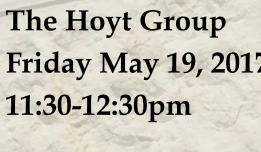
An assessment of local house prices: How low can we go?

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Federal Housing Finance Agency (FHFA)

based on a series of co-authored papers with Alexander Bogin & William Larson (both at FHFA)

Friday May 19, 2017





Disclaimer: The analysis and conclusions are those of the authors and do not necessarily represent the views of the Federal Housing Finance Agency or the United States.



10 years ago house prices fell dramatically.

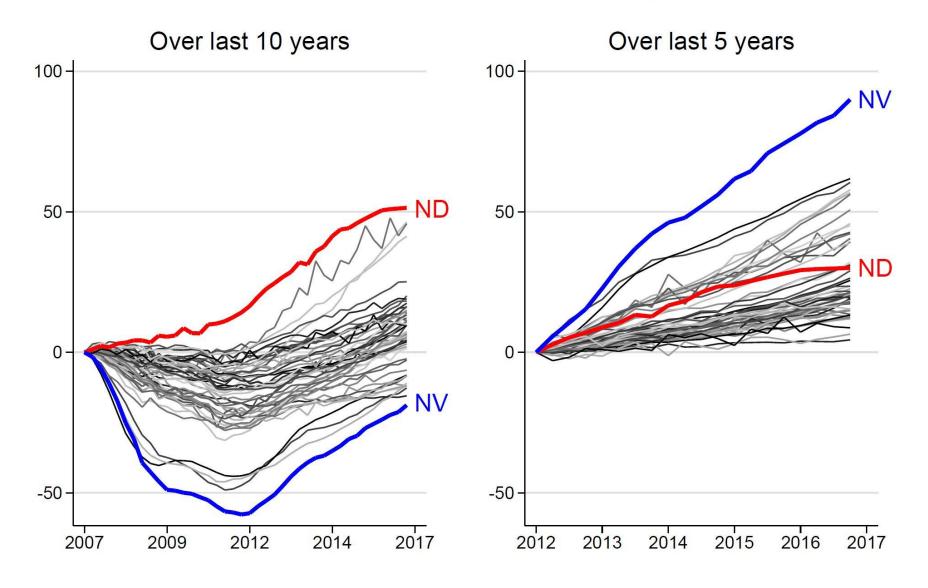
2 weeks ago major news sources ran headlines like:

"Most U.S. homes remain below precrash peaks"

Is this a really bad sign for the "future of real estate"?

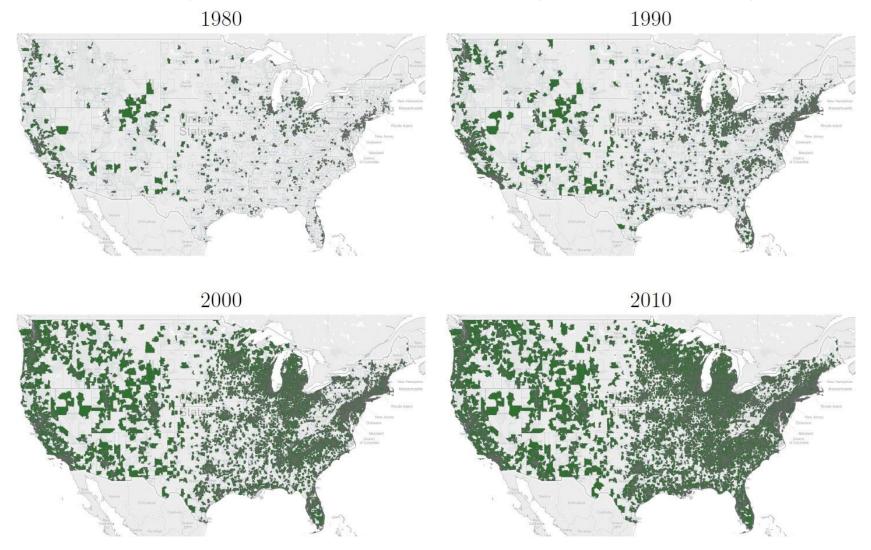
No.

Cumulative house price gains (%)



We released local indices.

These data can provide insights across the nation. And show price trends are <u>actually fine in most places</u>.



A main claim in a USA Today article:

"Only about one-third of U.S. homes have topped their prerecession price peaks, undermining other measures that have shown average national housing prices zooming past those high-water marks."

The claim and data analysis were a bit misleading.

Local values vs national HPIs. Where are HPIs above peak?

- 74% of states, 50% of MSAs, 34% of ZIPs, 37% of tracts
- You get those results as you go more local with data.
- We have such indices but news sources didn't use them.

Peak vs trend. How close are prices to long-run trends?

- 70% of ZIP codes are within 10%, 37% are within 5%.
- Prior peaks don't convey current market health.
- Today's environment is very different than 10 years ago.

