Drivers of the Great Housing Boom-Bust: Credit Conditions, Beliefs, or Both?

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- "**Great Housing Cycle**" $\approx$ 2000-2010, with a *boom* $\approx$ 2000-2006, a *bust* $\approx$ 2007-2010.
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  - Davis & Heathcote '05; Kahn '08; Kiyotaki et. al. '11; Piazessi Schneider '08; Iacoviello Pavan '13; Sommer et. al. '13; Landvoigt et. al., '15; Favilukis, et. al., '17; Greenwald '17; Kaplan et. al., '17.

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- Points to need for **empirical evidence**.

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- Often these views discussed as if they were **mutually exclusive** possibilities.

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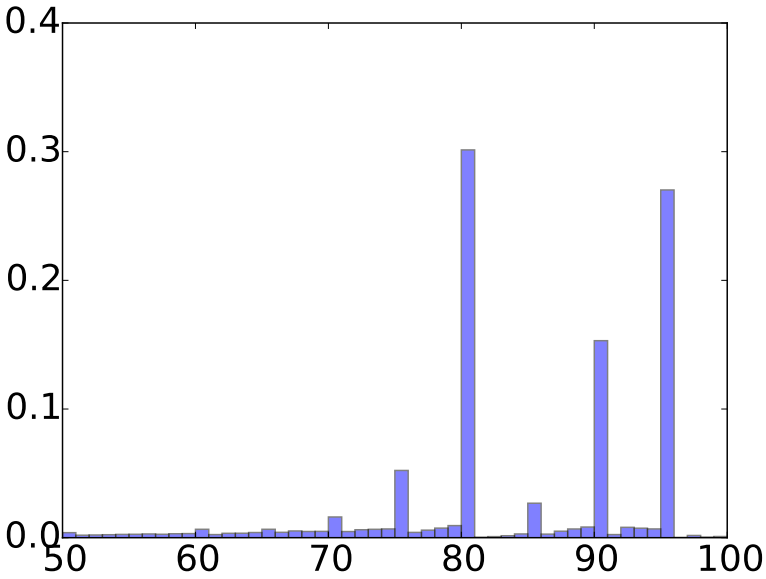
- Greenwald '17: evidence vast majority of *prime borrowers* take out **largest mortgage possible** given their CLTV, PTI limits + other eligibility requirements...
- => Any homeowner who isn't **buying with cash** likely to be constrained, or nearly so.

CLTV and PTI on Fannie Mae Mortgages: 2014

(a) CLTV: Purchases (2014)



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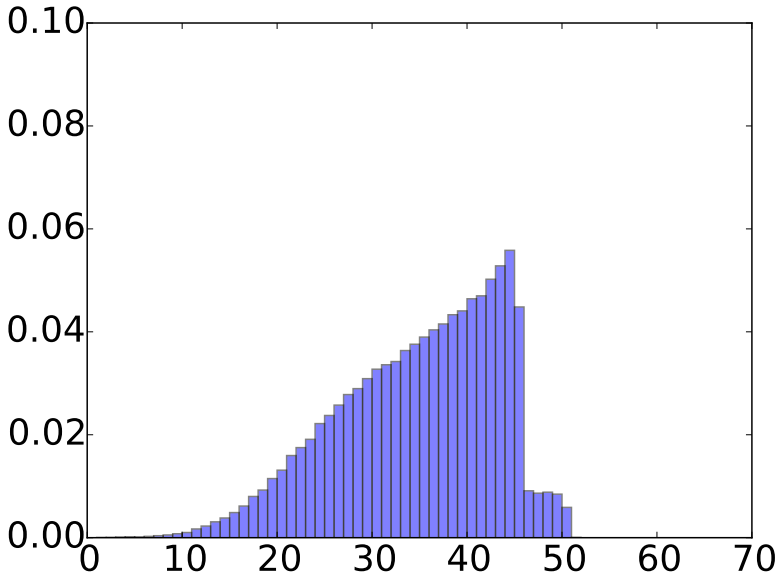

Distribution of combined LTV (CLTV) and PTI ratios on newly issued conventional fixed-rate mortgages securitized by Fannie Mae. Panel (a) presents CLTV, the ratio of total mortgage debt to the value of the house, summing over multiple mortgages against the same property. Panel (b) displays the distribution of PTI ratios, weighted by loan balance. *Source:* Fannie Mae Single Family Dataset and Greenwald (2017).

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- CLTV distribution: Majority of borrowers grouped in **spikes** at known institutional limits and cost discontinuities.

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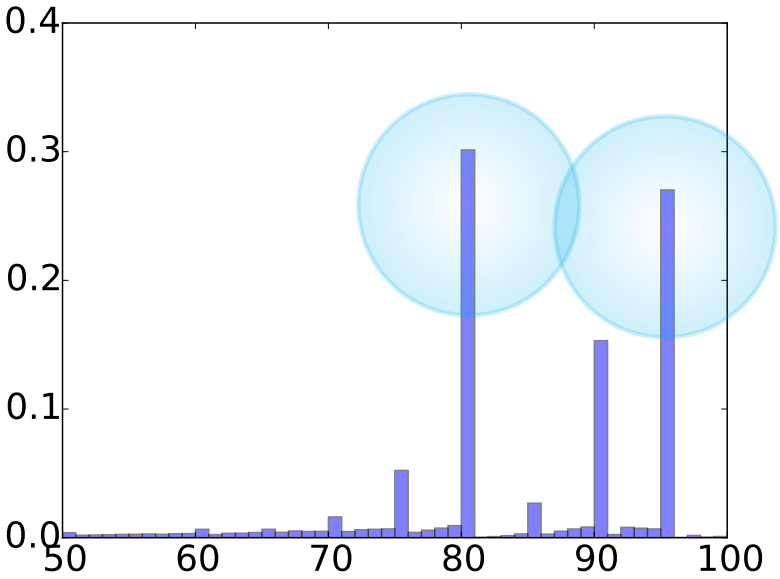

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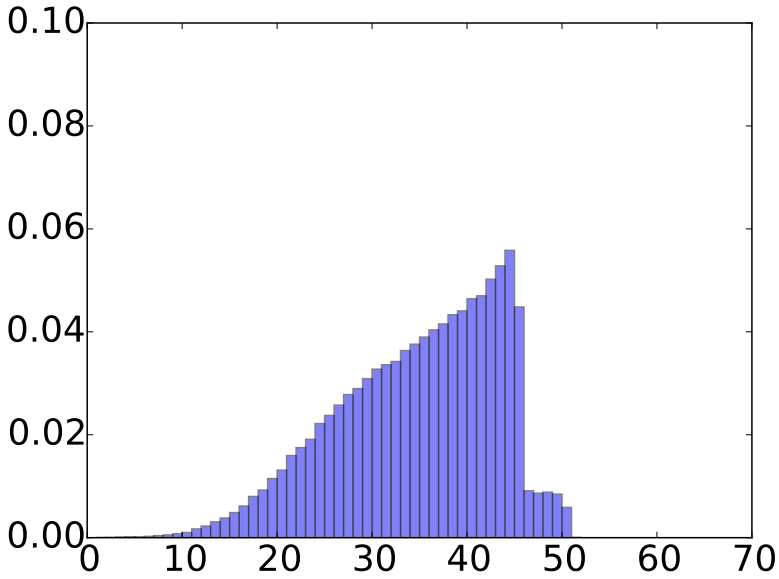

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- PTI: Clear influence of spike at institutional limit (45%) distributions building before **complete truncation**.

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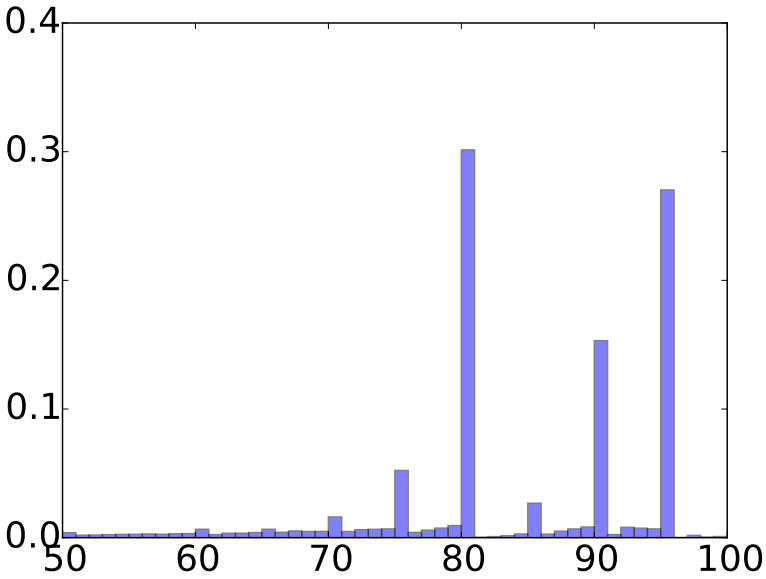

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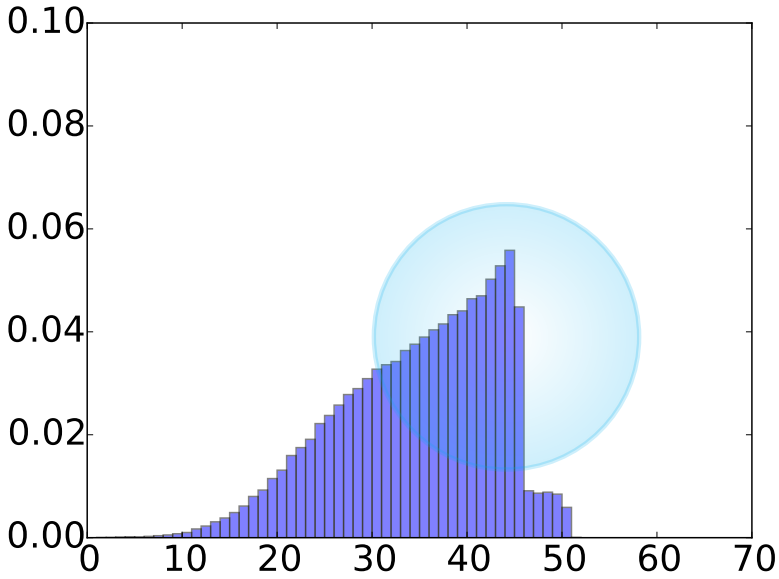

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- Smooth shape of PTI, rather than spike, likely stems from **search frictions**.

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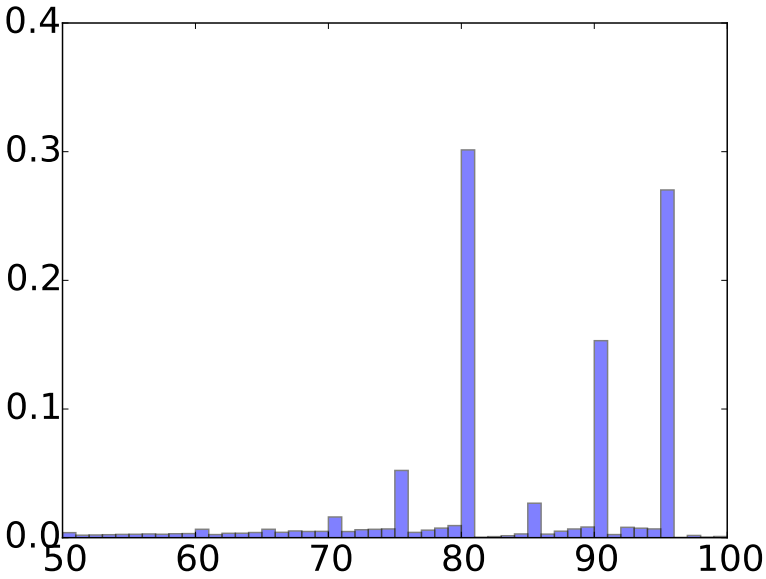

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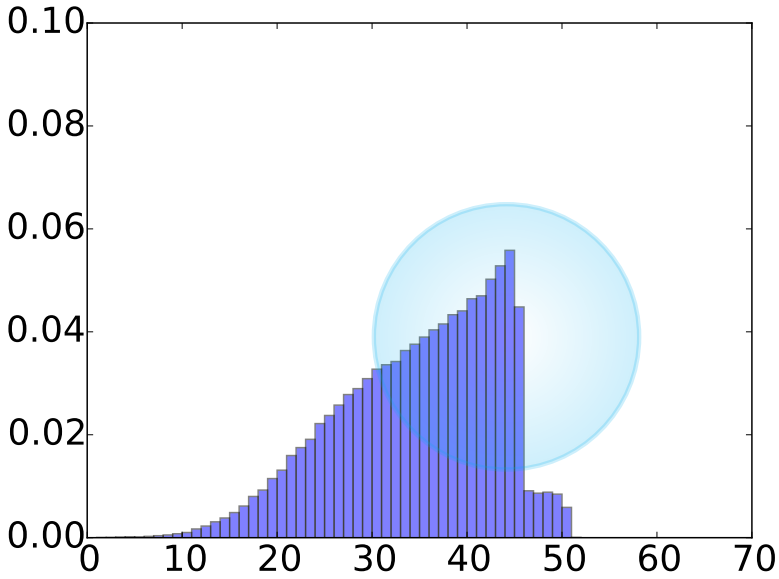

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- **Missing** from the analysis is **direct measures** of credit conditions and beliefs.

Here: Direct measures of Credit Conditions, Beliefs

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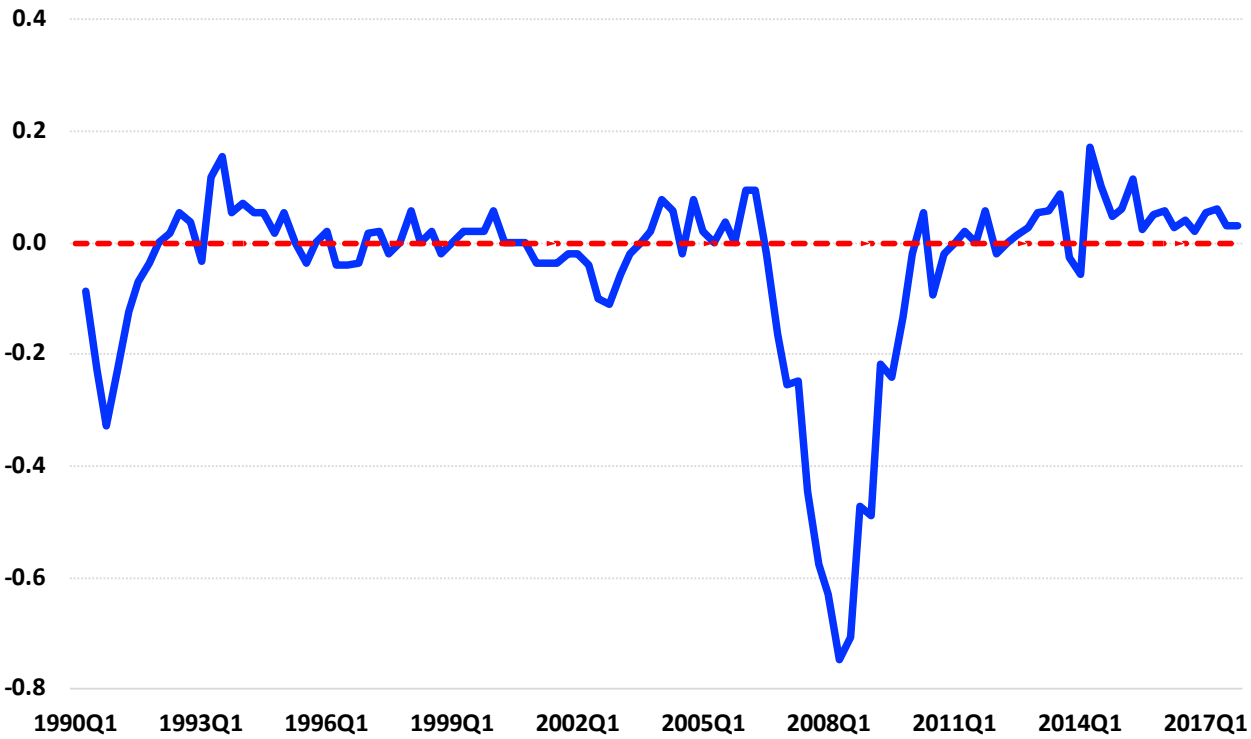
- SLOOS used previously by Faviluks, Kohn, Ludvigson, Van Neiuwerbugh (2015) (FKLV). We extend sample, add beliefs data.

Net Percentage of U.S. Banks: Easier Credit Standards

- Quarterly data on **net percentage banks** reporting *easier* lending standards (ΔCS_t) => rise in ΔCS indicates a *slackening*.



Net percentage of banks that reported easier credit standards. A positive number indicates more banks report easing than tightening. A negative number indicates the opposite. *Source:* Federal Reserve - SLOOS.

