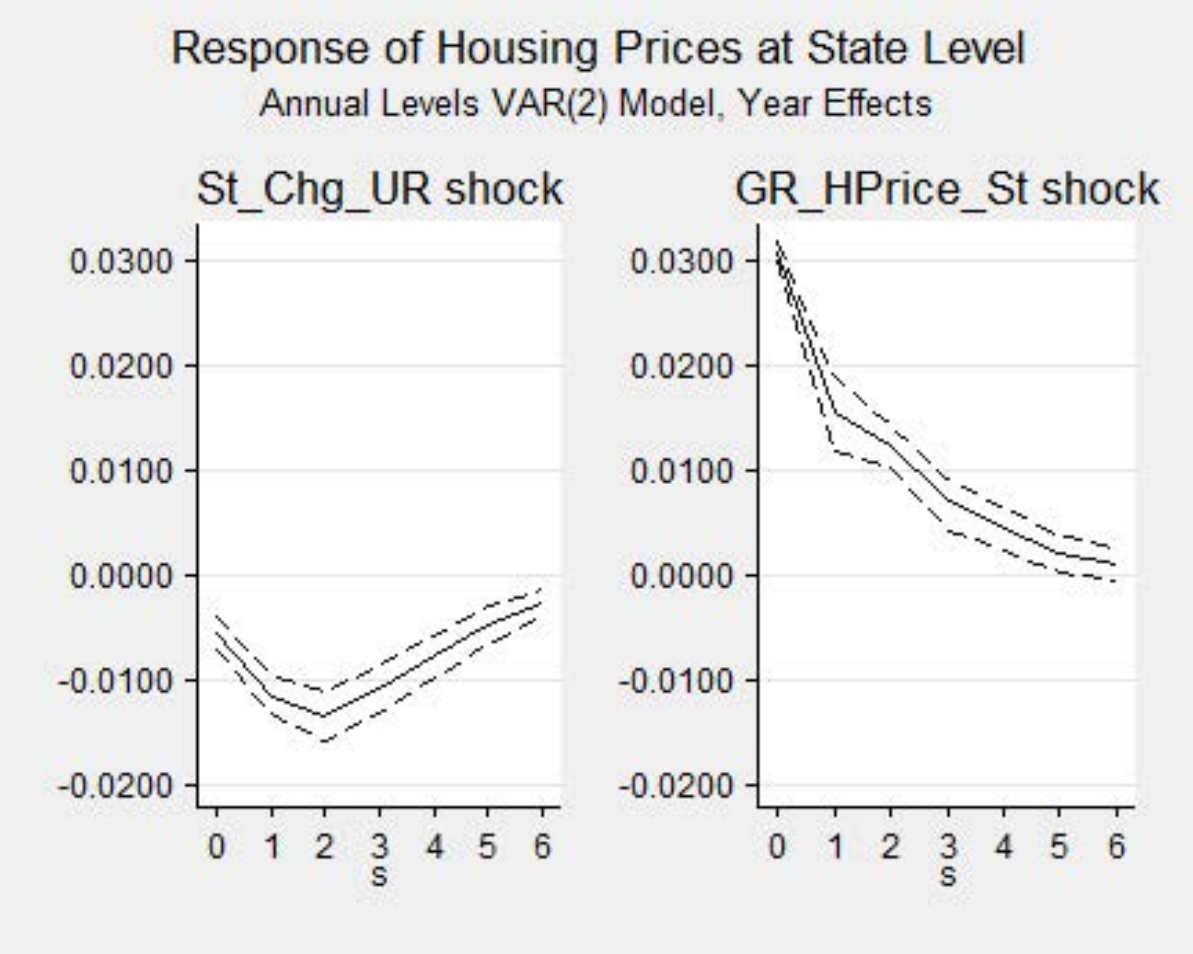
$$Y_{s,t} = \{\Delta \text{Unemployment}, \Delta \text{HousingPrice}, \text{NetGrowthDifference}\}$$

- Control for state and year effects
- Put change in unemployment rate first in causal ordering

Focus attention on first two innovations:

