Supply restrictions, subprime lending and regional US housing prices

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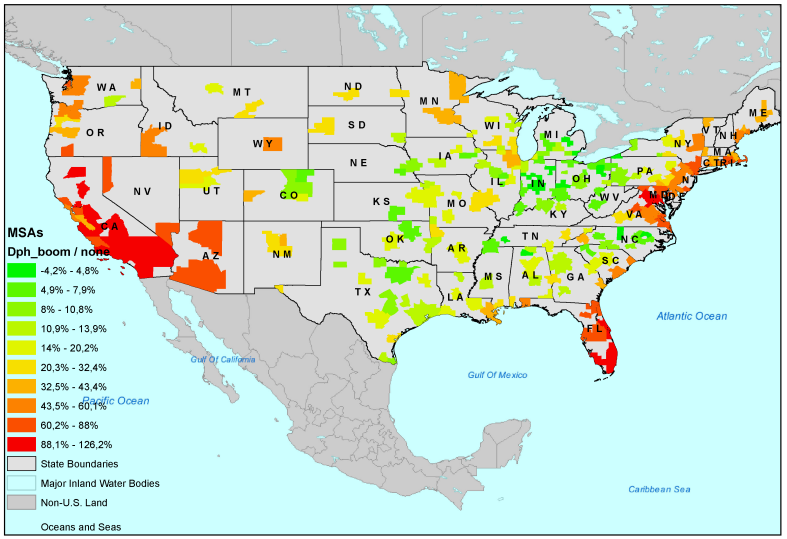
Large regional variation in housing price volatility over the recent cycle:

Boom period price increase



Bust period price decrease

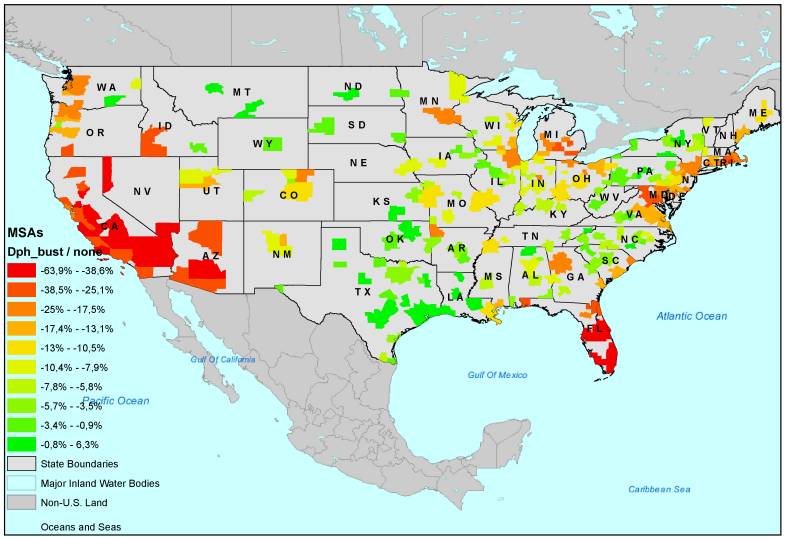


Figure : Percentage change in housing prices over the 2000–2006 boom and 2006–2010 bust period, across 247 metropolitan statistical areas

Supply restrictions as a possible explanation?

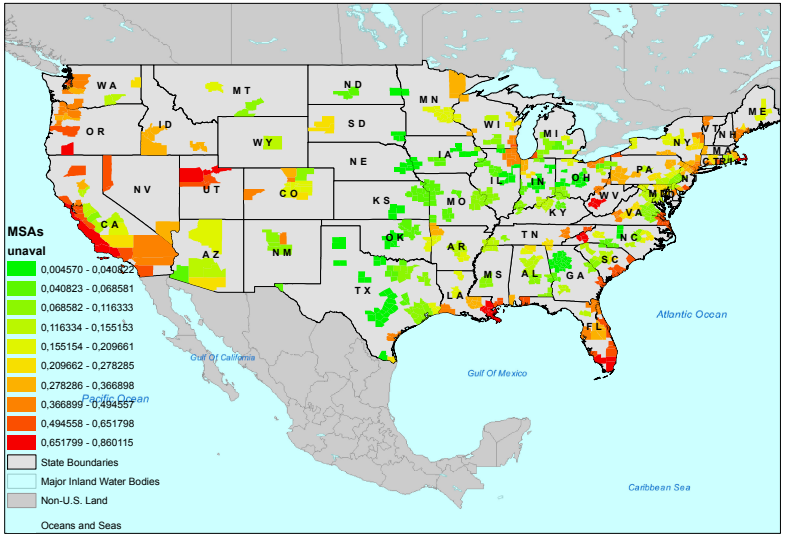
This has been studied by Glaeser et.al (2008) and Huang and Tang (2012), finding significant effects of regional differences in man-made and nature-given supply restrictions:

- Saiz (2010) develops an index for **physical supply restrictions** (UNAVAL)
- Gyourko et.al (2008) construct a **regulatory supply restriction index** (WRLURI)

Both types of restrictions are sought to affect the **housing supply elasticity**, and will therefore affect regional housing price dynamics.