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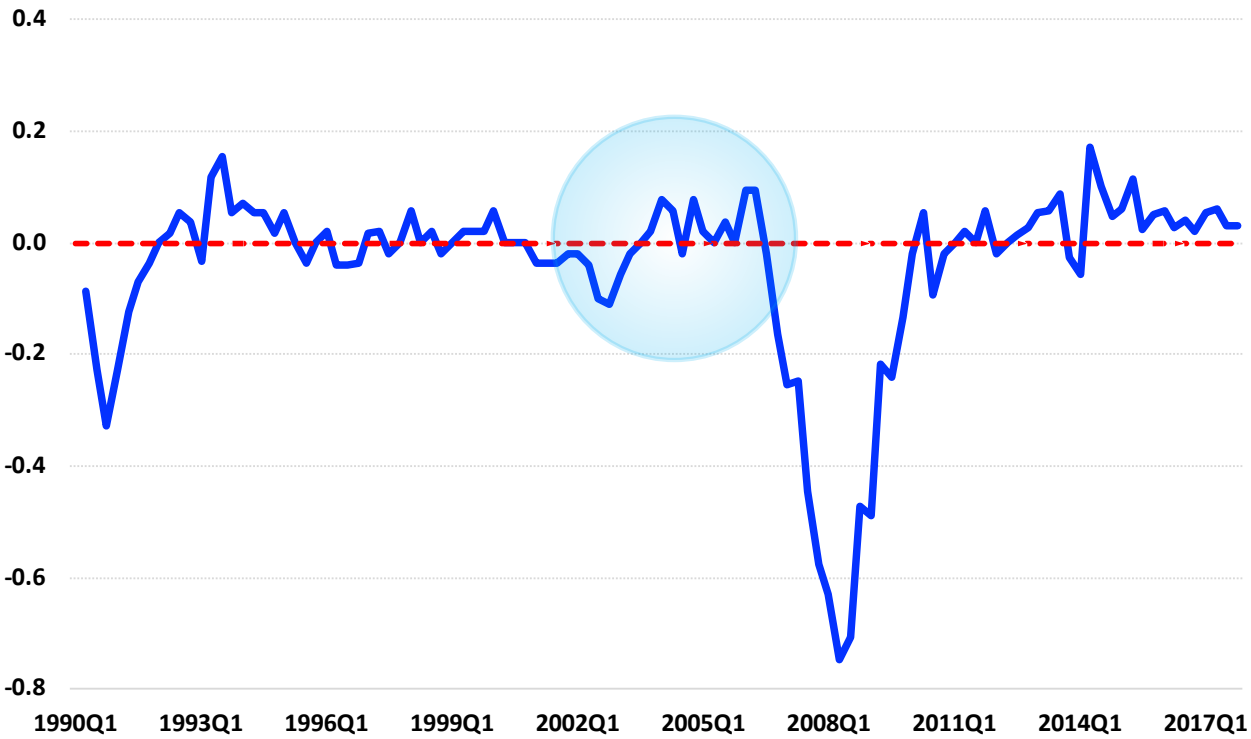
- String obs. starting in 2002-2006 show standards were *easy or easing*. Could => substantial relaxation underwriting standards, cumulated.



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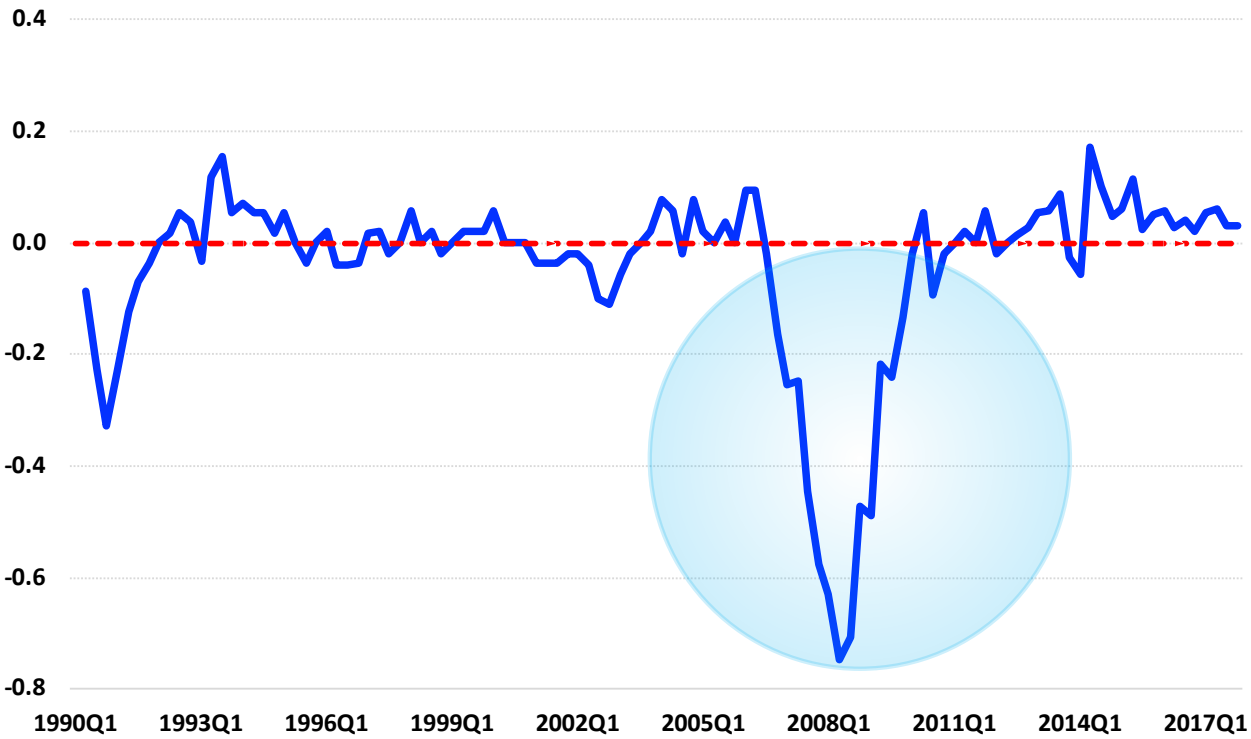
- Marked broad tightening beginning in 2006, reversed in a few years.



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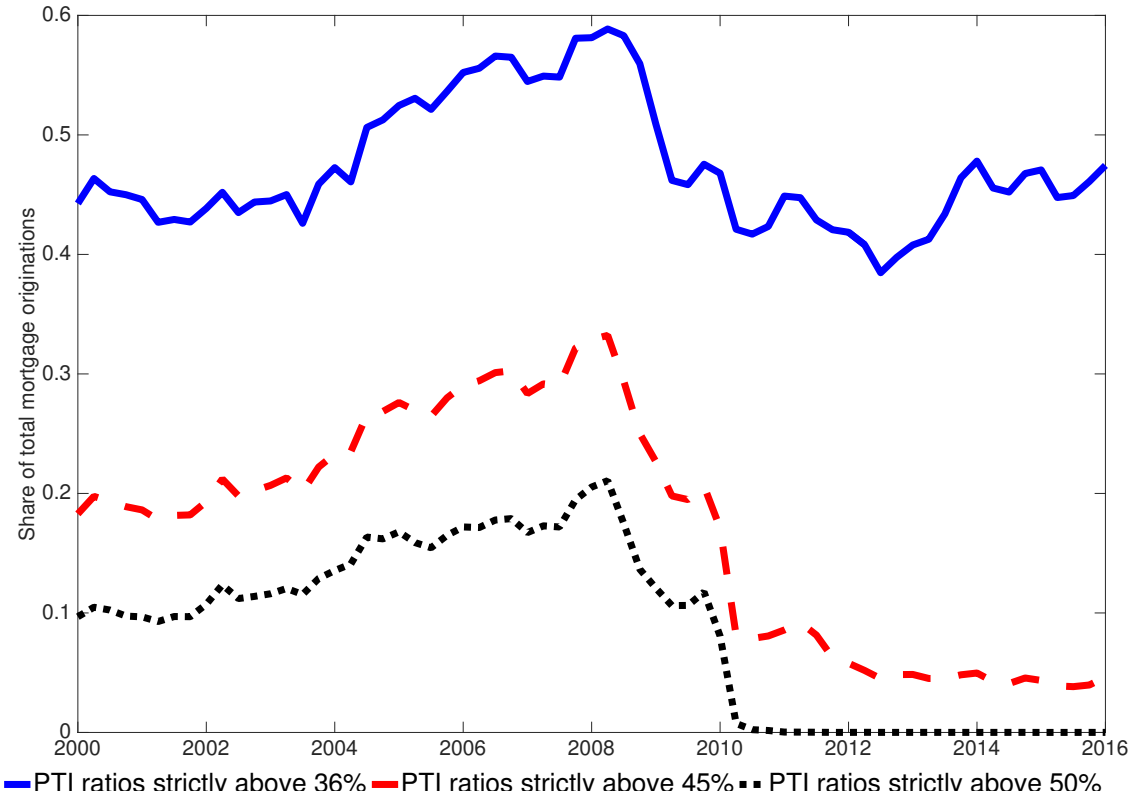
Originations and payment to income ratio (PTI)

- **Other measures of credit standards** even for *prime* borrowers indicate relaxation in boom and tightening in bust.



Share of originations with PTI> X%. Figure displays the fraction, over time, of mortgage originations purchased by Fannie Mae with PTI ratios $> 36\%$, 45%, and 50%, weighted by loan balance. Sample: 2000 - 2016. *Source:* Annual data from Fannie Mae Single Family Dataset.

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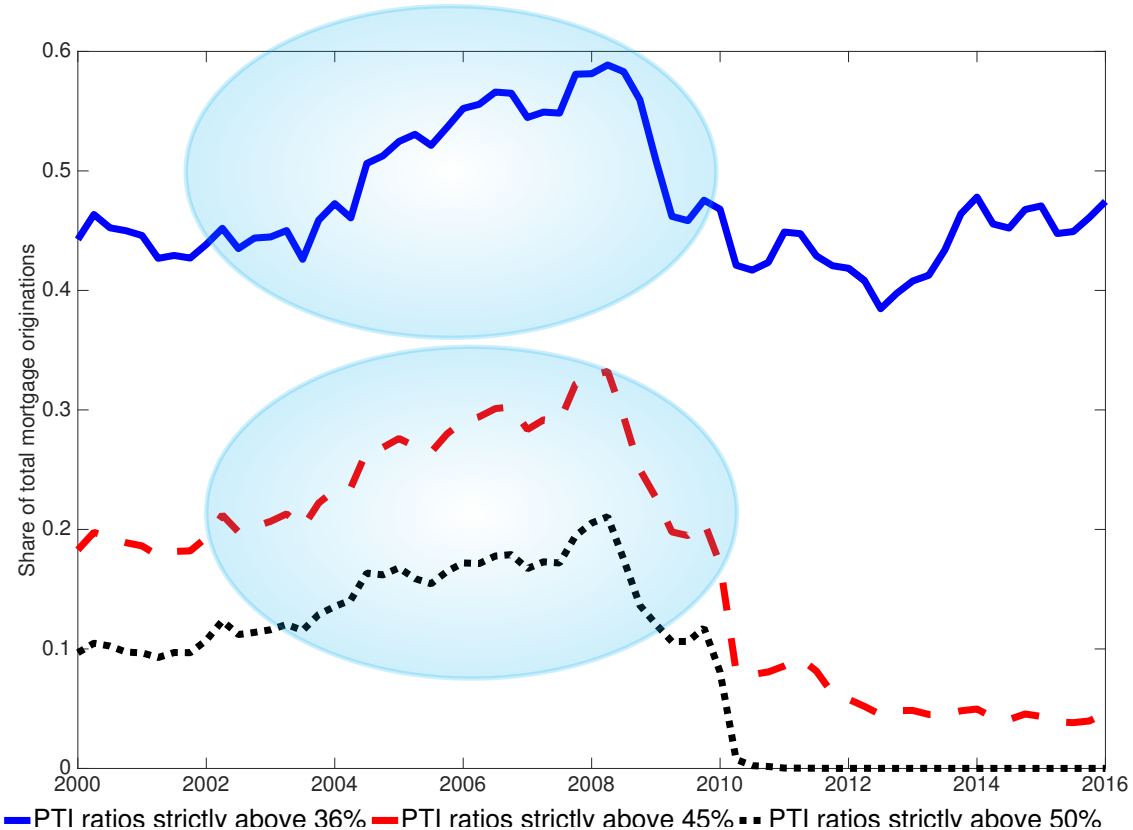
- Monthly PTI ratios increased dramatically 2002-2006.



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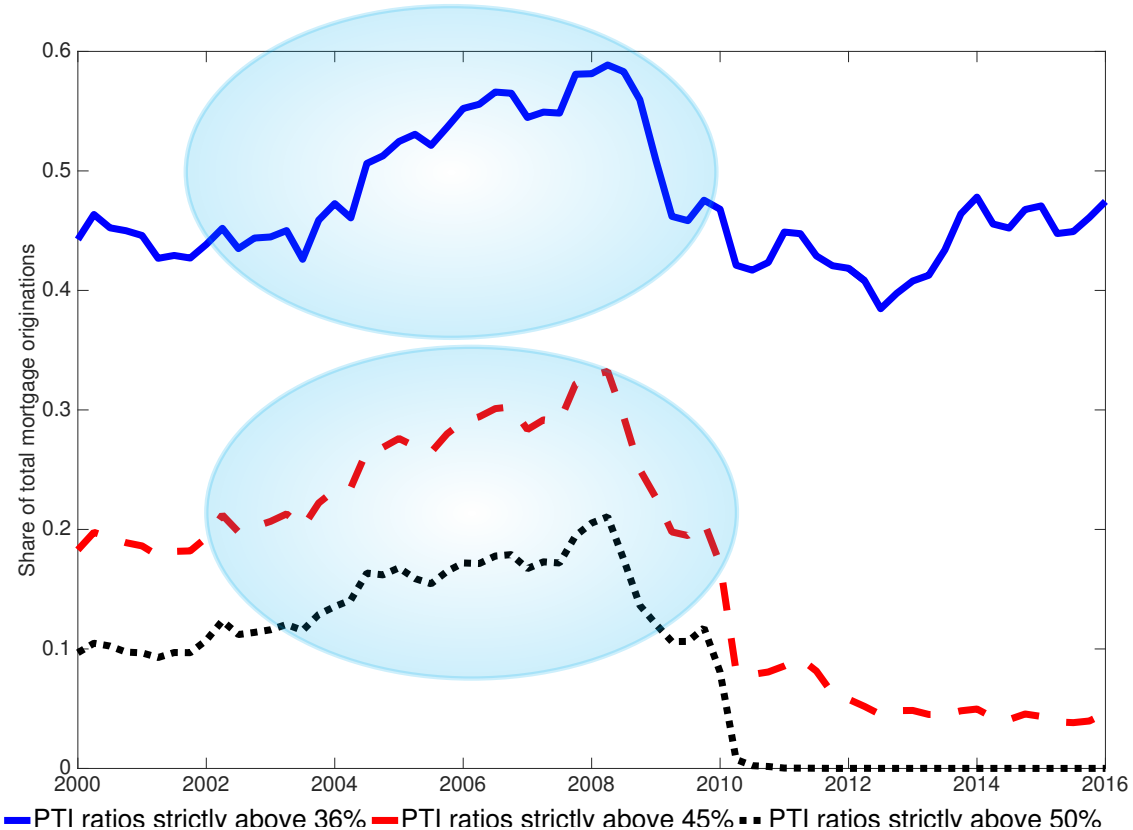
- Largest increase for the share that exceeded 50%, which ↑ 85%.



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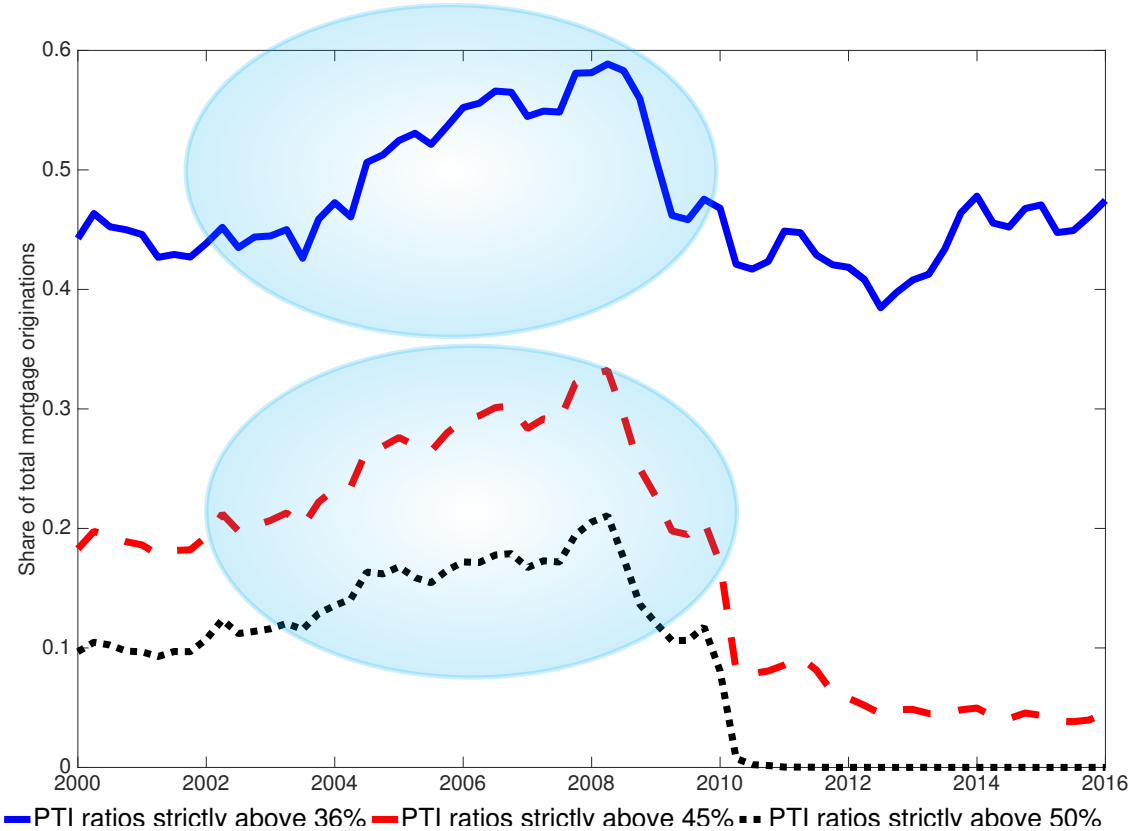
- Greenwald (2017): GE model where time-variation in PTI limits has large effects on home price variation.