- unobserved state-specific cyclical innovation
- state-specific housing price growth innovation

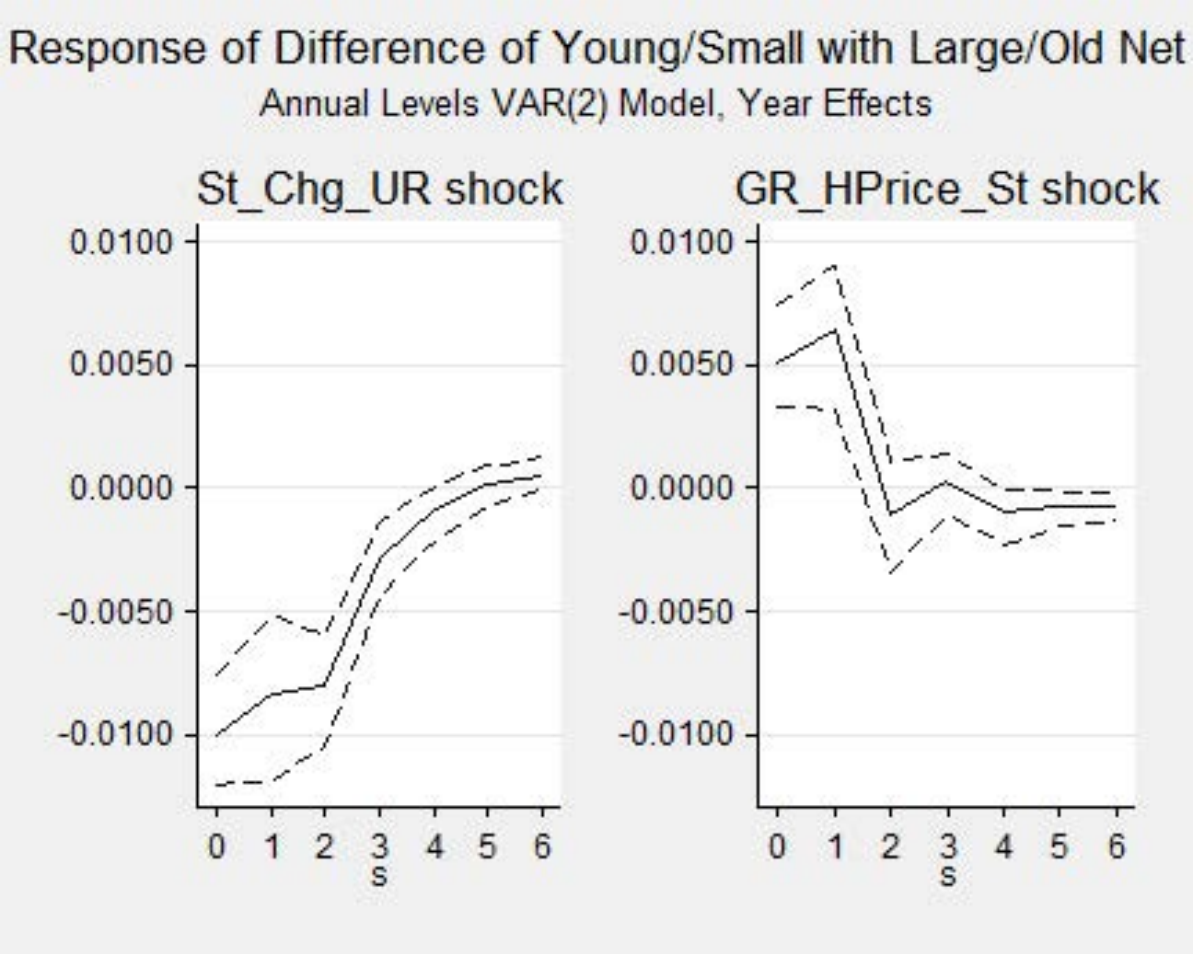
Housing Prices