Large regional variation in supply restrictions:

UNAVAL (Physical res.)



WRLURI (Regulatory res.)

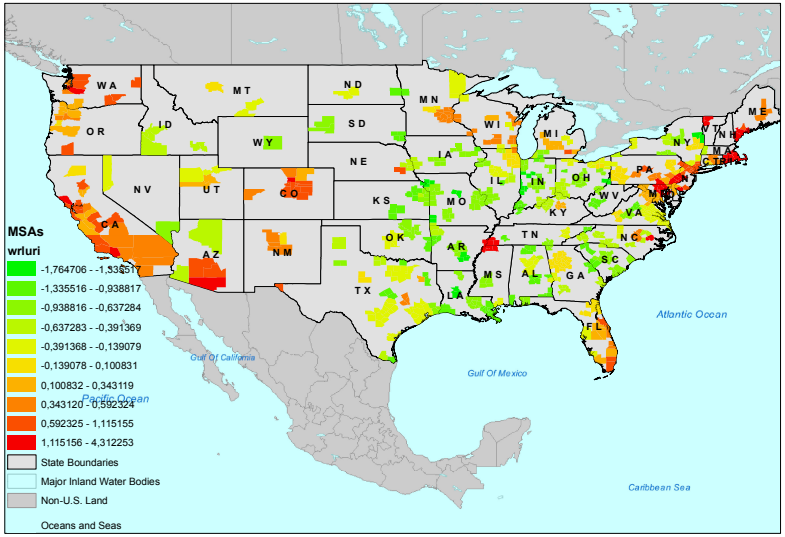
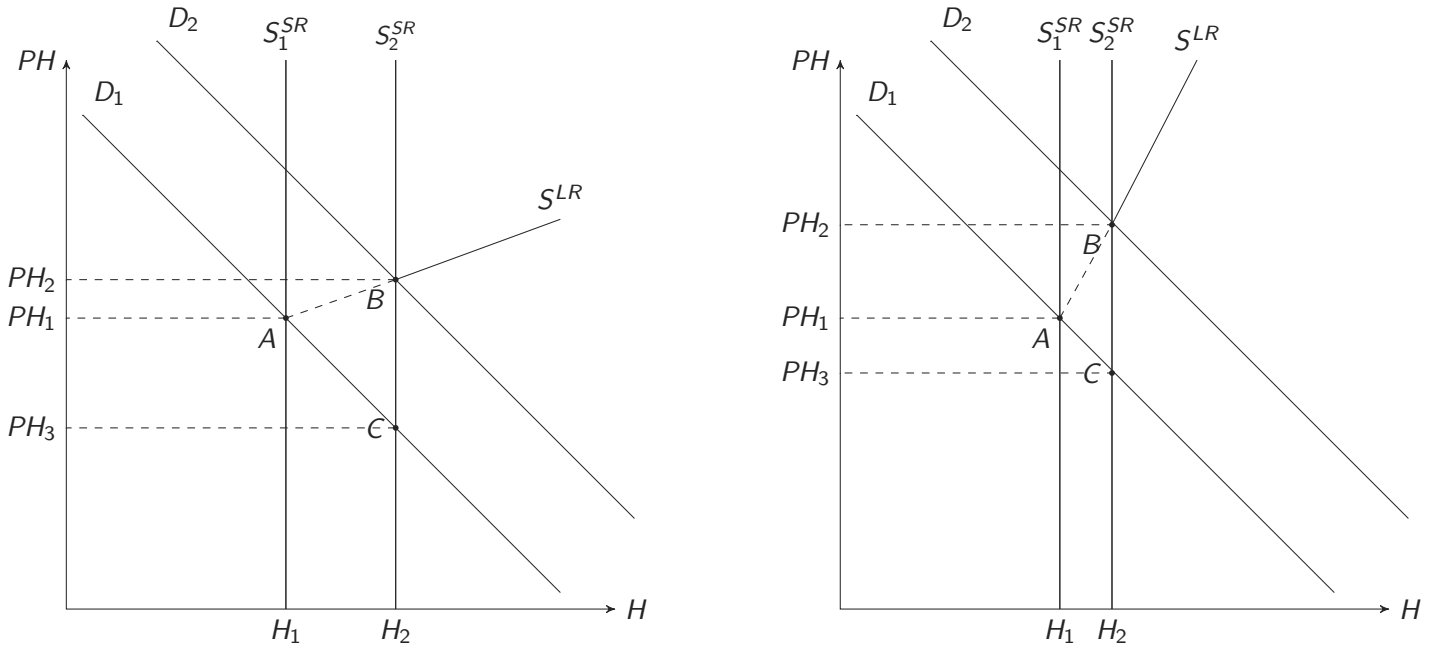