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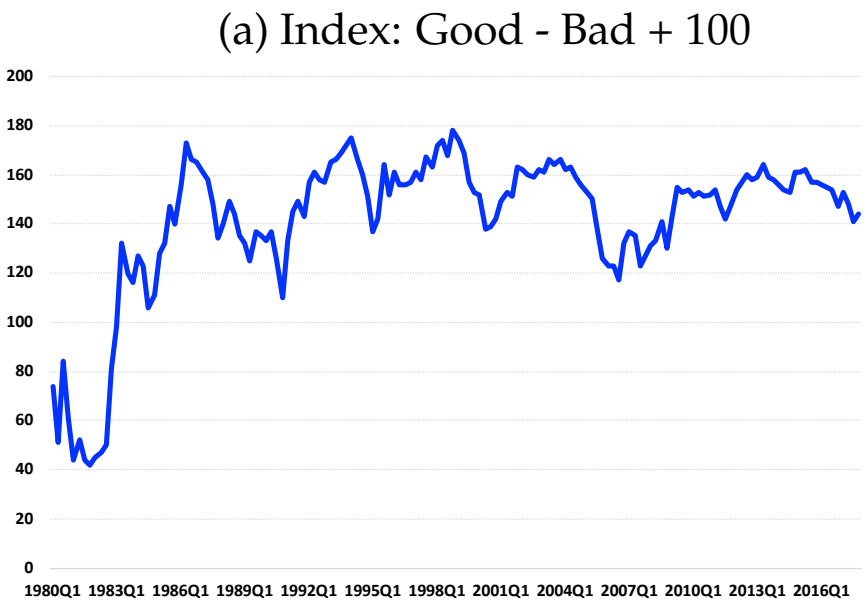
4. *National* version of **Soo's (2018) housing media sentiment index** created from textual analysis of newspapers coverage of housing (2000-2013).

Buying Condition for Houses (SOC)

- Net buying conditions index BCI (left) similar to *fraction* (right) that say now is a **good time** to buy.

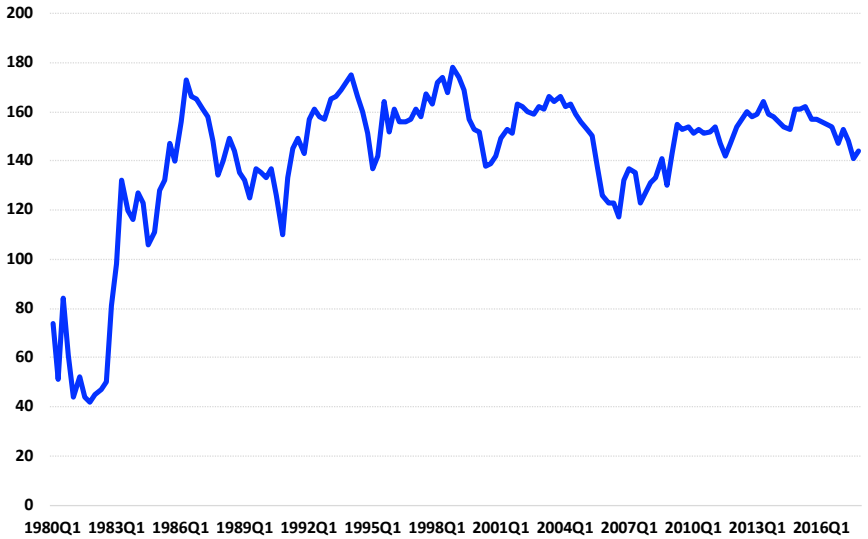


Buying Condition for Houses. Panel (a) presents the buying condition index constructed by taking the number of good answers, subtracting the number of bad answers and adding 100. Panel (b) presents the share of respodents who answer that now is a good time to buy a house. *Source:* SoC, University of Michigan.

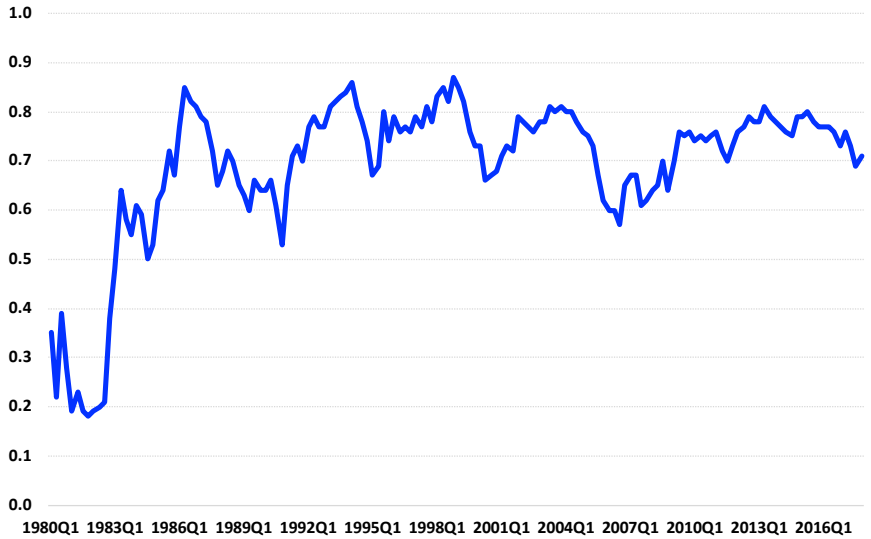
Buying Condition for Houses (SOC)

- Study relation bet. *log difference of house prices* and covariates, so use log difference in BCI Δbci_t as our empirical measure.

(a) Index: Good - Bad + 100



(b) Share of Good Answers



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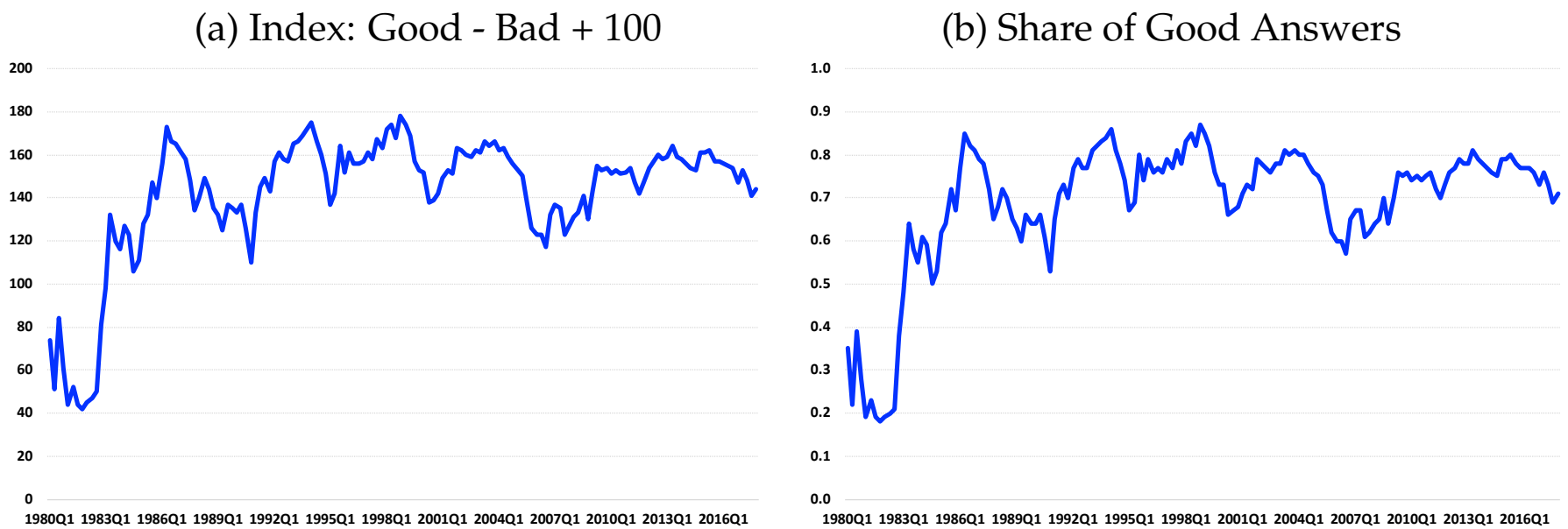
Buying Condition for Houses (SOC)

- An *increase* in Δbci_t implies a shift toward *optimism*.



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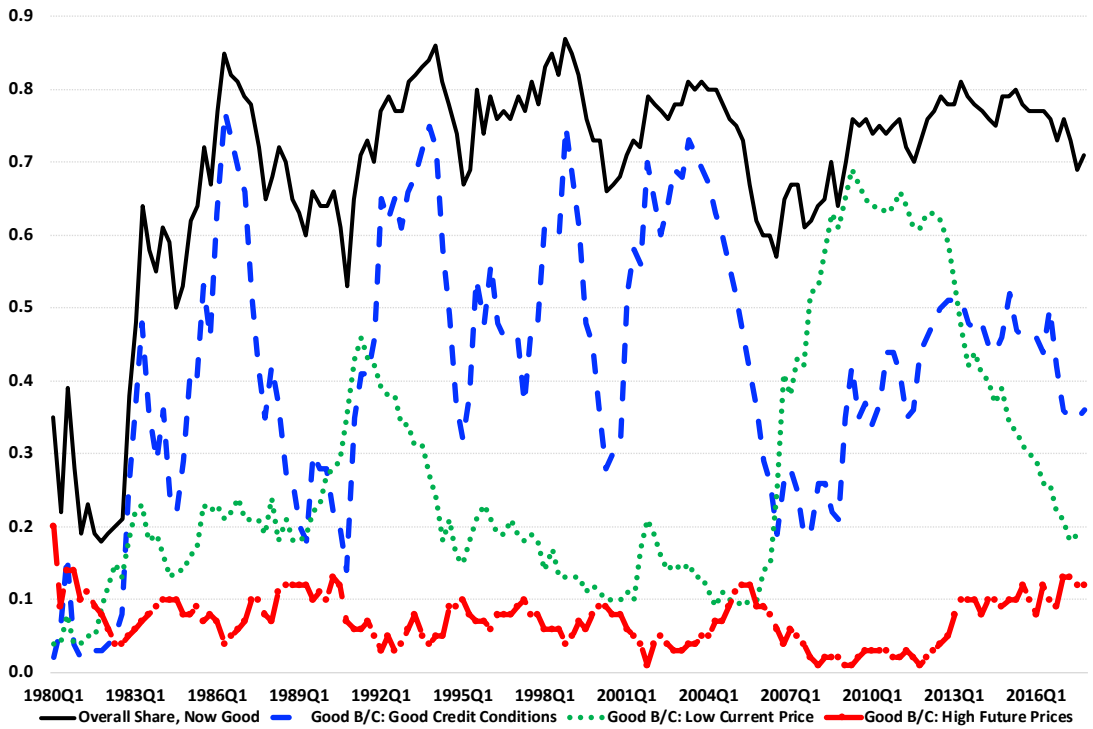
Reasons for Which it is a Good Time to Buy a House

- Open-ended follow-up question: *why* now good time to buy?



Why is now good time to buy a house? Black line is share of all respondents who say now is a good time to buy. Blue line is the share whose reason is *favorable credit conditions*. Green line is the share whose reason is *current prices are low*. Red line is the share whose reason is *higher future prices*. Source: SoC, University of Michigan.

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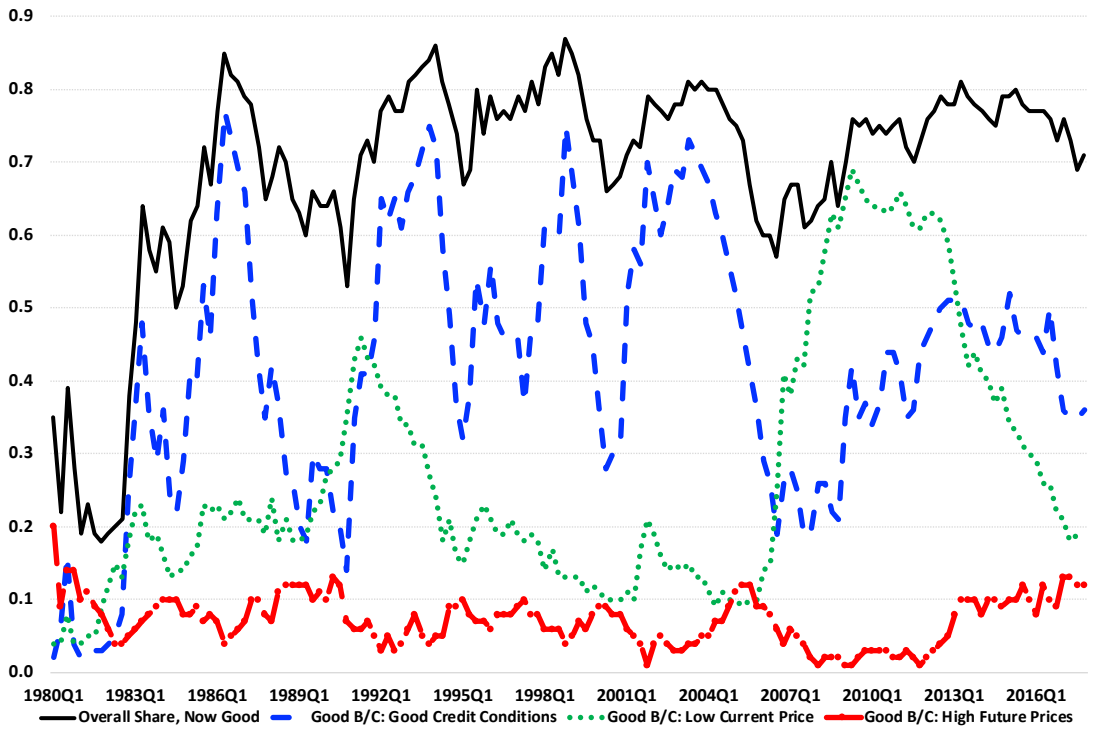
- Most common reason for positive view: **credit conditions good**.



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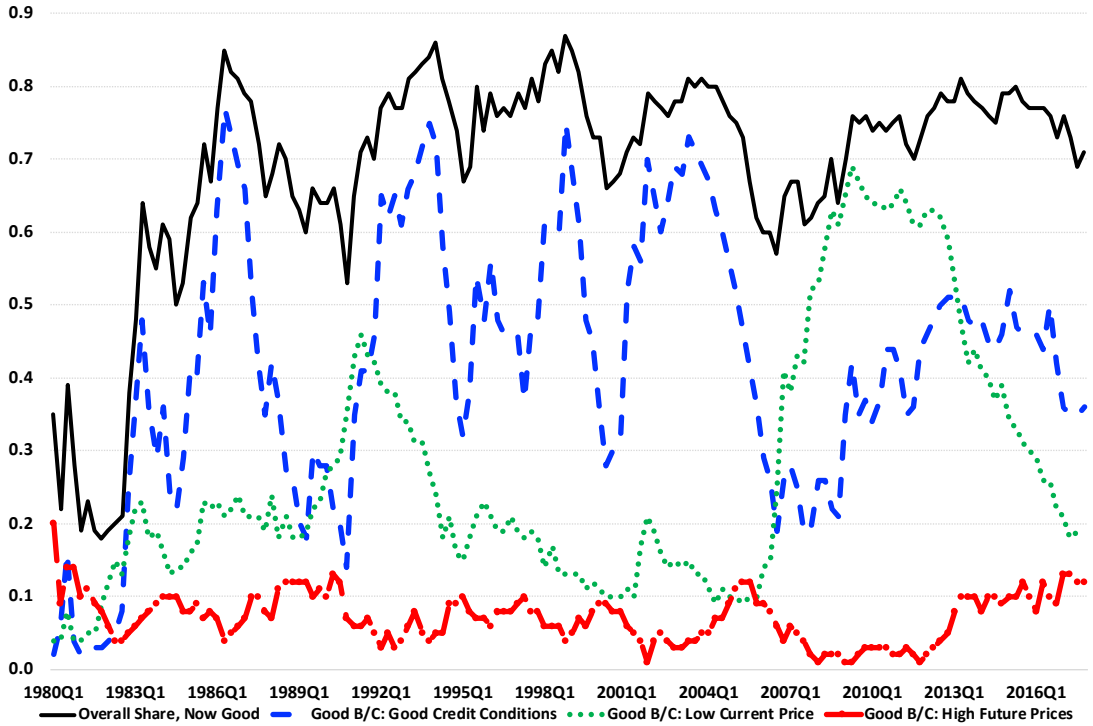
- **Future prices high** of interest b/c hones in on *expectations* component of beliefs central, in some theories, to driving home prices (e.g., Kaplan et. al. '17).