Innovation to state-specific cyclical shock yields a decline

Housing price innovation generates a persistent increase

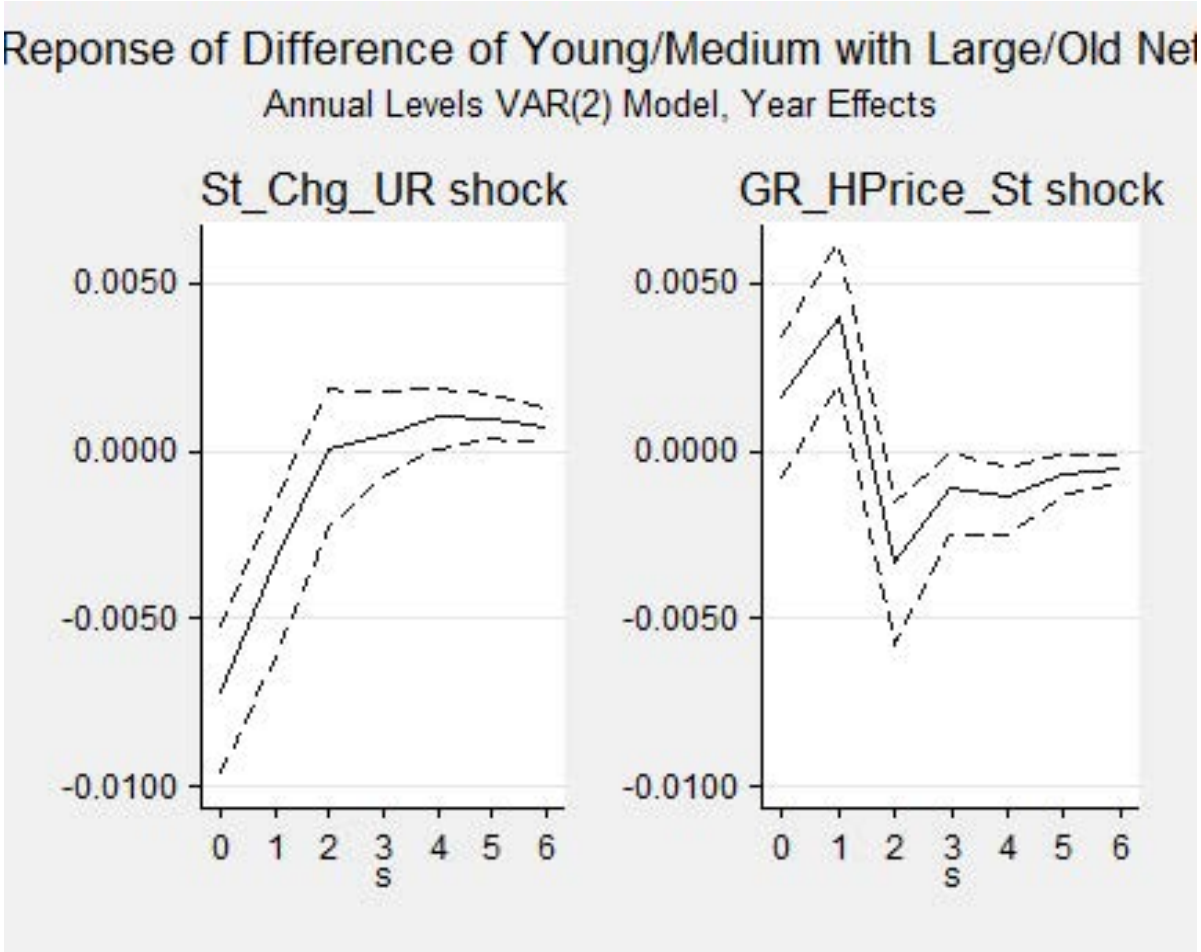