Figure : Supply restriction indexes, across 247 metropolitan statistical areas

Conjectures from a standard supply-demand story:

(a) Elastic housing supply (b) Inelastic housing supply



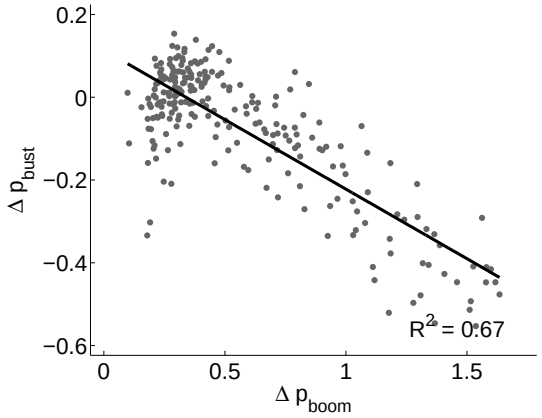
i) The supply elasticity only affects the relative size of the boom period supply vs. price response, and **ii**) not the size of the bust period price drop.

Puzzling results from previous single price equation studies

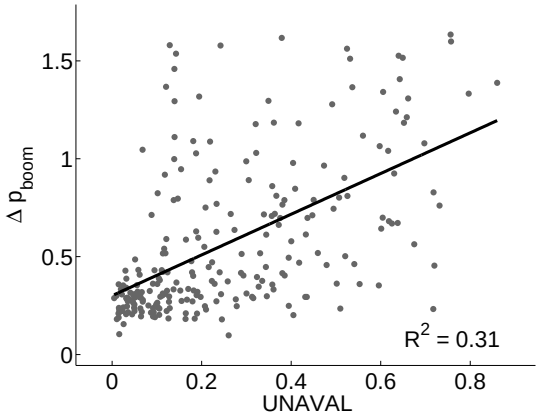
- Both Glaeser et.al (2008) and Huang and Tang (2012) find a greater boom price response in more supply restricted areas.
- Glaeser et.al (2008) finds that the bust period price drop is unrelated to supply restrictions (1990-1996).
- Huang and Tang (2012) finds a positive relation between supply restrictions and the bust period price drop (2006-2009).

Our data indicate the same puzzles

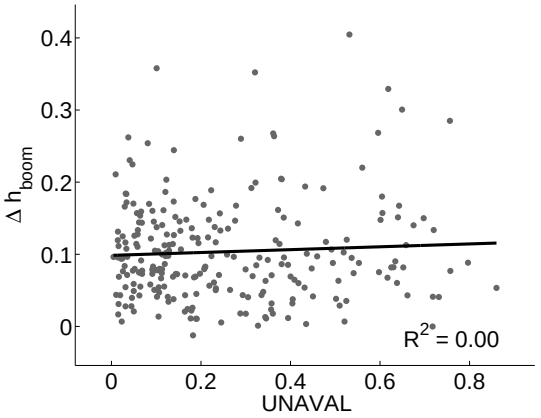
Bust price drop × boom price increase



Boom price increase × UNAVAL



Boom supply increase × UNAVAL



We ask three key questions

1. Is there evidence of a regional specific financial accelerator that is (indirectly) dependent on the degree of supply restrictions?
2. How does this explain the price **and** supply response during the boom in relation to supply side restrictions?
3. Does supply restrictions matter for the size of the bust?

We use system based methods (FIML) and data on 247 Metropolitan Statistical Areas (MSAs) for the recent US housing cycle to address these questions.
Specifically, we focus on the effects of shocks to subprime lending.

Outline for the rest of the talk

Theoretical motivation

Empirical model

Results

Conclusions

Supply and demand relations for heterogeneous markets

Supply: In the paper we derive the following regional log-supply relation, assuming a relatively standard MC-function:

$$h_{i,t} = h_{i,t-1} + max\left(0, \varphi_i(p_{i,t} - c_{i,t})\right)$$

where $h_{i,t}$ is the log housing stock, φ_i is the regional specific supply elasticity, $p_{i,t}$ is the the log of housing prices and $c_{i,t}$ represent construction costs.