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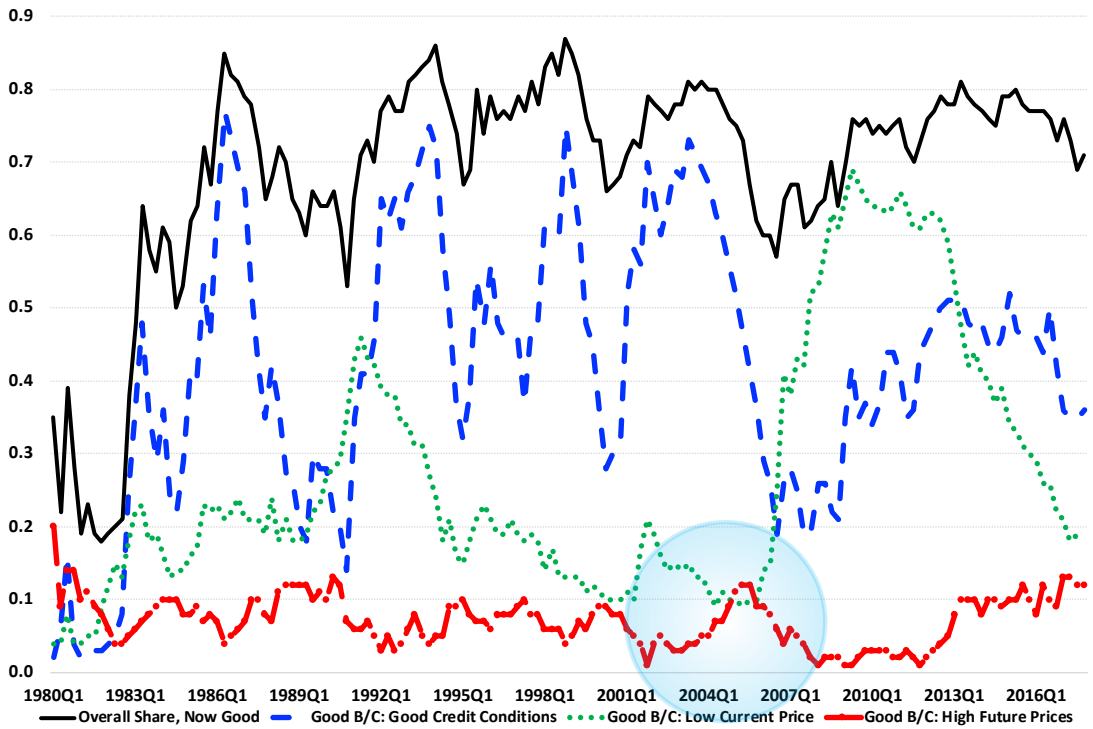
- Piazzesi and Schneider '09: search frictions => a **few optimists** can drive transaction prices without a large trading volume.



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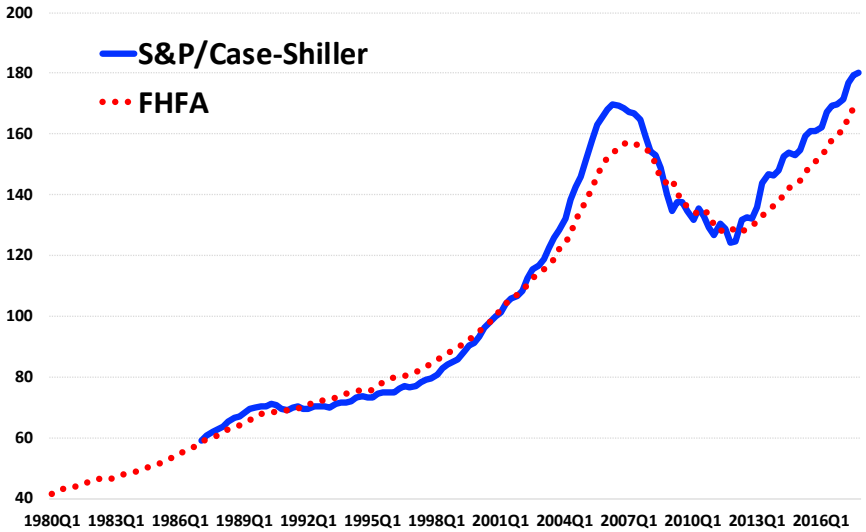
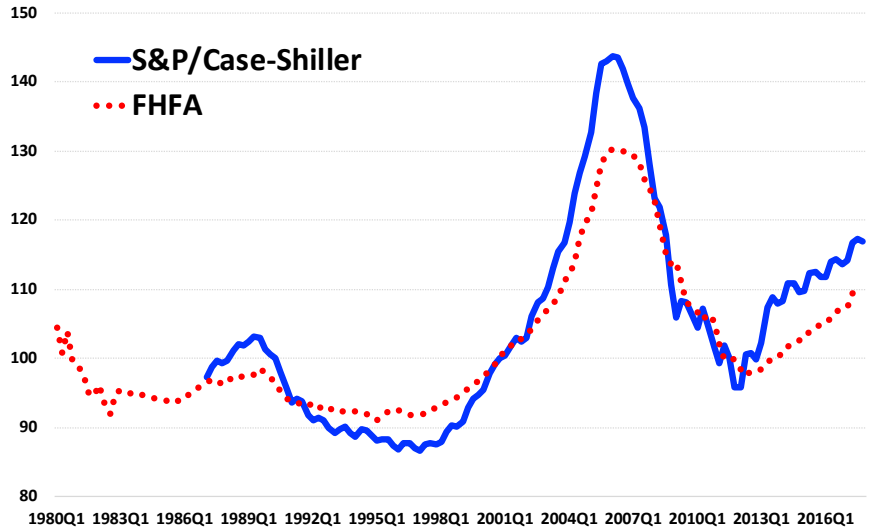
Data on Aggregate House Prices: Repeat Sales Indexes

- Two repeat-sale indexes: S&P Case-Shiller U.S. (CSUS) and FHFA

(a) Price Indices (2000:Q4 = 100)



(b) Price-Rent Ratio Indices (2000:Q4 = 100)



House Price Indices. Panel (a) plots the S&P/Case-Shiller home price index (solid line) and the FHFA home price index (dotted line), both by deflated by CPI. Panel (b) presents price-rent ratio indices, constructed by dividing the real price in Panel (a) by the shelter CPI for all urban consumers. Source: Federal House Finance Agency, S&P Dow Jones Indices LLC, and U.S. Bureau of Labor Statistics.

Data on Aggregate House Prices: Repeat Sales Indexes

- Boom-Bust cycle more pronounced in CSUS than in FHFA.

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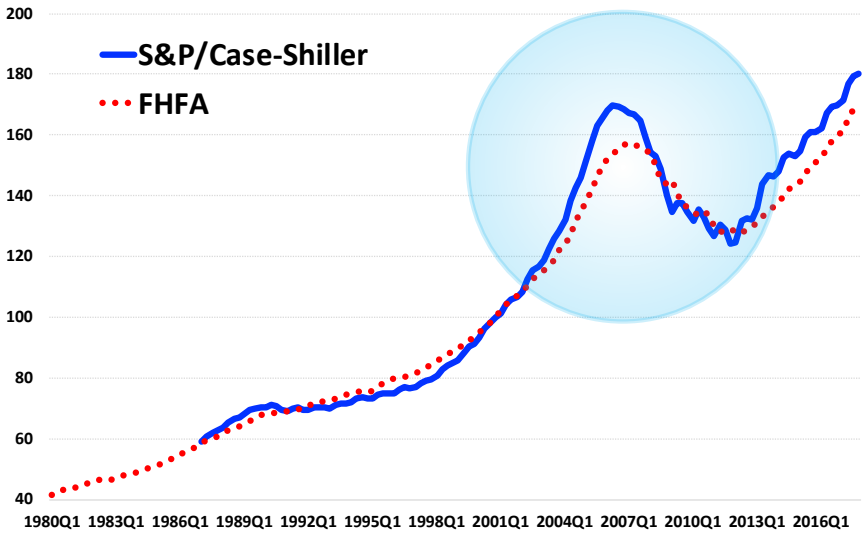

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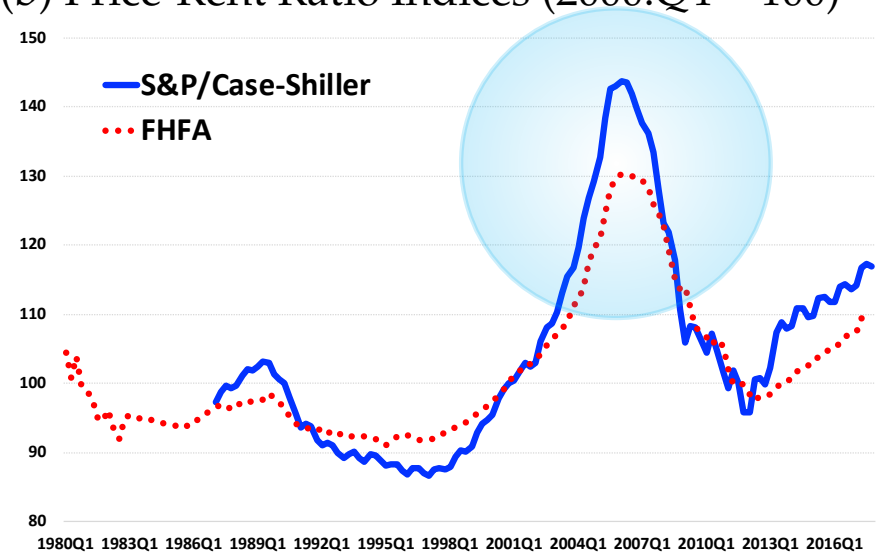

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Data on Aggregate House Prices: Repeat Sales Indexes

- FHFA only for homes purchased with *conforming debt* (Fannie Mae and Freddie Mac eligible).

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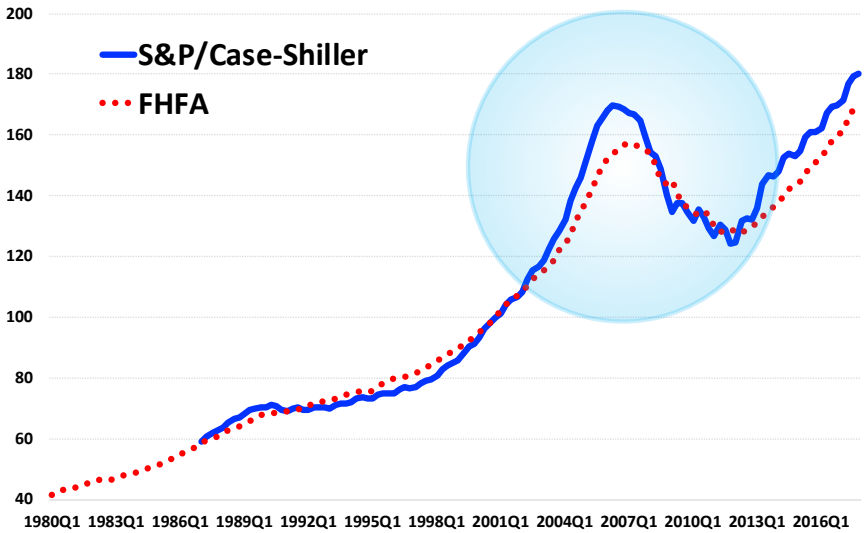

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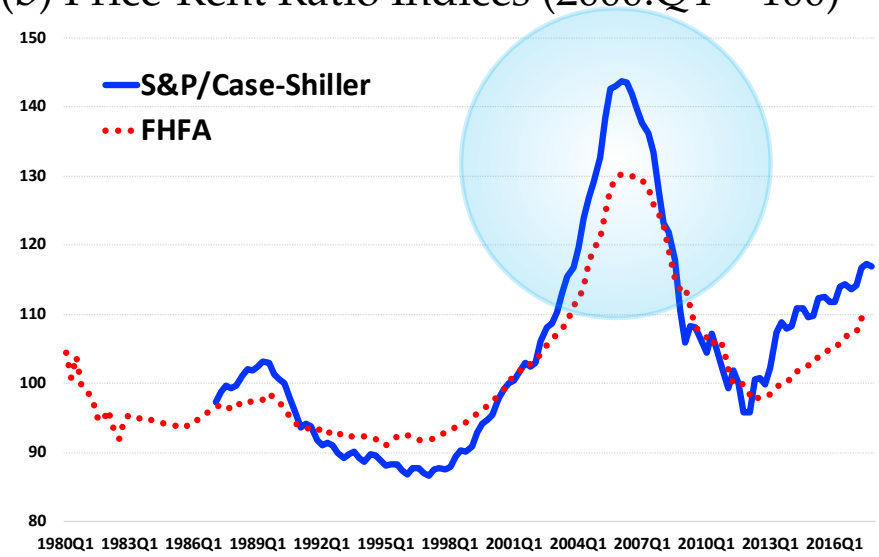

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Data on Aggregate House Prices: Repeat Sales Indexes

- CSUS measures *all available transactions* single family homes purchased, incl. *non-conforming* debt (subprime, Alt-A, jumbo).

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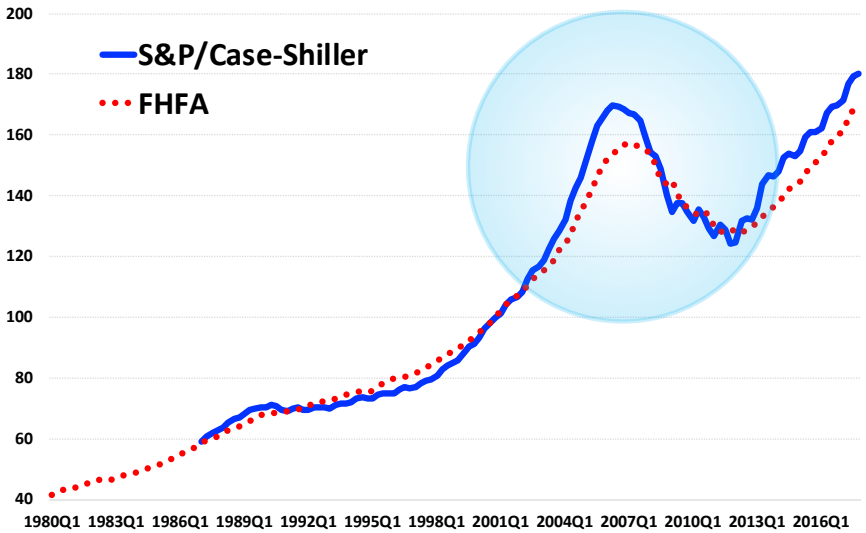

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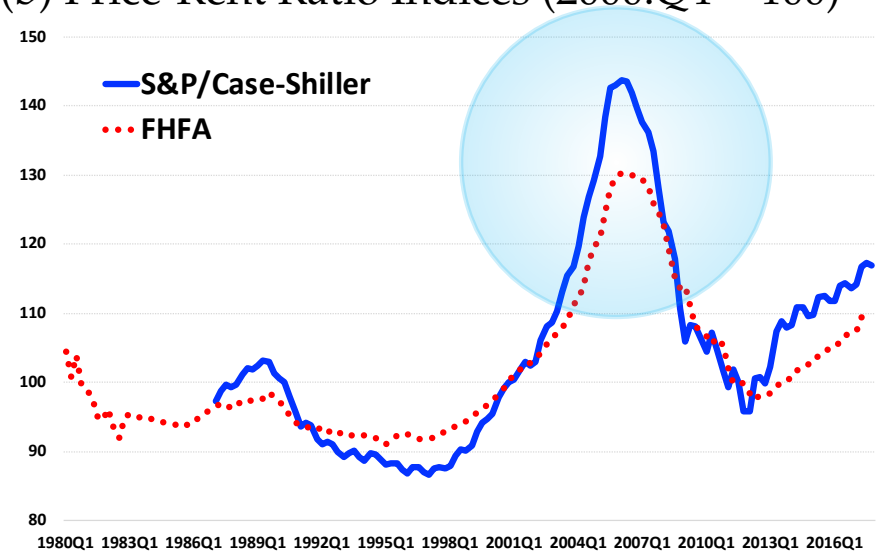

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Data on Aggregate House Prices: Repeat Sales Indexes

- Because of its breadth & out-sized role of non-conforming debt in GHC, CSUS/CPI is our main measure *log price changes* Δp_t.

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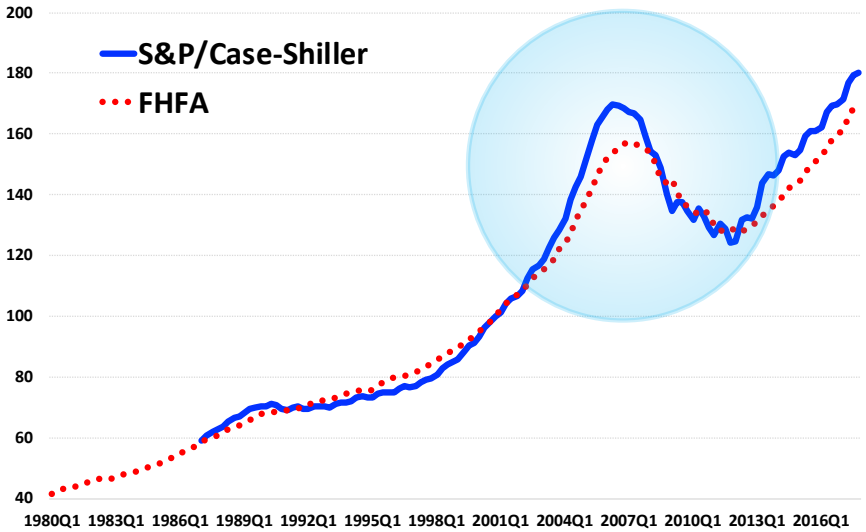

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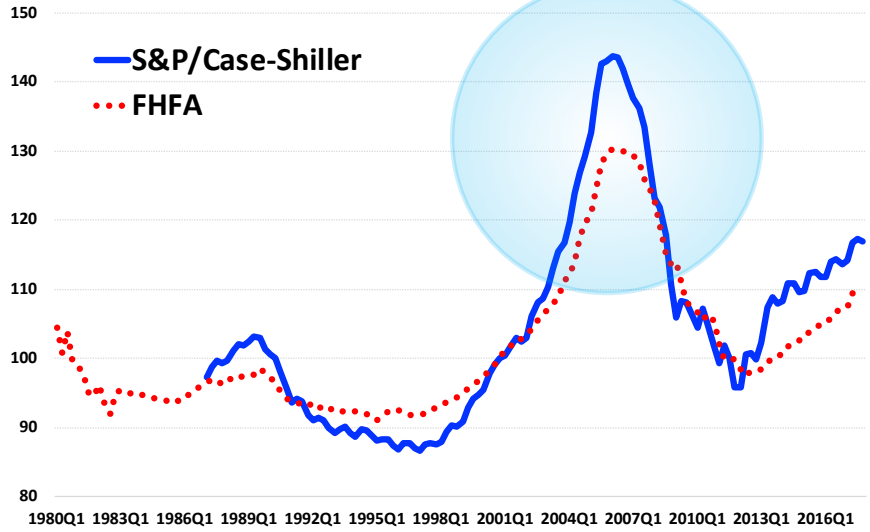

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- => Ask whether beliefs contain information for Δp_t not contained in ΔCS_t and other economic *fundamentals*.