Net Differential of Young, Small



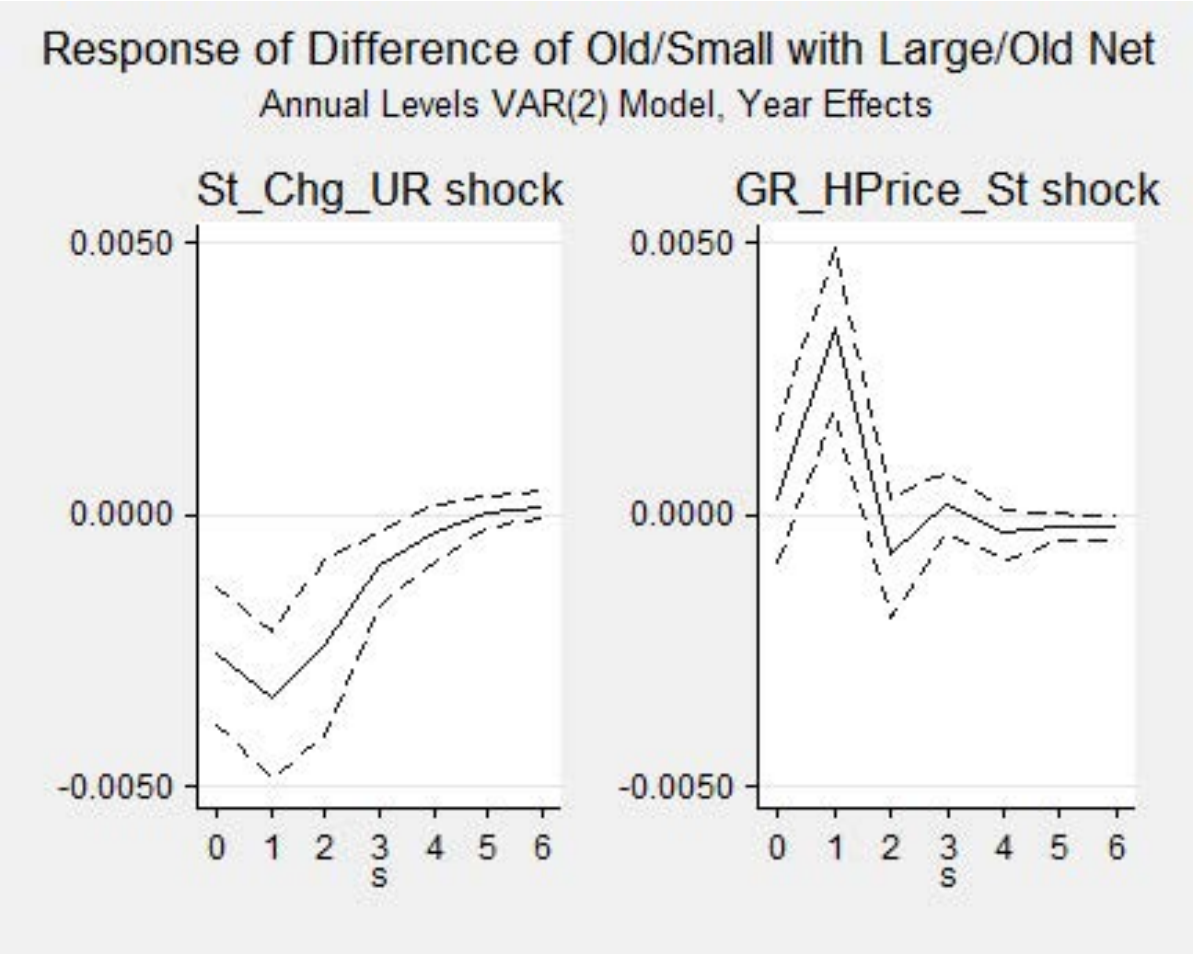
State-specific cyclical shock narrows the differential