Demand: From the life-cycle model we have the following demand relation:

$$p_{i,t} = \tilde{v}_{0,i,t} + v_1 h_{i,t} + \eta b_{i,t} \quad ; \tilde{v}_1 < 0, \eta \geq 0$$

where $b_{i,t}$ measures log credit availability and $\tilde{v}_{0,i,t}$ is a vector of other demand shifters.

Further we assume a financial accelerator effect

For the boom period, we follow Kyiotaki and Moore (1997) and others, assuming that credit, $b_{i,t}$, is endogenously related to housing prices (as collateral):

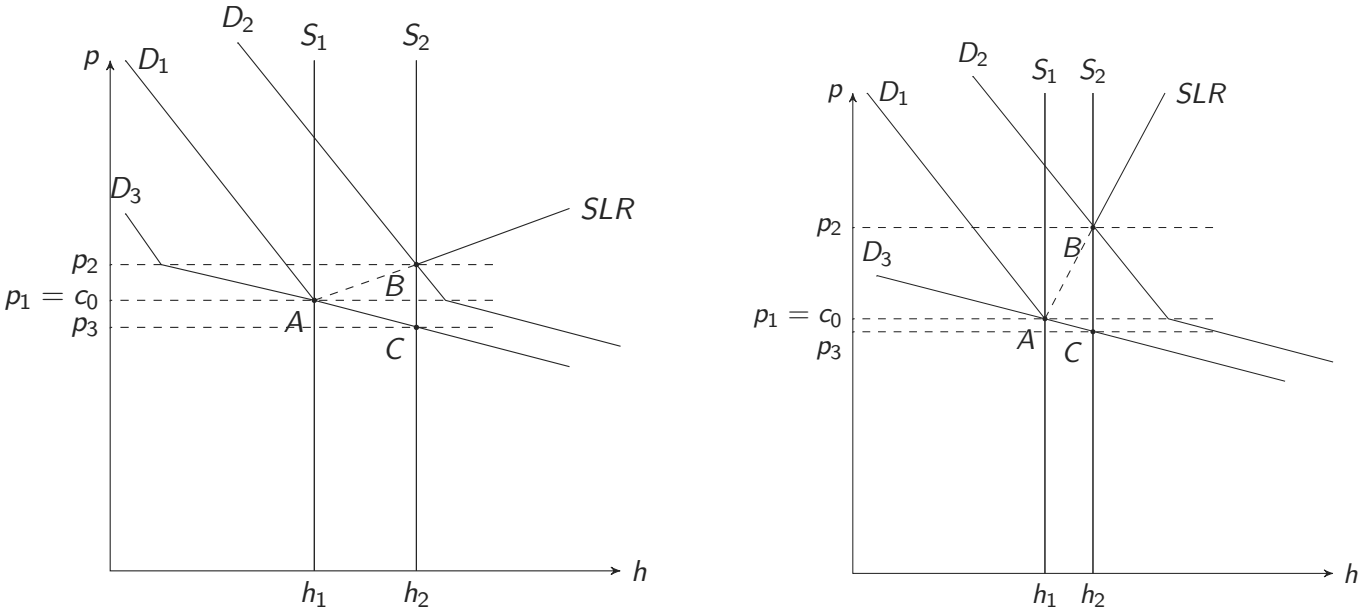
$$b_{i,t} = \begin{cases} \kappa_0 + \kappa_1 p_{i,t} & \text{, for } p_{i,t} > p_{i,t-1} \\ \kappa_0 & \text{, otherwise} \end{cases} \tag{1}$$

Substituting out for (1) in the demand equation gives:

$$p_{i,t} = \begin{cases} \frac{1}{1-\eta\kappa_{1,t}} \left[\tilde{v}_{0,i,t} + \eta\kappa_0 + v_1 h^d_{i,t} \right] & \text{, for } p_{i,t} > p_{i,t-1} \\ \tilde{v}_{0,i,t} + \eta\kappa_0 + v_1 h^d_{i,t} & \text{, otherwise} \end{cases} \tag{2}$$

Conjectures from this supply-demand FA theory:

(a) Elastic housing supply (b) Inelastic housing supply



i) The boom period price response is more dependent on the supply elasticity, while the supply response is less. **ii**) The bust period price drop is bigger in supply restricted areas.

Our data

For 247 Metropolitan Statistical Areas:

- The two regulation indexes alluded to above: WRLURI and UNAVAL.
- Registry data (HMDA) at the loan applicant level, used to construct a measure for the log cumulative increase in subprime lending per capita (Δsp).
- Percentage change in housing prices (Δph), housing stock (Δh), income (Δy) and construction costs (Δcc), based on FHFA, Moodys data and data from St.Louis FED.