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- $=>$ Ask whether *beliefs predict future* Δp_{t+h} once ΔCS_t, economic fundamentals, **lagged** Δp_t are controlled for.

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- Address question using bivariate structural VAR in ΔCS_t and Δp_t using the **shock-restricted identification** approach of Ludvigson, Ma, and Ng (2015, 2016).
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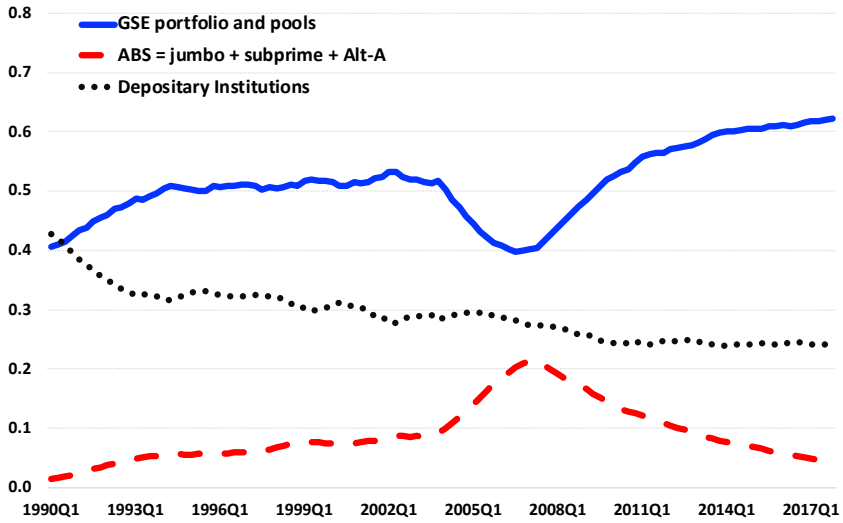
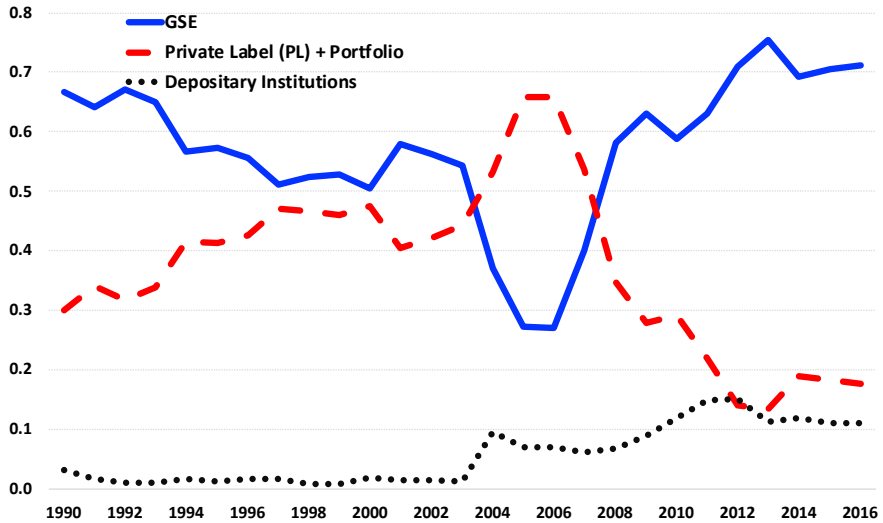
- $=>$ Ask whether *shocks to* ΔCS_t that are mutually uncorrelated with Δp_t shocks have any dynamic causal impact on Δp_t.

Share of Mortgages by Mortgage Type

(a) Share of Mortgages Outstanding



(b) Share of Mortgage Originations



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Share of Mortgages by Mortgage Type

- Natural to expect an *easing* of standards be associated with increase in share of *non*-conforming debt.

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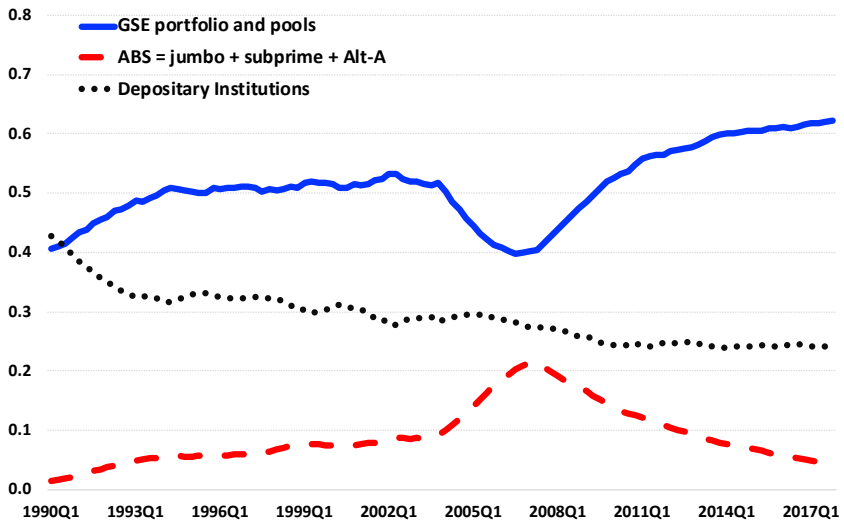

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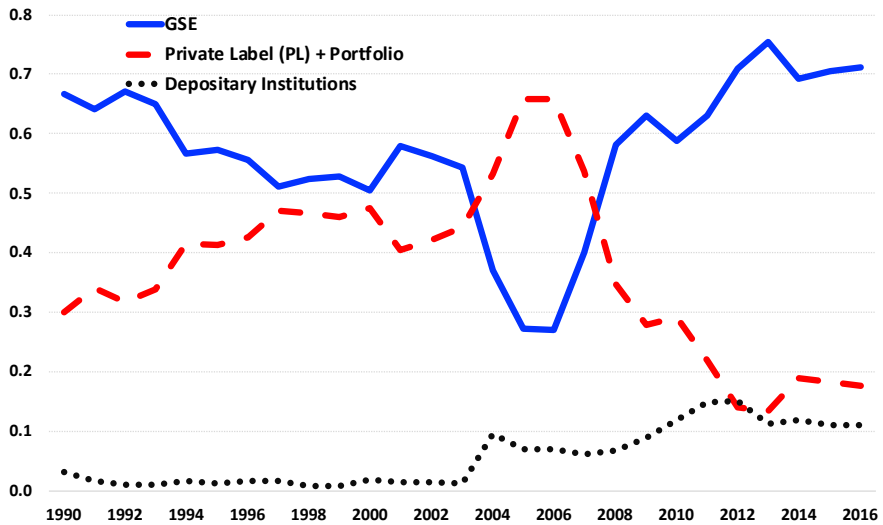

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- From 2002-2006 the *share* of ABS in total mortgages rises sharply, mirrors decline in GSE share.

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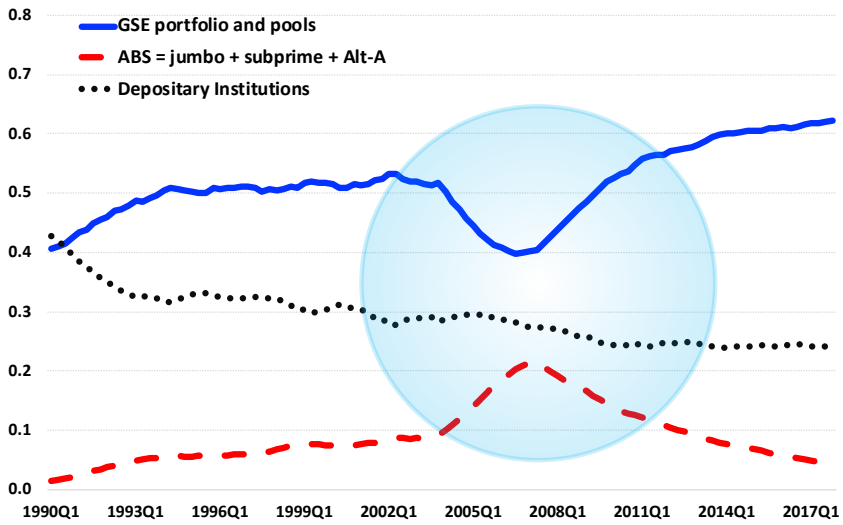

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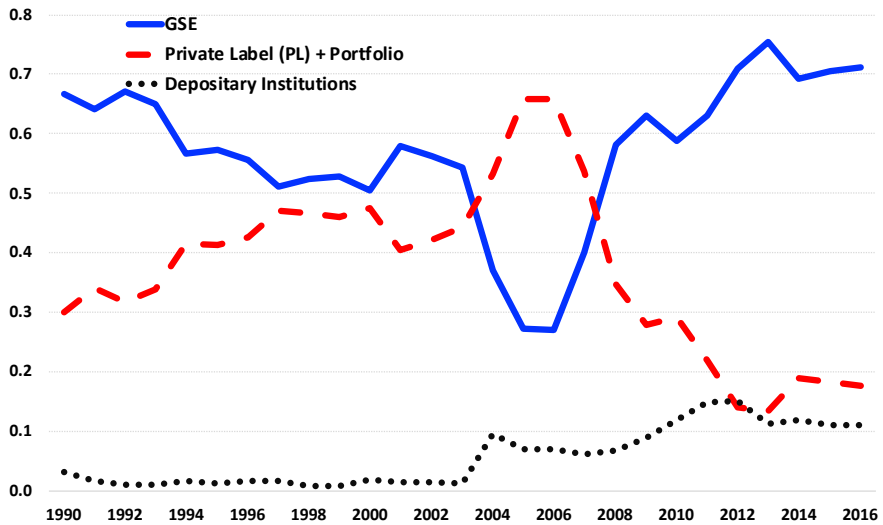

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- Analogy to ABS share in *originations* space is PL+Porfolio. Similar pattern appears in the PL+Portfolio share of originations.

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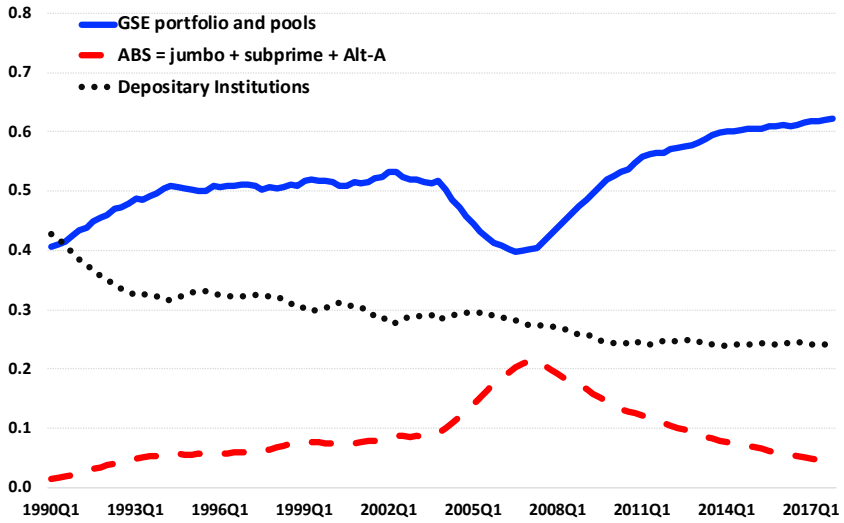

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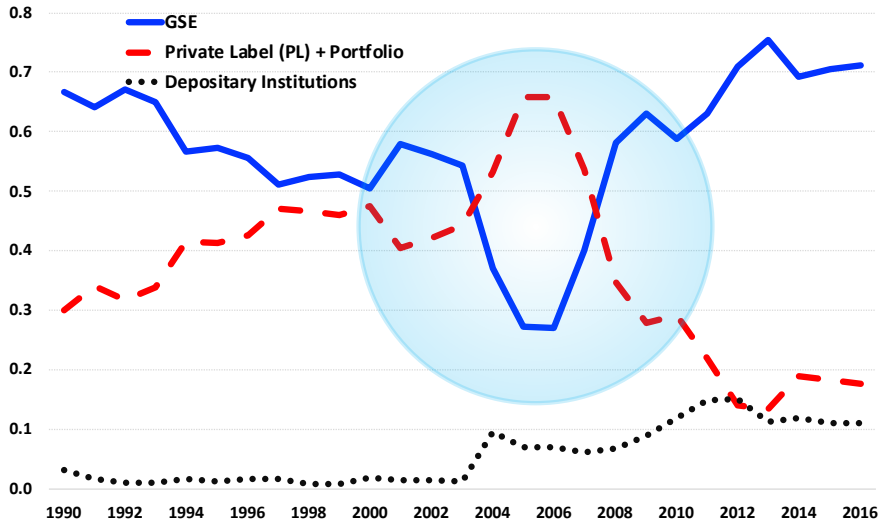

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Mortgages, credit standards, and beliefs

Holder	Full sample					
	1991:Q4-2017:Q4			2000:Q1-2013:Q4	2007:Q1-2017:Q4	
	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$	$\Delta p_t^{e,med}$	$\Delta p_t^{e,avg}$
Δ_4 log All	0.003	-0.133	-0.013	-1.446	0.006	0.007
$t-$stat	(1.517)	(-1.613)	(-0.994)	(-1.167)	(0.582)	(1.431)
$\bar{R}^2$	[0.024]	[0.043]	[0.013]	[0.029]	[-0.004]	[0.094]
Δ_4 log ABS	0.013**	-0.037	-0.054	-6.313	-0.002	0.009
$t-$stat	(2.270)	(-0.072)	(-0.957)	(-1.437)	(-0.202)	(1.201)
$\bar{R}^2$	[0.044]	[-0.009]	[0.013]	[0.059]	[-0.023]	[0.003]
Δ_4 log GSE	-0.005***	0.131**	-0.030***	-0.493	-0.018	-0.009
$t-$stat	(-3.362)	(2.363)	(-3.942)	(-0.460)	(-1.232)	(-1.209)
$\bar{R}^2$	[0.157]	[0.071]	[0.165]	[-0.008]	[0.091]	[0.100]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.018***	-0.168	-0.025	-5.819	0.016	0.018**
$t-$stat	(3.587)	(-0.337)	(-0.435)	(-1.304)	(1.597)	(2.539)
$\bar{R}^2$	[0.101]	[-0.004]	[-0.004]	[0.049]	[0.001]	[0.113]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). $\Delta p_t^{e,med}$ (median house price growth). $\Delta p_t^{e,avg}$ (average house price growth). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Full sample spans available data in each case.

Mortgages, credit standards, and beliefs

- ΔCS *positively* related to growth in **ABS**; *negatively* related to growth in **GSE** mortgages.

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- ΔCS *positively* related to growth in **ratio of ABS/GSE**.

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Δ_4 log GSE	-0.005***	0.131**	-0.030***	-0.493	-0.018	-0.009
$t-$stat	(-3.362)	(2.363)	(-3.942)	(-0.460)	(-1.232)	(-1.209)
$\bar{R}^2$	[0.157]	[0.071]	[0.165]	[-0.008]	[0.091]	[0.100]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.018***	-0.168	-0.025	-5.819	0.016	0.018**
$t-$stat	(3.587)	(-0.337)	(-0.435)	(-1.304)	(1.597)	(2.539)
$\bar{R}^2$	[0.101]	[-0.004]	[-0.004]	[0.049]	[0.001]	[0.113]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). $\Delta p_t^{e,med}$ (median house price growth). $\Delta p_t^{e,avg}$ (average house price growth). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Full sample spans available data in each case.

Mortgages, credit standards, and beliefs

- Little evidence shifts in **composition of credit** associated with **beliefs** *in a sample containing housing boom-bust*.

Holder	Full sample					
	1991:Q4-2017:Q4			2000:Q1-2013:Q4	2007:Q1-2017:Q4	
	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$	$\Delta p_t^{e,med}$	$\Delta p_t^{e,avg}$
Δ_4 log All	0.003	-0.133	-0.013	-1.446	0.006	0.007
$t-$stat	(1.517)	(-1.613)	(-0.994)	(-1.167)	(0.582)	(1.431)
$\bar{R}^2$	[0.024]	[0.043]	[0.013]	[0.029]	[-0.004]	[0.094]
Δ_4 log ABS	0.013**	-0.037	-0.054	-6.313	-0.002	0.009
$t-$stat	(2.270)	(-0.072)	(-0.957)	(-1.437)	(-0.202)	(1.201)
$\bar{R}^2$	[0.044]	[-0.009]	[0.013]	[0.059]	[-0.023]	[0.003]
Δ_4 log GSE	-0.005***	0.131**	-0.030***	-0.493	-0.018	-0.009
$t-$stat	(-3.362)	(2.363)	(-3.942)	(-0.460)	(-1.232)	(-1.209)
$\bar{R}^2$	[0.157]	[0.071]	[0.165]	[-0.008]	[0.091]	[0.100]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.018***	-0.168	-0.025	-5.819	0.016	0.018**
$t-$stat	(3.587)	(-0.337)	(-0.435)	(-1.304)	(1.597)	(2.539)
$\bar{R}^2$	[0.101]	[-0.004]	[-0.004]	[0.049]	[0.001]	[0.113]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). $\Delta p_t^{e,med}$ (median house price growth). $\Delta p_t^{e,avg}$ (average house price growth). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Full sample spans available data in each case.

Mortgages, credit standards, and beliefs

- One measure of beliefs does, but *since 2007*.