Increase in housing prices widens the differential

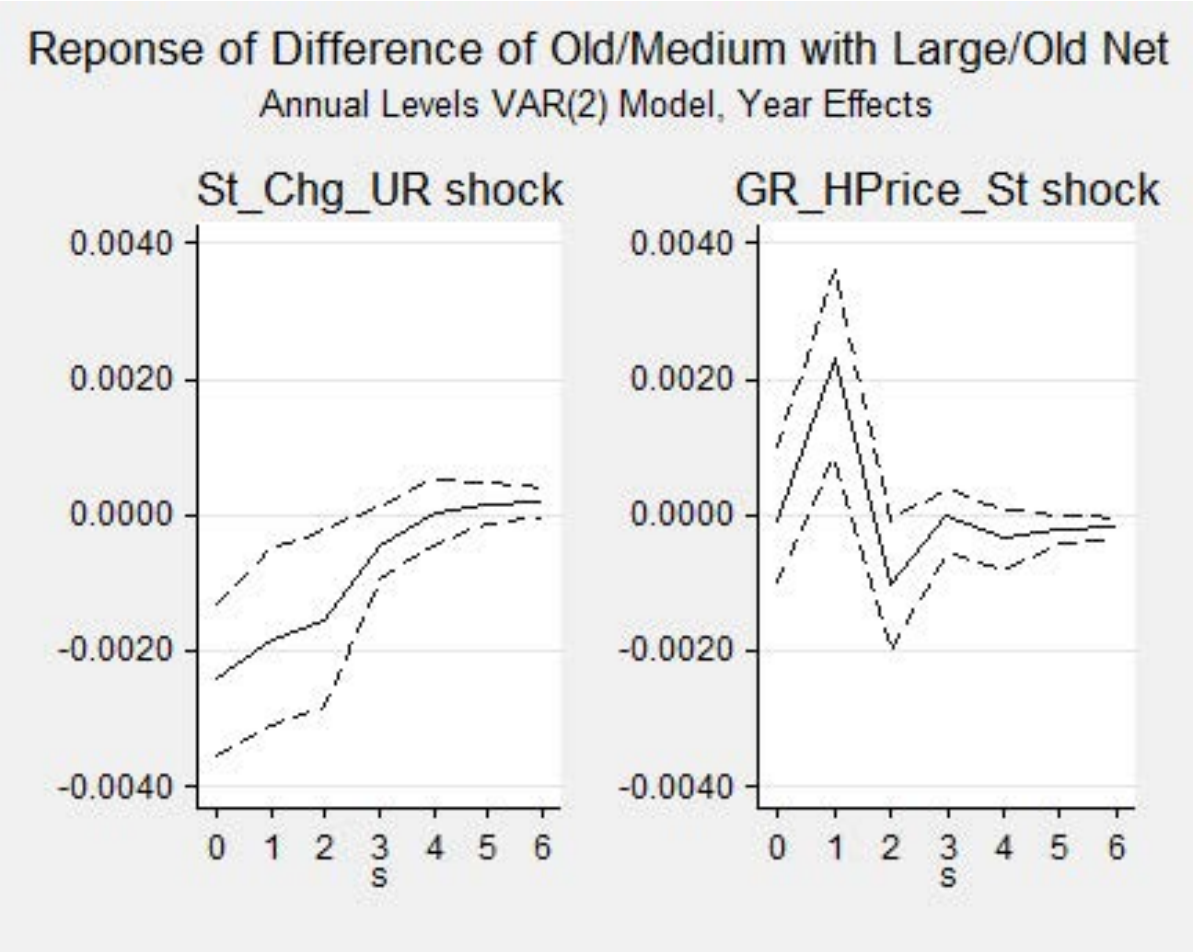
Net Differential of Young, Medium



Net Differential of Old, Small



Net Differential of Old, Medium



Summary of IRFs

Response to cyclical downturns:

- Narrow the net differential
- Largest effect for young/small, smallest for old ones