Various control variables used in the literature (Main sources: US Census Bureau and Moodys).

The boom system

Based on the theory model in differences (2000–06):

$$
\begin{aligned}
\Delta ph_i^{Boom} &= \alpha_1 + \beta_{1,\Delta h}\Delta h_i^{Boom} + \beta_{1,\Delta sp}\Delta sp_i^{Boom} + \beta_{1,\Delta y}\Delta y_i^{Boom} + \varepsilon_{\Delta ph,i} \\
\Delta h_i^{Boom} &= \alpha_2 + \left(\beta_{2,\Delta ph} + \boldsymbol{\beta}'_{2,\Delta ph\times \mathbf{Reg}} \times \mathbf{Reg}_i\right)\Delta ph_i^{Boom} + \\
&\quad \beta_{2,\Delta cc}\Delta cc_i^{Boom} + \beta_{2,\Delta y}\Delta y_i^{Boom} + \varepsilon_{\Delta h,i} \\
\Delta sp_i^{Boom} &= \alpha_3 + \beta_{3,\Delta ph}\Delta ph_i^{Boom} + \boldsymbol{\beta}'_{\mathbf{w}}\mathbf{w}_i + \varepsilon_{\Delta sp,i}
\end{aligned}
$$

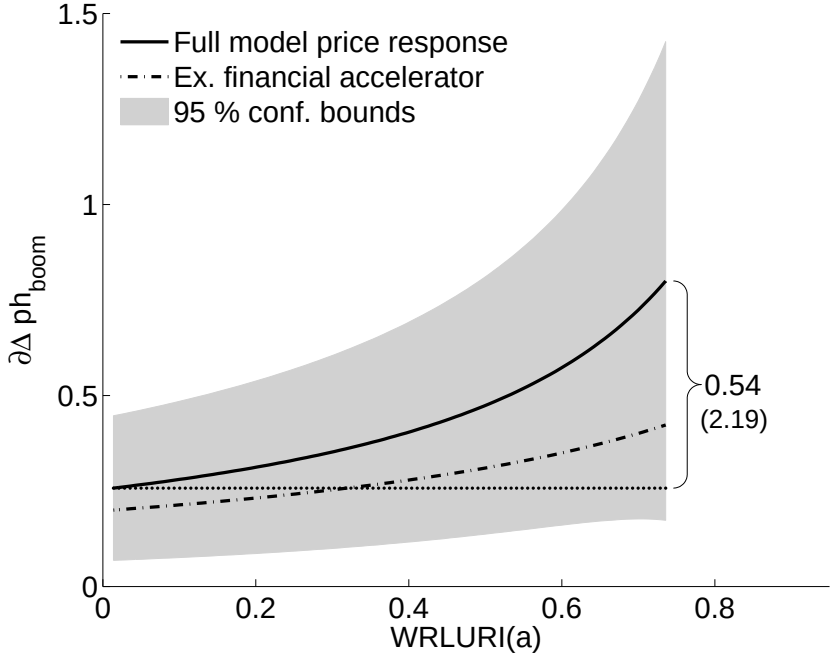
- We follow Mian and Sufi (2009) and use 1996 loan rejection rates to identify subprime equation ($\mathbf{w}$). Also consider LTI ratio as of 1996 (as in Wheaton and Nechayev (2008)).
- It is non-linear in the regional specific supply elasticity: $\beta_{2,\Delta ph} + \boldsymbol{\beta}'_{2,\Delta ph\times \mathbf{Reg}} \times \mathbf{Reg}_i$.
- We assume $\varepsilon_i's$ follow a joint normal, and estimate by FIML for the 2000–2006 boom period.