Holder	Full sample					
	1991:Q4-2017:Q4			2000:Q1-2013:Q4	2007:Q1-2017:Q4	
	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$	$\Delta p_t^{e,med}$	$\Delta p_t^{e,avg}$
Δ_4 log All	0.003	-0.133	-0.013	-1.446	0.006	0.007
$t-$stat	(1.517)	(-1.613)	(-0.994)	(-1.167)	(0.582)	(1.431)
$\bar{R}^2$	[0.024]	[0.043]	[0.013]	[0.029]	[-0.004]	[0.094]
Δ_4 log ABS	0.013**	-0.037	-0.054	-6.313	-0.002	0.009
$t-$stat	(2.270)	(-0.072)	(-0.957)	(-1.437)	(-0.202)	(1.201)
$\bar{R}^2$	[0.044]	[-0.009]	[0.013]	[0.059]	[-0.023]	[0.003]
Δ_4 log GSE	-0.005***	0.131**	-0.030***	-0.493	-0.018	-0.009
$t-$stat	(-3.362)	(2.363)	(-3.942)	(-0.460)	(-1.232)	(-1.209)
$\bar{R}^2$	[0.157]	[0.071]	[0.165]	[-0.008]	[0.091]	[0.100]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.018***	-0.168	-0.025	-5.819	0.016	0.018**
$t-$stat	(3.587)	(-0.337)	(-0.435)	(-1.304)	(1.597)	(2.539)
$\bar{R}^2$	[0.101]	[-0.004]	[-0.004]	[0.049]	[0.001]	[0.113]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). $\Delta p_t^{e,med}$ (median house price growth). $\Delta p_t^{e,avg}$ (average house price growth). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Full sample spans available data in each case.

Mortgages, credit supply, and beliefs: GHC Sample

- ΔCS *more positively* related to growth in **ratio of ABS/GSE** in GHC subsample, underscoring role **easier credit** during boom.

	GHC subsample 2000:Q1-2010:Q4			
Holder	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$
Δ_4 logAll	0.007***	-0.239**	0.001	-0.545
$t-$stat	(4.713)	(-2.285)	(0.039)	(-0.397)
$\bar{R}^2$	[0.389]	[0.149]	[-0.024]	[-0.017]
Δ_4 log ABS	0.028***	-0.986**	0.034	-3.939
$t-$stat	(4.568)	(-2.169)	(0.418)	(-0.815)
$\bar{R}^2$	[0.427]	[0.189]	[-0.013]	[0.009]
Δ_4 log GSE	-0.003**	0.177***	-0.030***	0.495
$t-$stat	(-2.215)	(2.803)	(-3.372)	(0.553)
$\bar{R}^2$	[0.150]	[0.186]	[0.250]	[-0.009]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.032***	-1.162**	0.064	-4.434
$t-$stat	(4.700)	(-2.508)	(0.742)	(-0.881)
$\bar{R}^2$	[0.472]	[0.239]	[0.012]	[0.013]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. The GHC sample spans 2000:Q1 - 2010:Q4.

Mortgages, credit supply, and beliefs: GHC Sample

- Only one measure of beliefs, $\Delta_4 bci$, related to **credit composition** *during GHC subperiod*; has wrong (negative) sign.

	GHC subsample 2000:Q1-2010:Q4			
Holder	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$
Δ_4 logAll	0.007***	-0.239**	0.001	-0.545
$t-$stat	(4.713)	(-2.285)	(0.039)	(-0.397)
$\bar{R}^2$	[0.389]	[0.149]	[-0.024]	[-0.017]
Δ_4 log ABS	0.028***	-0.986**	0.034	-3.939
$t-$stat	(4.568)	(-2.169)	(0.418)	(-0.815)
$\bar{R}^2$	[0.427]	[0.189]	[-0.013]	[0.009]
Δ_4 log GSE	-0.003**	0.177***	-0.030***	0.495
$t-$stat	(-2.215)	(2.803)	(-3.372)	(0.553)
$\bar{R}^2$	[0.150]	[0.186]	[0.250]	[-0.009]
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$t-$stat	(4.700)	(-2.508)	(0.742)	(-0.881)
$\bar{R}^2$	[0.472]	[0.239]	[0.012]	[0.013]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. The GHC sample spans 2000:Q1 - 2010:Q4.

Mortgages, credit supply, and beliefs: GHC Sample

- Possible *lenders' beliefs* altered willingness to bear mortgage credit risk, with optimistic beliefs associated with growth in ABS/GSE.

	GHC subsample 2000:Q1-2010:Q4			
Holder	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$
Δ_4 logAll	0.007***	-0.239**	0.001	-0.545
$t-$stat	(4.713)	(-2.285)	(0.039)	(-0.397)
$\bar{R}^2$	[0.389]	[0.149]	[-0.024]	[-0.017]
Δ_4 log ABS	0.028***	-0.986**	0.034	-3.939
$t-$stat	(4.568)	(-2.169)	(0.418)	(-0.815)
$\bar{R}^2$	[0.427]	[0.189]	[-0.013]	[0.009]
Δ_4 log GSE	-0.003**	0.177***	-0.030***	0.495
$t-$stat	(-2.215)	(2.803)	(-3.372)	(0.553)
$\bar{R}^2$	[0.150]	[0.186]	[0.250]	[-0.009]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.032***	-1.162**	0.064	-4.434
$t-$stat	(4.700)	(-2.508)	(0.742)	(-0.881)
$\bar{R}^2$	[0.472]	[0.239]	[0.012]	[0.013]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. The GHC sample spans 2000:Q1 - 2010:Q4.

Mortgages, credit supply, and beliefs: GHC Sample

- Lenders beliefs would need **differ** from those captured by the measures here, else evidence unsupportive.

	GHC subsample 2000:Q1-2010:Q4			
Holder	$\Delta_4 CS$	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$
Δ_4 logAll	0.007***	-0.239**	0.001	-0.545
$t-$stat	(4.713)	(-2.285)	(0.039)	(-0.397)
$\bar{R}^2$	[0.389]	[0.149]	[-0.024]	[-0.017]
Δ_4 log ABS	0.028***	-0.986**	0.034	-3.939
$t-$stat	(4.568)	(-2.169)	(0.418)	(-0.815)
$\bar{R}^2$	[0.427]	[0.189]	[-0.013]	[0.009]
Δ_4 log GSE	-0.003**	0.177***	-0.030***	0.495
$t-$stat	(-2.215)	(2.803)	(-3.372)	(0.553)
$\bar{R}^2$	[0.150]	[0.186]	[0.250]	[-0.009]
$\Delta_4 \log\left(\frac{\text{ABS}}{\text{GSE}}\right)$	0.032***	-1.162**	0.064	-4.434
$t-$stat	(4.700)	(-2.508)	(0.742)	(-0.881)
$\bar{R}^2$	[0.472]	[0.239]	[0.012]	[0.013]

Regressions of 4-quarter log change of each mortgage type. $\Delta_4 CS$ (four quarter sum of ΔCS). $\Delta_4 bci$ (annual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (annual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (annual change in house media index). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. The GHC sample spans 2000:Q1 - 2010:Q4.

Summary of Evidence on Hypothesis 1

- Foregoing analysis pertinent to hypothesis 1 on mortgage composition, credit conditions, beliefs.
- **Easing of credit standards** positively related to fraction of riskier non-conforming debt in total mortgage lending.
- **Measures of beliefs**, **unrelated** to this ratio.
- Underscores role of **easier credit** in proliferation of non-conforming debt during boom and its subsequent reversal during bust.

Univariate regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

Regression of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.011***			0.012***		0.011***		
$t-$stat	(11.575)			(8.286)		(8.176)		
Δbci_t		-0.043						
$t-$stat		(-1.362)						
Δbci_t^{highFP}			0.017**					
$t-$stat			(2.551)					
Δhmi_t					1.212**			
$t-$stat					(2.666)			
$\Delta p_t^{e,med}$							0.012***	
$t-$stat							(3.935)	
$\Delta p_t^{e,avg}$								0.007***
								(5.541)
$\bar{R}^2$	[0.307]	[0.000]	[0.087]	[0.370]	[0.079]	[0.380]	[0.107]	[0.201]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). *Sig. at 10%. **Sig. at 5%. ***Sig. at 1%. Full sample spans all the available data in each case.

Univariate regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- ΔCS explains quantitatively **large magnitudes** of Δp_t

Regression of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.011***			0.012***		0.011***		
$t-$stat	(11.575)			(8.286)		(8.176)		
Δbci_t		-0.043						
$t-$stat		(-1.362)						
Δbci_t^{highFP}			0.017**					
$t-$stat			(2.551)					
Δhmi_t					1.212**			
$t-$stat					(2.666)			
$\Delta p_t^{e,med}$							0.012***	
$t-$stat							(3.935)	
$\Delta p_t^{e,avg}$								0.007***
								(5.541)
$\bar{R}^2$	[0.307]	[0.000]	[0.087]	[0.370]	[0.079]	[0.380]	[0.107]	[0.201]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). *Sig. at 10%. **Sig. at 5%. ***Sig. at 1%. Full sample spans all the available data in each case.

Univariate regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- Coeff of 0.01 => a 1 St. Dev $\uparrow \Delta CS \rightarrow$ 100bp $\uparrow$ quart. real HP growth $\approx$ 4% at annual rate $\approx \frac{1}{2}$ of 1 St. Dev change in Δp_t.

Regression of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.011***			0.012***		0.011***		
$t-$stat	(11.575)			(8.286)		(8.176)		
Δbci_t		-0.043						
$t-$stat		(-1.362)						
Δbci_t^{highFP}			0.017**					
$t-$stat			(2.551)					
Δhmi_t					1.212**			
$t-$stat					(2.666)			
$\Delta p_t^{e,med}$							0.012***	
$t-$stat							(3.935)	
$\Delta p_t^{e,avg}$								0.007***
								(5.541)
$\bar{R}^2$	[0.307]	[0.000]	[0.087]	[0.370]	[0.079]	[0.380]	[0.107]	[0.201]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). *Sig. at 10%. **Sig. at 5%. ***Sig. at 1%. Full sample spans all the available data in each case.

Univariate regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- Several measures of beliefs do as well, though fraction variation explained is more modest.

Regression of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.011***			0.012***		0.011***		
$t-$stat	(11.575)			(8.286)		(8.176)		
Δbci_t		-0.043						
$t-$stat		(-1.362)						
Δbci_t^{highFP}			0.017**					
$t-$stat			(2.551)					
Δhmi_t					1.212**			
$t-$stat					(2.666)			
$\Delta p_t^{e,med}$							0.012***	
$t-$stat							(3.935)	
$\Delta p_t^{e,avg}$								0.007***
								(5.541)
$\bar{R}^2$	[0.307]	[0.000]	[0.087]	[0.370]	[0.079]	[0.380]	[0.107]	[0.201]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). *Sig. at 10%. **Sig. at 5%. ***Sig. at 1%. Full sample spans all the available data in each case.

Univariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- ΔCS explains even **larger magnitudes** of Δp_t in the **GHC subsample**.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	GHC Subsample 2000:Q1-2010:Q4			
Regressors:	(1)	(2)	(3)	(4)
ΔCS_t	0.013***			
$t-$stat	(9.704)			
Δbci_t		-0.075		
$t-$stat		(-1.562)		
Δbci_t^{highFP}			-0.004	
$t-$stat			(-0.638)	
Δhmi_t				1.021**
$t-$stat				(2.310)
$\Delta p_t^{e,med}$				
$t-$stat				
$\Delta p_t^{e,avg}$				
$t-$stat				
$\bar{R}^2$	[0.535]	[-0.001]	[-0.014]	[0.061]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%. GHC sample spans the period 2000:Q1 - 2010:Q4.

Univariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- In GHC subsample, only Soo's **housing media index** is significant as measure of beliefs.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	GHC Subsample 2000:Q1-2010:Q4			
Regressors:	(1)	(2)	(3)	(4)
ΔCS_t	0.013***			
$t-$stat	(9.704)			
Δbci_t		-0.075		
$t-$stat		(-1.562)		
Δbci_t^{highFP}			-0.004	
$t-$stat			(-0.638)	
Δhmi_t				1.021**
$t-$stat				(2.310)
$\Delta p_t^{e,med}$				
$t-$stat				
$\Delta p_t^{e,avg}$				
$t-$stat				
$\bar{R}^2$	[0.535]	[-0.001]	[-0.014]	[0.061]

Notes: Regressions of Δp_t on ΔCS_t and beliefs. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%. GHC sample spans the period 2000:Q1 - 2010:Q4.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- Control simultaneously for credit conditions, beliefs, economic fundamentals.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.008**	0.006
$t-$stat	(6.820)	(6.690)	(7.977)	(4.604)	(4.656)	(4.772)	(2.230)	(1.599)
Δbci_t		0.002						
$t-$stat		(0.078)						
Δbci_t^{highFP}			0.012**					
$t-$stat			(2.026)					
Δhmi_t					0.930**			
$t-$stat					(2.383)			
$\Delta p_t^{e,med}$							0.002	
$t-$stat							(0.360)	
$\Delta p_t^{e,avg}$								0.003
								(1.247)
Fundamentals	✓	✓	✓	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.341]	[0.334]	[0.384]	[0.395]	[0.443]	[0.360]	[0.345]	[0.372]

Notes: Regressions of Δp_t on *CS*, beliefs. **Fundamentals: 10-year bond yield minus median SPF 10-year inflation forecast, and the median SPF *forecast*$_t$ of real GDP growth between t and $t+4$.** Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- ΔCS_t strongly significant; $\overline{R}^2$ column (1) about same as in **univariate regression** of Δp_t on ΔCS_t alone.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.008**	0.006
$t-$stat	(6.820)	(6.690)	(7.977)	(4.604)	(4.656)	(4.772)	(2.230)	(1.599)
Δbci_t		0.002						
$t-$stat		(0.078)						
Δbci_t^{highFP}			0.012**					
$t-$stat			(2.026)					
Δhmi_t					0.930**			
$t-$stat					(2.383)			
$\Delta p_t^{e,\,med}$							0.002	
$t-$stat							(0.360)	
$\Delta p_t^{e,\,avg}$								0.003
								(1.247)
Fundamentals	✓	✓	✓	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.341]	[0.334]	[0.384]	[0.395]	[0.443]	[0.360]	[0.345]	[0.372]

Notes: Regressions of Δp_t on *CS*, beliefs. **Fundamentals: 10-year bond yield minus median SPF 10-year inflation forecast, and the median SPF *forecast*$_t$ of real GDP growth between t and $t+4$.** Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- **Two measures of beliefs** have statistically significant explanatory power, add modestly to $\overline{R}^2$ compared to regression w/o beliefs.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.008**	0.006
$t-$stat	(6.820)	(6.690)	(7.977)	(4.604)	(4.656)	(4.772)	(2.230)	(1.599)
Δbci_t		0.002						
$t-$stat		(0.078)						
Δbci_t^{highFP}			0.012**					
$t-$stat			(2.026)					
Δhmi_t					0.930**			
$t-$stat					(2.383)			
$\Delta p_t^{e,med}$							0.002	
$t-$stat							(0.360)	
$\Delta p_t^{e,avg}$								0.003
								(1.247)
Fundamentals	✓	✓	✓	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.341]	[0.334]	[0.384]	[0.395]	[0.443]	[0.360]	[0.345]	[0.372]

Notes: Regressions of Δp_t on *CS*, beliefs. **Fundamentals: 10-year bond yield minus median SPF 10-year inflation forecast, and the median SPF *forecast*$_t$ of real GDP growth between t and $t+4$.** Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- **Two measures of beliefs** previously significant no longer are, once ΔCS, fundamentals included.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	Full Sample							
Regressors:	1991:Q4 - 2017:Q4			2000:Q1 - 2013:Q4		2007:Q1 - 2017:Q4		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔCS_t	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.008**	0.006
$t-$stat	(6.820)	(6.690)	(7.977)	(4.604)	(4.656)	(4.772)	(2.230)	(1.599)
Δbci_t		0.002						
$t-$stat		(0.078)						
Δbci_t^{highFP}			0.012**					
$t-$stat			(2.026)					
Δhmi_t					0.930**			
$t-$stat					(2.383)			
$\Delta p_t^{e,med}$							0.002	
$t-$stat							(0.360)	
$\Delta p_t^{e,avg}$								0.003
								(1.247)
Fundamentals	✓	✓	✓	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.341]	[0.334]	[0.384]	[0.395]	[0.443]	[0.360]	[0.345]	[0.372]

Notes: Regressions of Δp_t on *CS*, beliefs. **Fundamentals: 10-year bond yield minus median SPF 10-year inflation forecast, and the median SPF *forecast*$_t$ of real GDP growth between t and $t+4$.** Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- GHC subsample, marginal explanatory power of credit standards **larger**.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	GHC Subsample 2000:Q1-2010:Q4			
Regressors:	(1)	(2)	(3)	(4)
ΔCS_t	0.008***	0.008***	0.008***	0.008***
$t-$stat	(3.292)	(3.401)	(3.611)	(3.542)
Δbci_t		0.029		
$t-$stat		(0.750)		
Δbci_t^{highFP}			0.007	
$t-$stat			(1.166)	
Δhmi_t				0.659*
$t-$stat				(1.914)
$\Delta p_t^{e,med}$				
$t-$stat				
$\Delta p_t^{e,avg}$				
$t-$stat				
Fundamentals	✓	✓	✓	✓
$\bar{R}^2$	[0.581]	[0.573]	[0.585]	[0.607]

Notes: Regressions of Δp_t on *CS*, beliefs. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%. GHC sample spans the period 2000:Q1 - 2010:Q4.

Multivariate Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

- **One measure of beliefs** is marginally significant; adds small amount to $\bar{R}^2$ compared to regression w/o Δhmi.