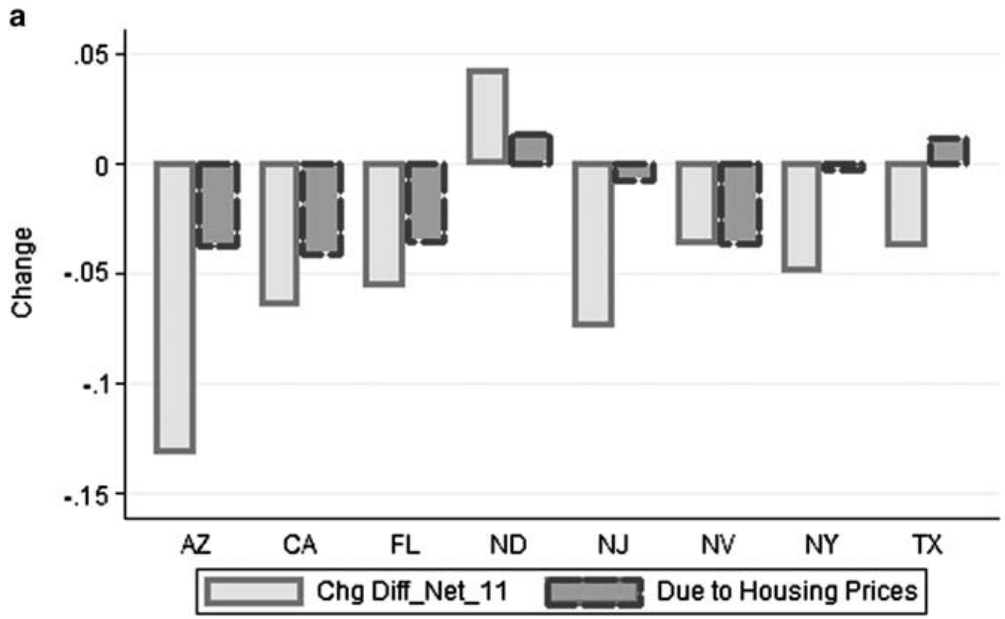
Response to housing price innovations:

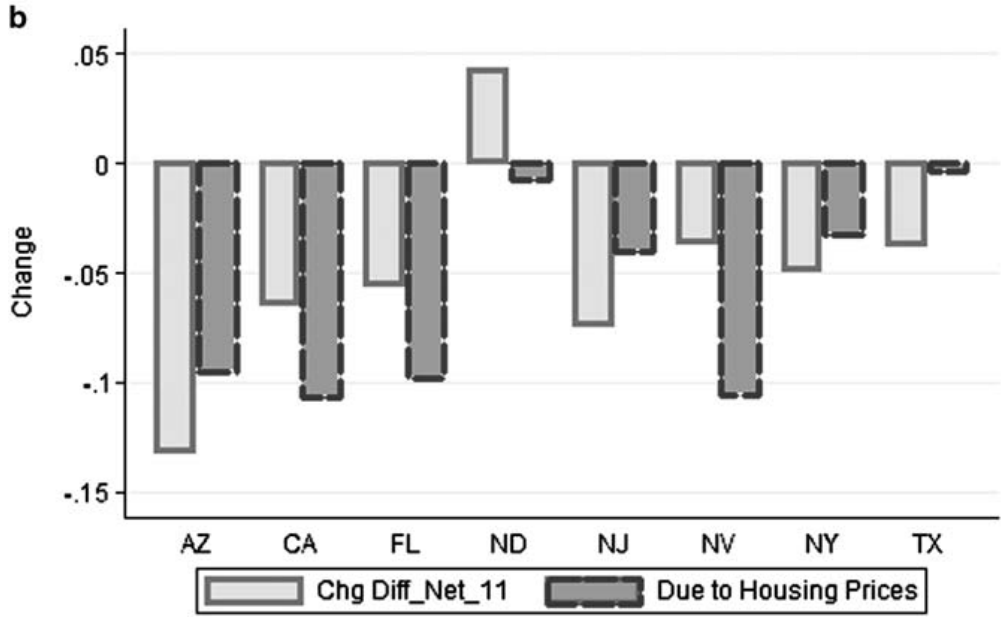
- tend to increase the differential
- i.e. a decrease in housing prices narrows the net differential
- Largest effect for young/small and young/medium

Real Housing Price Changes

Housing price explains net differential cross-state

- a: state-specific housing price growth
- b: including national variation





Summary of Results by Sector

Plot net differential for young/small relative to old/large

State-specific cyclical shock decreases the net differential for all sectors

In Construction, Retail Trade, FIRE, Services, housing prices and net differential comove
In Manufacturing, Wholesale Trade, Transportation, Public Utilities, housing prices and net differential have negative correlation

- higher startup, fixed costs
- home equity play a small role

Conclusion

- Young, small firms have large declines during recession
- Housing prices is critical factor for this sensitivity