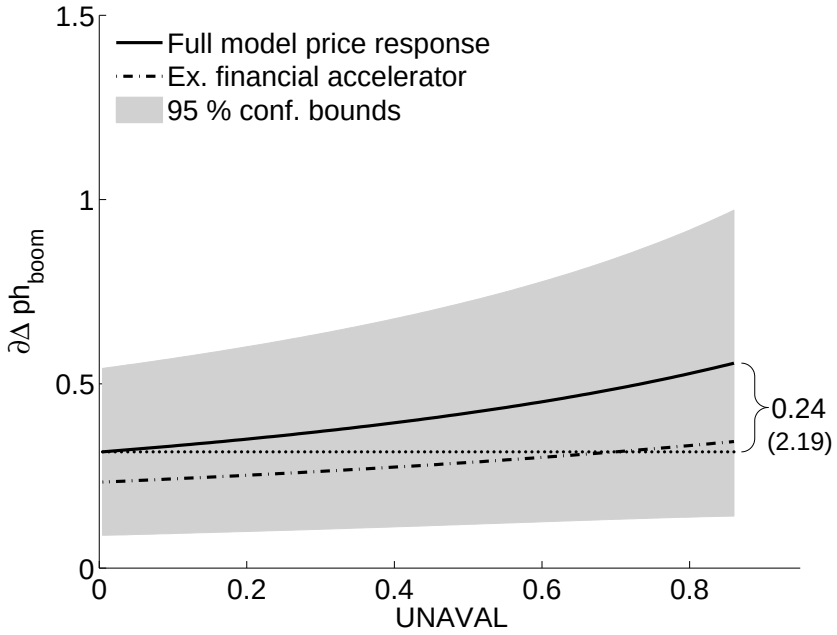
Results from supply-demand FA boom system

Variables	Δp_{boom}	Δh_{boom}	Δsp_{boom}
Δh_{boom}	-7.07 $(-3.64)^{***}$		
Δp_{boom}		0.33 $(3.07)^{***}$	1.11 $(6.41)^{***}$
Δsp_{boom}	0.61 $(9.92)^{***}$		
una $\times \Delta p_{boom}$		-0.14 $(-2.77)^{***}$	
wrl $\times \Delta p_{boom}$		-0.31 $(-2.76)^{***}$	
ΔHH income$_{boom}$	3.38 $(4.07)^{***}$	0.32 $(5.37)^{***}$	0.35 (1.06)
Δc. cost$_{boom}$		-0.10 $(-3.03)^{***}$	
Denial rate$_{1996}$			1.00 $(3.68)^{***}$
LTI$_{1996}$			-0.96 $(-1.83)^{*}$

Impulse responses in price

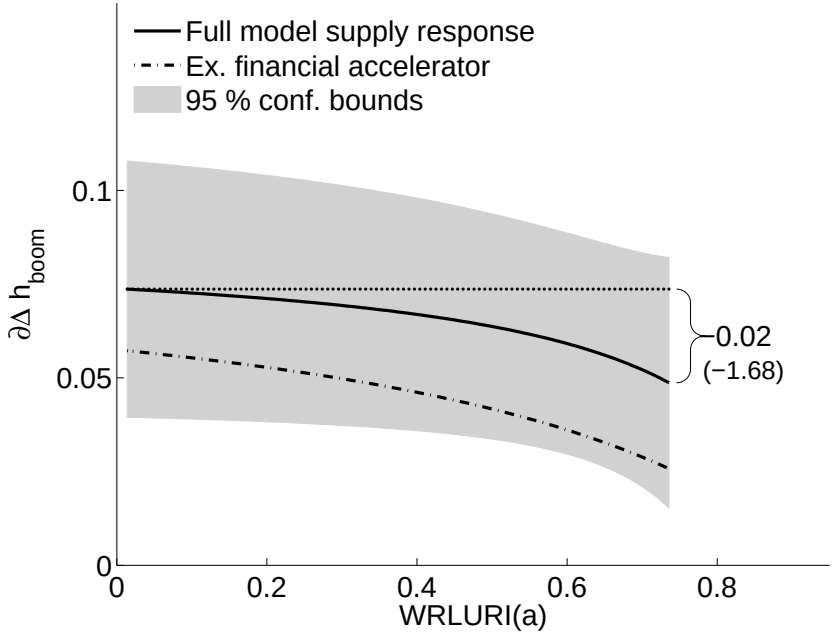
Housing price response during boom, following a 1 % shock to subprime lending:

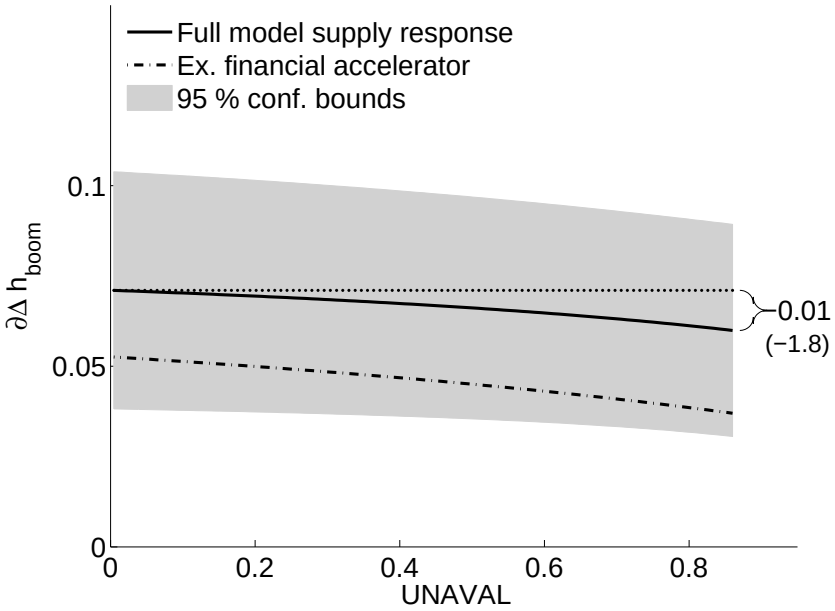




Impulse responses in supply

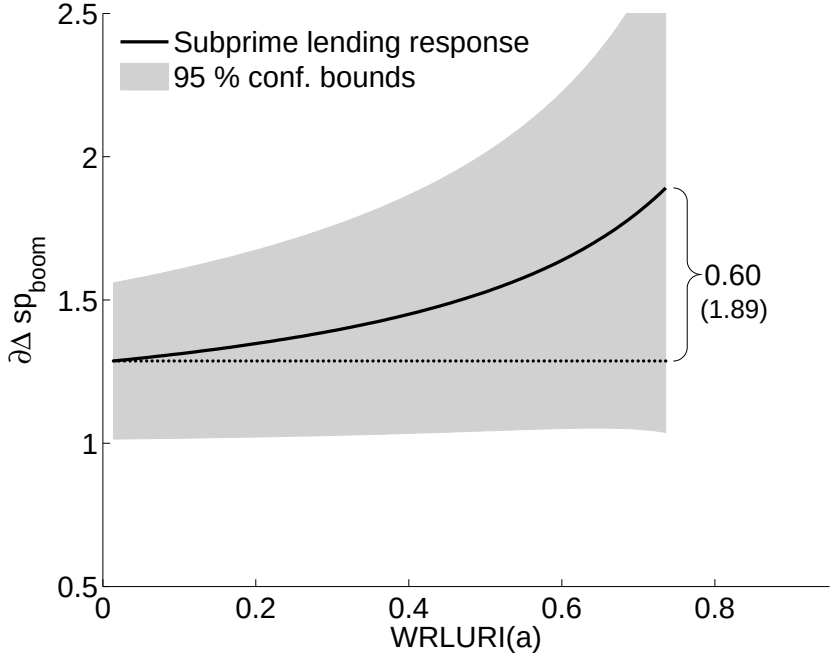
Housing supply response during boom, following a 1 % shock to subprime lending:

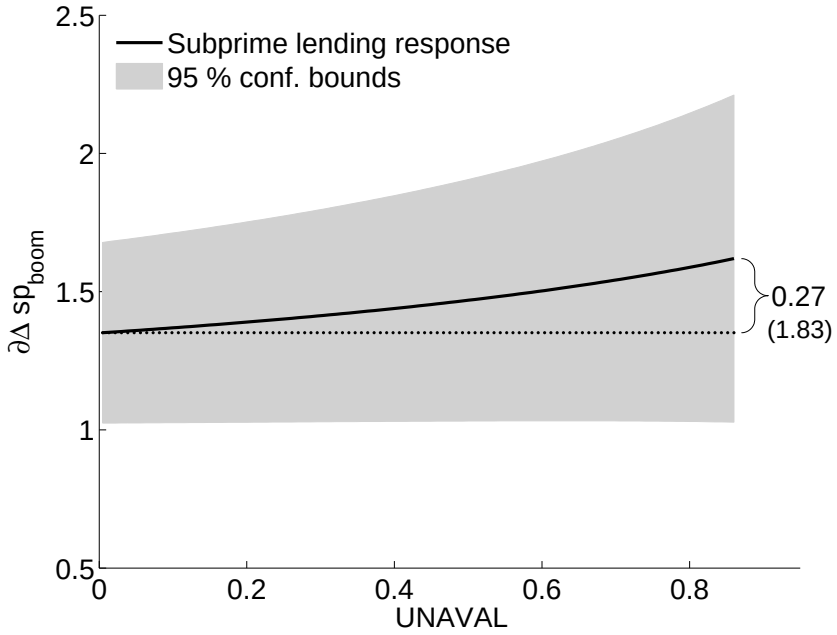




Impulse responses in subprime lending

Subprime lending response during boom, following a 1 % shock to subprime lending:





Extending with a bust period price equation

The bust period price equation:

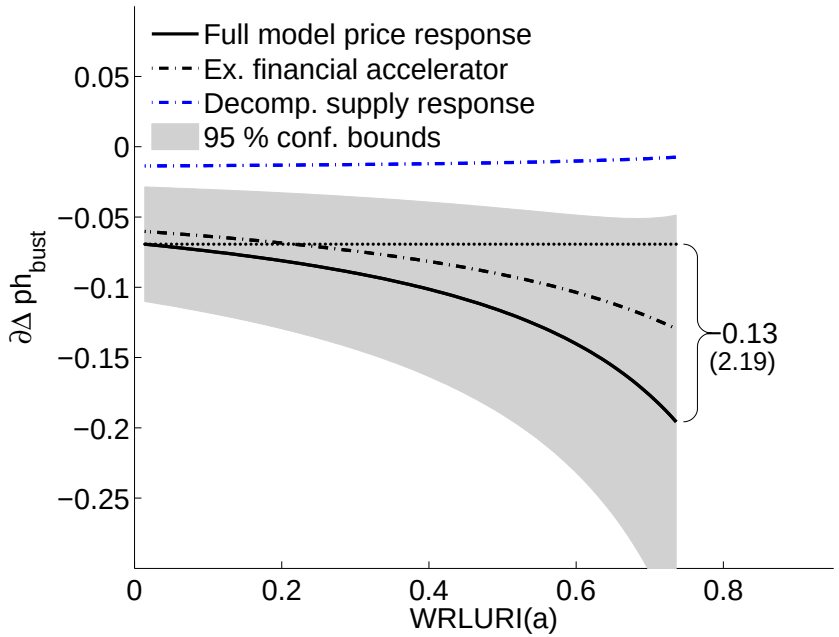
$$\Delta ph_i^{Bust} = \alpha_4 + \gamma_{\Delta ph}\Delta ph_i^{Boom} + \gamma_{\Delta h}\Delta h_i^{Boom} + \boldsymbol{\gamma}_{\mathbf{w}}'\mathbf{w}_i^{Bust} + \varepsilon_{3,i}$$

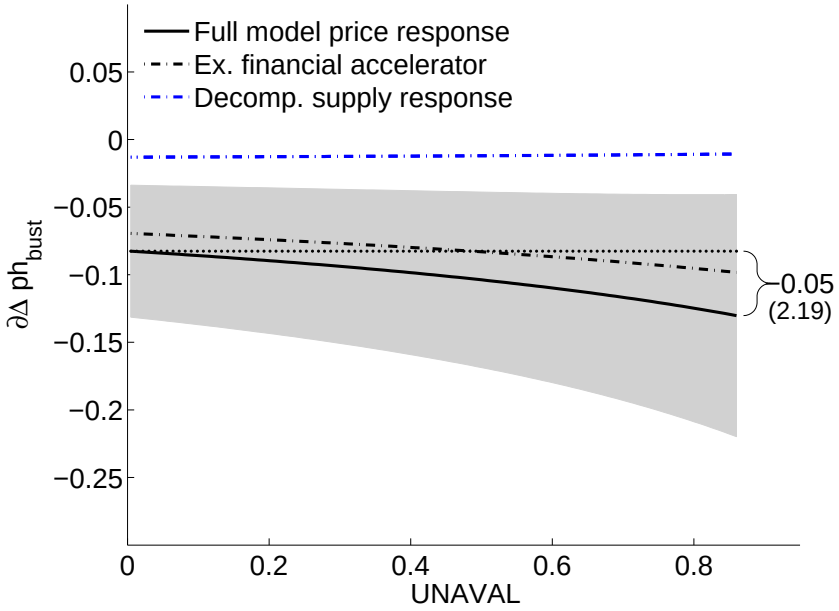
The empirical results:

Variables	Δp_{bust}
Δh_{boom}	-0.24 $(-2.01)^{**}$
Δp_{boom}	-0.27 $(-12.67)^{***}$
ΔHH income$_{bust}$	0.92 $(11.62)^{***}$

Impulse responses in price during the bust

Housing price response during bust period, following a 1 % shock to subprime lending during the boom:





Conclusions

- For a given positive demand shock, supply restricted areas experiences a much larger price increase during the boom, while the supply response is almost the same as in unrestricted areas.
- Our results indicate that this may be explained by a FA-effect, which stimulates demand and prices in restricted areas and, hence, also stimulates construction activity.
- Hereby it follows naturally that the bust period price drop is greater in supply restricted areas, since these areas got the worst of both worlds: both a large price and supply overhang.
- Policy implication: Supply regulations may increase volatility of housing prices over the course of a boom-bust cycle, and especially so in tandem with liberal credit markets!

Thank you!