Regressions of Δp_t on ΔCS_t and $\Delta beliefs_t$

	GHC Subsample 2000:Q1-2010:Q4			
Regressors:	(1)	(2)	(3)	(4)
ΔCS_t	0.008***	0.008***	0.008***	0.008***
$t-$stat	(3.292)	(3.401)	(3.611)	(3.542)
Δbci_t		0.029		
$t-$stat		(0.750)		
Δbci_t^{highFP}			0.007	
$t-$stat			(1.166)	
Δhmi_t				0.659*
$t-$stat				(1.914)
$\Delta p_t^{e,med}$				
$t-$stat				
$\Delta p_t^{e,avg}$				
$t-$stat				
Fundamentals	✓	✓	✓	✓
$\bar{R}^2$	[0.581]	[0.573]	[0.585]	[0.607]

Notes: Regressions of Δp_t on *CS*, beliefs. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%. GHC sample spans the period 2000:Q1 - 2010:Q4.

Summary of Evidence on Hypothesis 2

- Foregoing analysis pertinent to hypothesis 2 on explaining **contemporaneous house price changes**.
- ΔCS_t strong explanatory power controlling for fundamentals and beliefs.
- **Two measures of beliefs** have **explanatory power** controlling for fundamentals and ΔCS_t, but fraction variation explained smaller.
- **Did beliefs push house prices beyond that justified by fundamentals and credit standards in boom/bust?** Only Δhmi has marginal explanatory power for Δp_t in GHC subsample.
- This measure explains $\approx$ 2.6% more of variation compared to regression without Δhmi.

Predicting House Price Growth $\Delta p_{t+h,t}$

- Predict HP growth from $h = 1$ to $h = 4$ quarters ahead, controlling for **lagged house price** changes, **fundamentals**.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h = 1$	$h = 1$	$h = 2$	$h = 3$	$h = 4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- ΔCS_t strong marginal predictor of $\Delta p_{t+h,t}$, for $h = 1, ..., 4$. Adding *lagged* Δp_t adds modest amount to the $\bar{R}^2$ with ΔCS_t alone.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h = 1$	$h = 1$	$h = 2$	$h = 3$	$h = 4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- **Beliefs** have little quantitatively important predictive power.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- **One specification** $=>$ Δbci_t significant for predicting Δp_{t+1}.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- **Adds little to $\overline{R}^2$** over specification w/o Δbci_t.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- **No predictive power** for $h = 2, ..., 4$.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	**Sample: 1991:Q4 - 2017:Q4**				
	Forecast horizon				
	$h = 1$	$h = 1$	$h = 2$	$h = 3$	$h = 4$
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021***
t-stat	(5.025)	(3.539)	(3.989)	(3.421)	(2.688)
Δp_t		0.320***	0.205	0.539**	1.386***
t-stat		(4.352)	(1.091)	(2.000)	(4.234)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.323]	[0.308]	[0.380]	[0.505]
ΔCS_t	0.009***	0.007***	0.017***	0.021***	0.021***
t-stat	(5.025)	(3.934)	(4.131)	(3.461)	(2.750)
Δbci_t		0.073**	0.085	0.052	0.068
t-stat		(2.067)	(1.398)	(0.774)	(0.800)
Δp_t		0.319***	0.203	0.537*	1.381***
t-stat		(4.063)	(1.052)	(1.968)	(4.177)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.344]	[0.314]	[0.377]	[0.503]
ΔCS_t	0.009***	0.006***	0.016***	0.021***	0.021**
t-stat	(5.025)	(3.525)	(3.881)	(3.308)	(2.627)
Δbci_t^{highFP}		0.003	0.000	-0.004	-0.001
t-stat		(0.559)	(0.016)	(-0.427)	(-0.086)
Δp_t		0.301***	0.204	0.560*	1.391***
t-stat		(3.507)	(1.007)	(1.947)	(4.000)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.262]	[0.320]	[0.301]	[0.375]	[0.500]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and Δbeliefs$_t$. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- ΔCS_t strong marginal predictor of $\Delta p_{t+h,t}$, for $h = 1, ..., 4$.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	Panel A: 2000:Q1 - 2013:Q4				
	Forecast horizon				
	$h = 1$	$h = 1$	$h = 2$	$h = 3$	$h = 4$
ΔCS_t	0.010***	0.008***	0.020***	0.022***	0.019*
t-stat	(4.742)	(3.472)	(3.750)	(2.742)	(1.955)
Δhmi_t		0.109	0.076	-0.112	0.253
t-stat		(0.451)	(0.134)	(-0.148)	(0.319)
Δp_t		0.282***	0.171	0.542	1.320***
t-stat		(2.983)	(0.762)	(1.570)	(3.033)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.309]	[0.337]	[0.340]	[0.400]	[0.506]
	Panel B: 2007:Q1 - 2017:Q4				
ΔCS_t	0.010***	0.009***	0.022***	0.023***	0.024***
t-stat	(4.699)	(2.508)	(4.972)	(3.590)	(4.197)
$\Delta p_t^{e,med}$		0.001	0.002	0.001	-0.014
t-stat		(0.226)	(0.319)	(0.093)	(-1.488)
Δp_t		0.111	-0.400**	-0.359**	0.410**
t-stat		(1.203)	(-2.656)	(-2.289)	(2.478)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.319]	[0.293]	[0.542]	[0.750]	[0.835]
ΔCS_t	0.010***	0.008***	0.020***	0.018***	0.017**
t-stat	(4.699)	(2.848)	(6.176)	(3.451)	(2.654)
$\Delta p_t^{e,avg}$		0.001	0.005	0.006	0.000
t-stat		(0.759)	(1.262)	(1.248)	(0.089)
Δp_t		0.095	-0.463***	-0.442***	0.411**
t-stat		(1.126)	(-3.237)	(-2.940)	(2.312)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.319]	[0.297]	[0.561]	[0.769]	[0.823]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and beliefs. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%, ** Sig. at 5%, *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$

- **Beliefs** have no predictive power.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$

Regressor:	Forecast horizon				
	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
Panel A: 2000:Q1 - 2013:Q4					
ΔCS_t	0.010***	0.008***	0.020***	0.022***	0.019*
t-stat	(4.742)	(3.472)	(3.750)	(2.742)	(1.955)
Δhmi_t		0.109	0.076	-0.112	0.253
t-stat		(0.451)	(0.134)	(-0.148)	(0.319)
Δp_t		0.282***	0.171	0.542	1.320***
t-stat		(2.983)	(0.762)	(1.570)	(3.033)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.309]	[0.337]	[0.340]	[0.400]	[0.506]
Panel B: 2007:Q1 - 2017:Q4					
ΔCS_t	0.010***	0.009***	0.022***	0.023***	0.024***
t-stat	(4.699)	(2.508)	(4.972)	(3.590)	(4.197)
$\Delta p_t^{e,med}$		0.001	0.002	0.001	-0.014
t-stat		(0.226)	(0.319)	(0.093)	(-1.488)
Δp_t		0.111	-0.400**	-0.359**	0.410**
t-stat		(1.203)	(-2.656)	(-2.289)	(2.478)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.319]	[0.293]	[0.542]	[0.750]	[0.835]
ΔCS_t	0.010***	0.008***	0.020***	0.018***	0.017**
t-stat	(4.699)	(2.848)	(6.176)	(3.451)	(2.654)
$\Delta p_t^{e,avg}$		0.001	0.005	0.006	0.000
t-stat		(0.759)	(1.262)	(1.248)	(0.089)
Δp_t		0.095	-0.463***	-0.442***	0.411**
t-stat		(1.126)	(-3.237)	(-2.940)	(2.312)
Fundamentals	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.319]	[0.297]	[0.561]	[0.769]	[0.823]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and beliefs. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%, ** Sig. at 5%, *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$ in the GHC

- ΔCS_t strong marginal predictor of $\Delta p_{t+h,t}$, for $h = 1, ..., 3$.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$ 2000:Q1-2010:Q4

	Forecast horizon						Forecast horizon				
Regressor:	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$	*Regressor:*	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.010***	0.006**	0.015**	0.016*	0.009	ΔCS_t	0.010***	0.006**	0.015**	0.015*	0.009
t-stat	(2.865)	(2.090)	(2.661)	(1.975)	(1.101)	t-stat	(2.865)	(2.063)	(2.625)	(1.928)	(1.043)
Δp_t		0.435***	0.554*	1.072**	2.198***	Δbci_t^{highFP}		-0.002	-0.003	-0.003	-0.004
t-stat		(2.795)	(1.880)	(2.421)	(4.264)	t-stat		(-0.283)	(-0.390)	(-0.397)	(-0.376)
Fund.	✓	✓	✓	✓	✓	Δp_t		0.445***	0.568*	1.089**	2.219***
$\bar{R}^2$	[0.430]	[0.493]	[0.472]	[0.490]	[0.572]	t-stat		(2.824)	(1.915)	(2.371)	(4.167)
						Fund.	✓	✓	✓	✓	✓
						$\bar{R}^2$	[0.430]	[0.481]	[0.459]	[0.477]	[0.561]

	Forecast horizon						Forecast horizon				
Regressor:	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$	*Regressor:*	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.010***	0.006**	0.016***	0.016*	0.010	ΔCS_t	0.010***	0.006*	0.015**	0.014*	0.008
t-stat	(2.865)	(2.121)	(2.713)	(2.003)	(1.181)	t-stat	(2.865)	(1.925)	(2.613)	(1.839)	(0.958)
Δbci_t		0.056	0.079	0.078	0.115	Δhmi_t		-0.123	-0.025	-0.378	-0.307
t-stat		(1.222)	(0.947)	(0.600)	(0.617)	t-stat		(-0.540)	(-0.039)	(-0.431)	(-0.313)
Δp_t		0.420**	0.532*	1.051**	2.167***	Δp_t		0.461***	0.571**	1.145***	2.267***
t-stat		(2.543)	(1.750)	(2.352)	(4.076)	t-stat		(2.993)	(2.253)	(2.975)	(4.662)
Fund.	✓	✓	✓	✓	✓	Fund.	✓	✓	✓	✓	✓
$\bar{R}^2$	[0.430]	[0.493]	[0.466]	[0.480]	[0.565]	$\bar{R}^2$	[0.430]	[0.473]	[0.452]	[0.476]	[0.561]

Notes: Regressions of $\Delta p_{t+h,t}$ (h in quarters) on ΔCS_t and beliefs. Fundamentals: 10-year bond yield-median SPF 10-year inflation forecast, and the median SPF forecast of real GDP growth between t and $t+4$. Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. at 10%. ** Sig. at 5%. *** Sig. at 1%.

Predicting House Price Growth $\Delta p_{t+h,t}$ in the GHC

- ΔCS_t & $fundamentals_t$ highly correlated, drive other out $h = 4$.

Regressions of $\Delta p_{t+h,t}$ on ΔCS_t and $\Delta beliefs_t$ 2000:Q1-2010:Q4

	Forecast horizon						Forecast horizon				
Regressor:	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$	*Regressor:*	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
ΔCS_t	0.010***	0.006**	0.015**	0.016*	0.009	ΔCS_t	0.010***	0.006**	0.015**	0.015*	0.009
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Regressor:	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$	*Regressor:*	$h=1$	$h=1$	$h=2$	$h=3$	$h=4$
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- **Beliefs** have no predictive power.

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	Forecast horizon						Forecast horizon				
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Summary of Evidence on Hypothesis 3

- Foregoing analysis pertinent to hypothesis 3 on **predicting future house price changes**.
- ΔCS_t strong predictive power controlling for fundamentals and beliefs at horizons from $h = 1$ to $h = 4$ quarters ahead.
- **Beliefs**, exhibit **little meaningful predictive power** controlling for fundamentals and ΔCS_t.

Do Credit Standards *Cause* Changes in Home Prices?

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- If so, *shocks* to ΔCS_t that are **mutually uncorrelated** with *shocks* to Δp_t should have no impact on house price growth.
- Strategy: use a **structural VAR (SVAR)** in ΔCS_t and Δp_t.
- To identify **exogenous variation**, use the *shock-restricted* identification approach of Ludvigson, Ma, Ng (2015, 2016).
- *Set identification* of exogenous variation in SVAR under assumptions weaker than that required for *point identification*.

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- **Identifying assumption**: shifts in **composition of mortgages**, an *external variable (EV)*, are informative about ΔCS shocks.
- Implemented by requiring *positive* ΔCS_t *shocks* (an easing) to exhibit a **minimum correlation** $\lambda > 0$ with $\Delta \ln(ABS/GSE)$.

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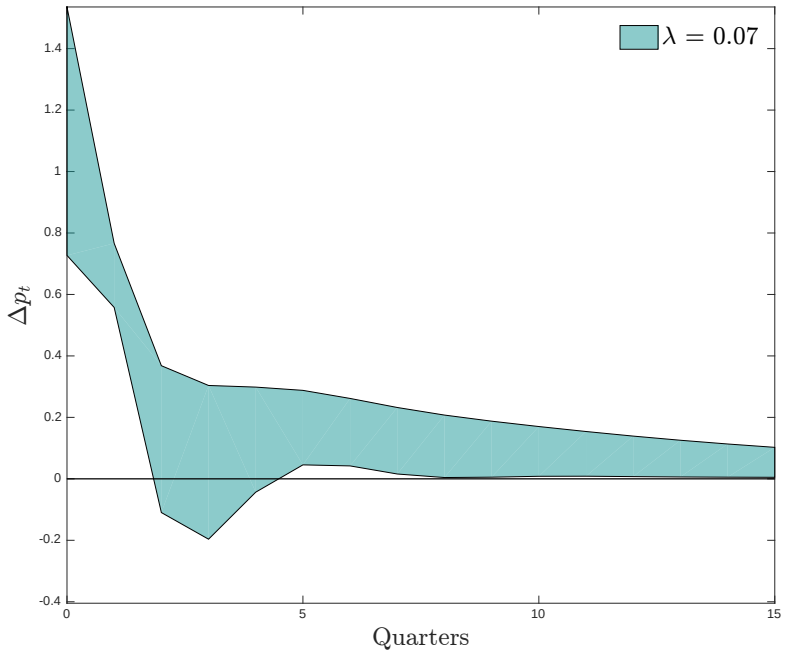
- Implemented by requiring *positive* ΔCS_t *shocks* (an easing) to exhibit a **minimum correlation** $\lambda > 0$ with $\Delta \ln(ABS/GSE)$.
- Has flavor of **External IV or proxy VAR** (Stock and Watson '08, Mertens and Ravn '14) but assumptions are **weaker**:
- Here the EV only required to exhibit minimum degree of *relevance*, *not required to be exogenous* as for valid IV.
- Because our **assumptions are weaker**, we do not achieve point identification. But bounds may still be informative.

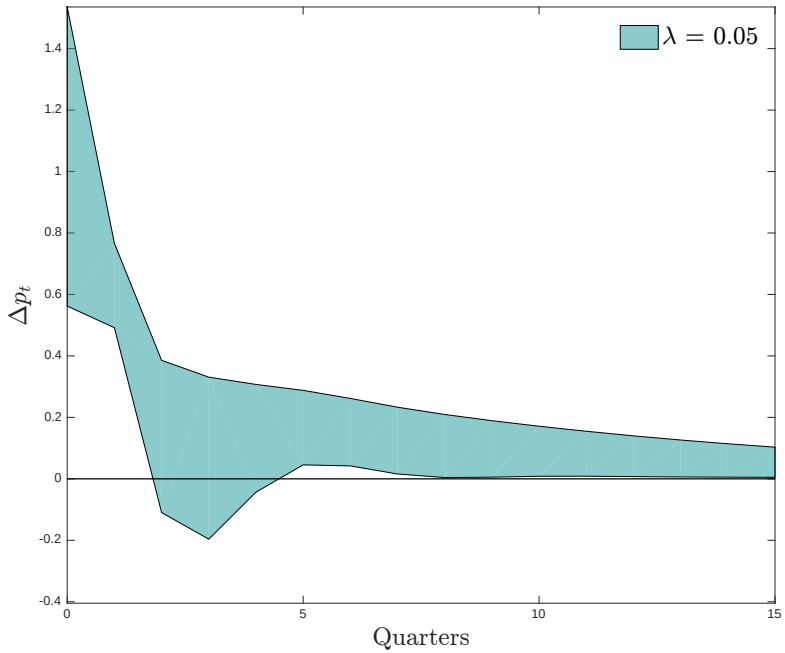
Dynamic Responses of Δp_t to ΔCS_t Shock

- Effects of a 1-StDev *increase* in ΔCS_t shock => *easing* of standards.

(a) Minimum Correlation: 7%



(b) Minimum Correlation: 5%

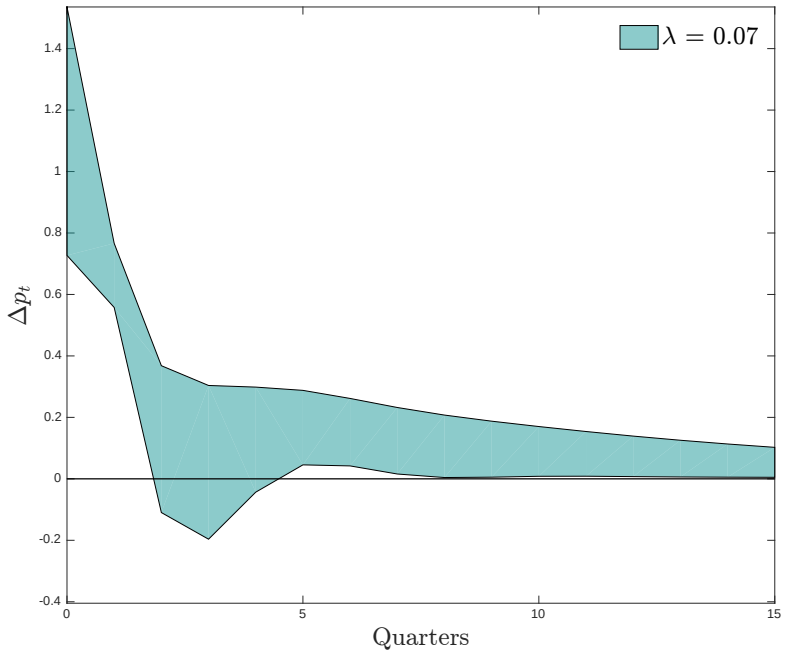


Dynamic Responses of Δp_t to a positive one standard deviation ΔCS_t shock. Panel (a) reports the identified set of responses of Δp_t to a one standard deviation shock in ΔCS with a correlation constraint that sets the minimum correlation between ΔCS and $\Delta \ln(\frac{ABS}{GSE})$ at $\lambda = 7\%$. Panel (b) reports the set of responses when $\lambda = 5\%$. The sample spans the period 1991:Q4-2017:Q4.

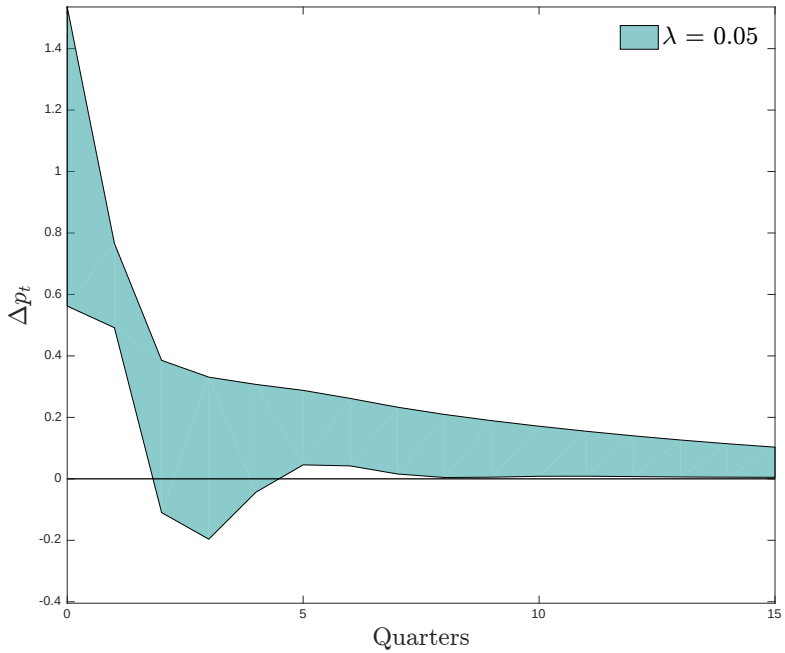
Dynamic Responses of Δp_t to ΔCS_t Shock

- **Bounds** of identified set are **informative** about impact effect.

(a) Minimum Correlation: 7%



(b) Minimum Correlation: 5%



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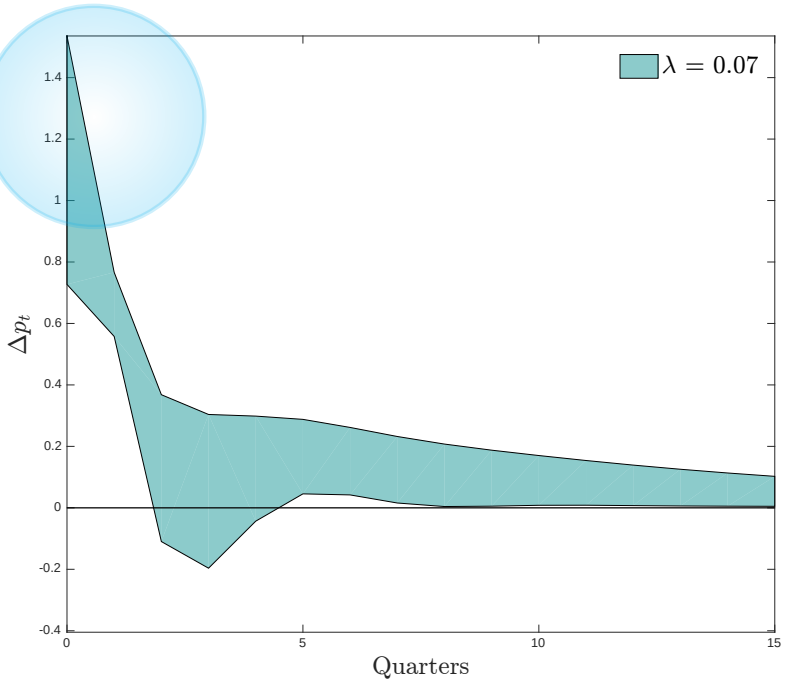
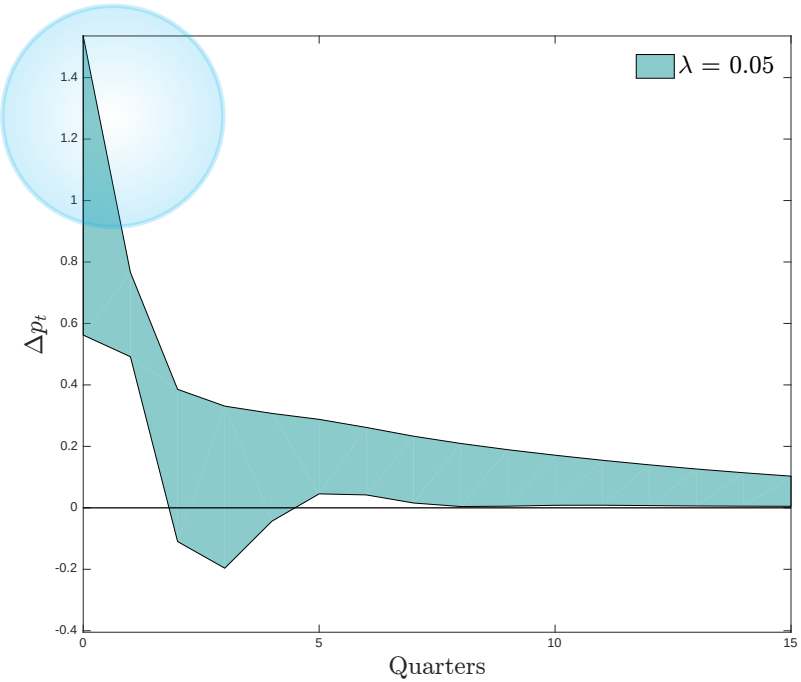
Dynamic Responses of Δp_t to ΔCS_t Shock

- **High end**: 1-StDev shock increases *quarterly* Δp_t by 1.4% on impact, or **5.7% at annual rate**.

(a) Minimum Correlation: 7%



(b) Minimum Correlation: 5%

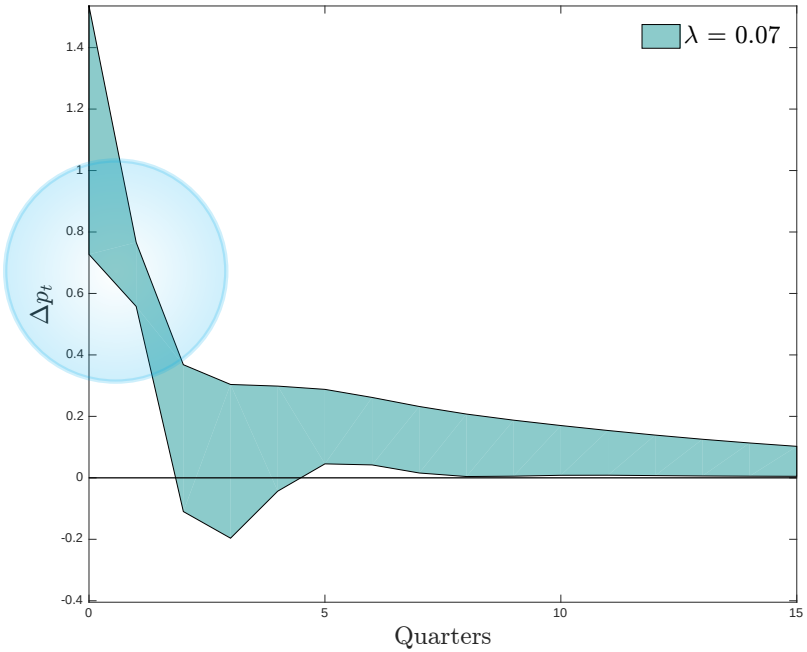


Dynamic Responses of Δp_t to a positive one standard deviation ΔCS_t shock. Panel (a) reports the identified set of responses of Δp_t to a one standard deviation shock in ΔCS with a correlation constraint that sets the minimum correlation between ΔCS and $\Delta \ln(\frac{ABS}{GSE})$ at $\lambda = 7\%$. Panel (b) reports the set of responses when $\lambda = 5\%$. The sample spans the period 1991:Q4-2017:Q4.

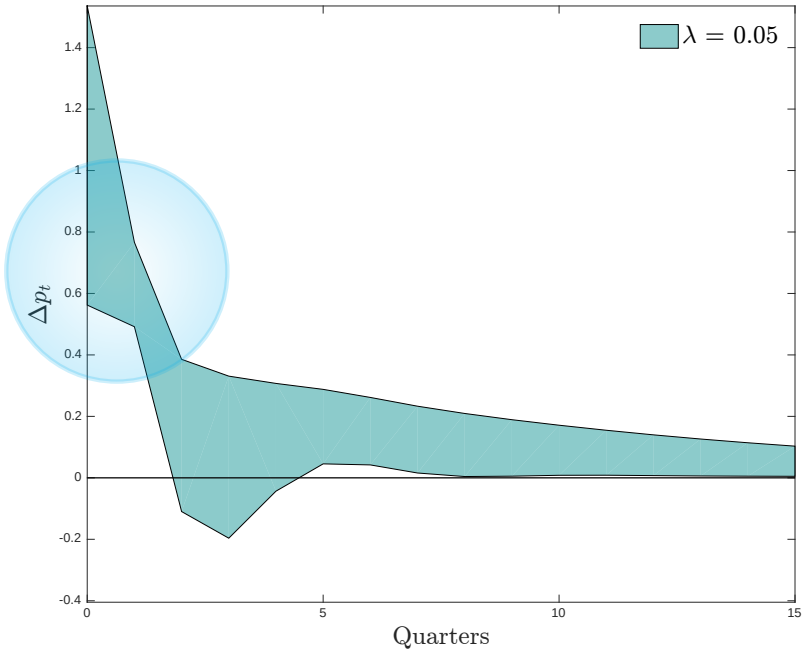
Dynamic Responses of Δp_t to ΔCS_t Shock

- **Low end**: 1-StDev shock increases quarterly Δp_t by 0.8% or 0.6% on impact **(3.2% or 2.4% at annual rate)**.

(a) Minimum Correlation: 7%



(b) Minimum Correlation: 5%



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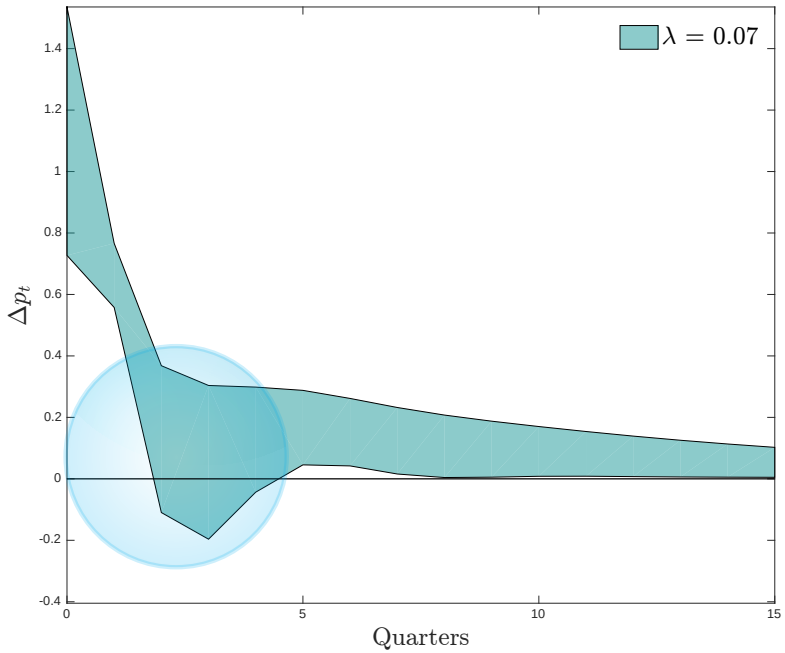
Dynamic Responses of Δp_t to ΔCS_t Shock

- **Magnitudes are substantial** and well determined, but *persistence* of effects less well determined.

(a) Minimum Correlation: 7%



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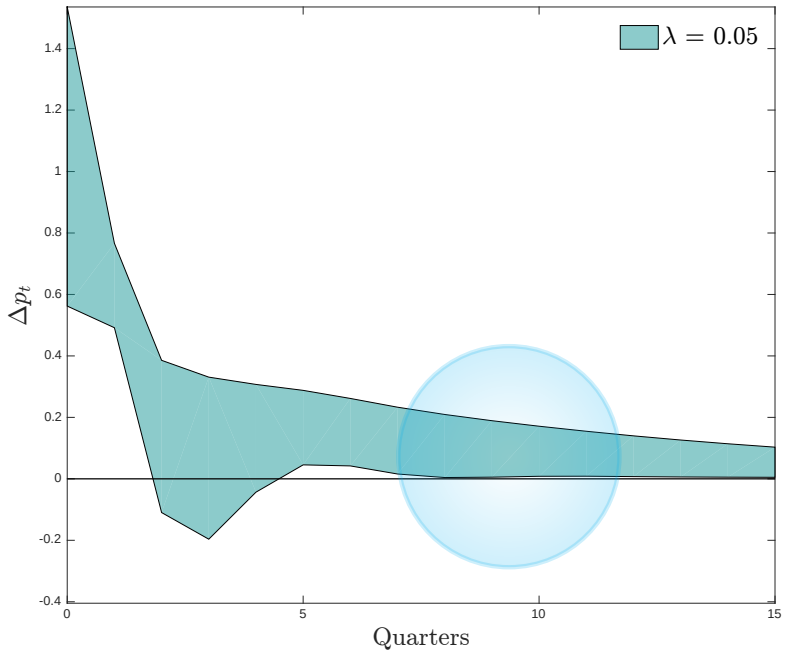

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Summary of Evidence on Hypothesis 4

- Foregoing analysis pertinent to hypothesis 4 on **do credit standards cause house price changes**?
- Shocks to ΔCS_t exhibit quantitatively important **dynamic causal effects** on Δp_t.
- Positive shocks $=>$ **an easing of credit**, **increase home values**; negative shocks $=>$ **a tightening** **decrease them**.

Conclusion

- Consider two potential driving forces of home price fluctuations: credit conditions and beliefs using direct measures of both spanning a range of time periods.
- A relaxation of credit standards positively related to the fraction of **riskier non-conforming debt** in total mortgage lending. **Beliefs** bear no relation to this fraction.
- Credit conditions have statistically and economically important **explanatory and predictive power** for **aggregate house price changes**.
- Two measures of beliefs have modest **explanatory power**, but **none have meaningful predictive power**.
- Structural VAR => credit standards shocks have **quantitatively large dynamic causal effects** on **house price changes**.

Appendix

Mortgage originations, credit supply, and beliefs

	Full sample			
Holder	ΔCS^{MA}	$\Delta_4 bci$	$\Delta_4 bci^{highFP}$	$\Delta_4 hmi$
Δ_4 log All	0.057	2.059***	-0.117	17.986***
$t-$stat	(1.274)	(3.003)	(-0.871)	(6.592)
$\bar{R}^2$	[-0.020]	[0.274]	[0.011]	[0.295]
Δ_4 log PL	0.187**	1.021	-0.177**	3.970
$t-$stat	(2.722)	(0.890)	(-2.305)	(0.430)
$\bar{R}^2$	[0.124]	[0.012]	[0.042]	[-0.082]
Δ_4 log GSE	-0.057	2.565***	-0.171	17.066***
$t-$stat	(-1.374)	(3.917)	(-1.106)	(5.830)
$\bar{R}^2$	[-0.024]	[0.352]	[0.048]	[0.169]
$\Delta_4 \log\left(\frac{\text{PL}}{\text{GSE}}\right)$	0.244***	-1.544	-0.006	-13.096
$t-$stat	(5.706)	(-1.517)	(-0.043)	(-1.290)
$\bar{R}^2$	[0.291]	[0.104]	[-0.042]	[-0.013]

Regressions of the anual log change of each mortgage type. ΔCS^{MA} (four quarter moving average of credit supply). $\Delta_4 bci$ (anual change in buying condition index). $\Delta_4 bci_t^{highFP}$ (anual change in good time b/c prices will increase). $\Delta_4 hmi_t$ (anual change in house media index). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Full sample spans available data in each case.

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Explanatory power of Δp_t for Δp_{t+h}

	Panel A			
	Δp_{t+h} on Forecast Horizon h			
Regressor	$h=1$	$h=2$	$h=3$	$h=4$
Δp_t	0.519***	0.706**	1.160***	1.949***
$t-$stat	(4.825)	(2.527)	(3.083)	(4.733)
$\bar{R}^2$	[0.265]	[0.158]	[0.242]	[0.425]
	Panel B			
	Δp_{t+h} on Forecast Horizon h			
Regressor	$h=1$	$h=2$	$h=3$	$h=4$
$\Delta p_t^{\perp \Delta CS}$	0.336***	0.234	0.568*	1.368***
$t-$stat	(3.672)	(1.053)	(1.826)	(3.778)
$\bar{R}^2$	[0.069]	[0.003]	[0.031]	[0.137]

Regressions of Δp_{t+h} on Δp_t and $\Delta p_t^{\perp \Delta CS}$. Panel A reports regressions of Δp_{t+h} on Δp_t. Panel B presents regression of Δp_{t+h} on the residual from a regression of Δp_t on ΔCS_t, ($e_t^{\perp \Delta CS}$). Newey-West corrected $t-$statistics in parentheses (lags = 4). * Sig. 10%. ** Sig. 5%. *** Sig. 1%. Sample spans 1991:Q4 - 2017:Q4.