Be fair, thorough, & transparent in analysis. Findings can impact public confidence.

Data should enlighten, not beguile.

OUTLINE



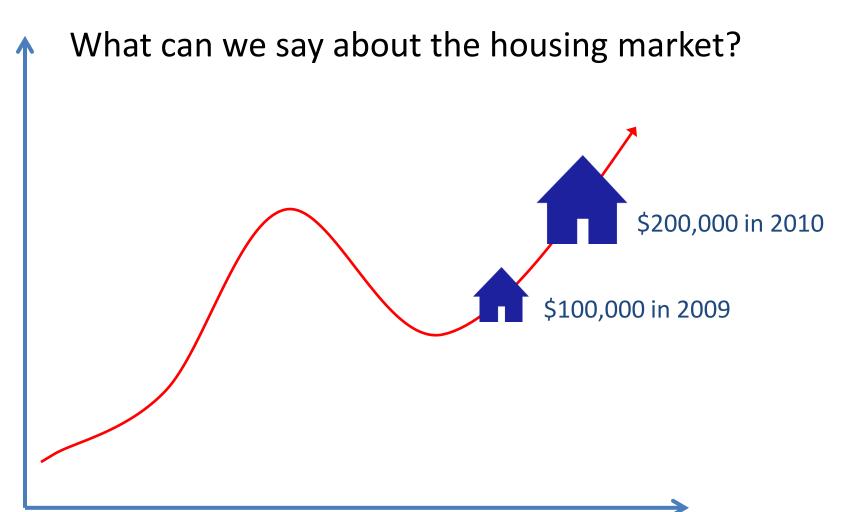
- Motivation for using an index
- FHFA's House Price Indices (HPIs)
- Our recent research on local HPIs
 - Construction of new indices and stylized facts
 - Local accelerations, declines, and recoveries
 - Mortgage valuation and modeling
- Concluding thoughts

How many of you have used house price measures before?

Motivation



Imagine we observe sales of two different houses.



Reflection



How do we measure value?

How is change measured?

$$V' = P'Q + Q'P$$

What does this imply for housing indices?

Medians and means conflate changes in price and quantity.

How do we measure a change?

We focus only on price (or "constant-quality") by pairing up transactions that sell more than once and compute average price changes using a statistical repeat-sales methodology.

How do we construct our HPIs?



Start with a standard house price specification:

$$ln(P_{it}) = \beta_{it} + H_{it} + N_{it}$$

Then use a three-step repeat-sales estimation:

Step 1:
$$\Delta V_i = \ln(P_{it}) - \ln(P_{is}) = \sum_{\tau=0}^{T} \beta_t D_{it} + \varepsilon_{it}$$

Step 2:
$$E\left[d_i^2\right] = A(t-s) + B(t-s)^2 + 2C$$

Step 3:
$$\frac{\Delta V_i}{\sqrt{\hat{d}_i^2}} = \sum_{\tau=0}^T \beta_t \frac{D_{it}}{\sqrt{\hat{d}_i^2}} + \frac{\varepsilon_{it}}{\sqrt{\hat{d}_i^2}}$$

Pros and cons



What are some of the challenges with repeat-sales?

- Houses do not transact every period.
- No two houses are perfectly identical.
- Data on characteristics don't go far back in time
- Data are seldom available across all jurisdictions.

What are some of the advantages with repeat-sales?

- Requires limited information.
- Provides a constant-quality comparison.
- Can be aggregated in different ways.



FHFA's House Price Indices (HPIs)

What is FHFA?



Federal Housing Finance Agency

An <u>independent regulatory agency</u> that oversees Fannie Mae,
 Freddie Mac, and the Federal Home Loan Bank System.

Combined, those entities provide over \$5.8 trillion in funding for the U.S. mortgage market and financial institutions. Our mission is to ensure they:

- Operate in a safe and sound manner.
- Serve as a reliable source of liquidity and funding for housing finance and community investment.
- Conservator of Fannie Mae and Freddie Mac.
- Our HPIs are still sometimes attributed to the Office of Federal Housing Enterprise Oversight (OFHEO) . . . but that had changed with HERA in 2008.

What is the FHFA HPI?



What does the HPI provide?

A broad measure of the movement of single-family house prices.

What data go into the HPI?

Transactions of conforming, conventional mortgages purchased or securitized by Fannie Mae or Freddie Mac.

What does the HPI represent?

The cumulative price change since a base period. The value is nominal and is not annualized.

What is meant, then, if an index rises from 120 to 150?

An area has experienced a 25% increase in the average house price.

$$\frac{150 - 120}{120} * 100\% = \frac{30}{120} * 100\% = 0.25 * 100\% = 25\%$$

Let's use the data for an example



	A	В	C	D	E	F	G	H					
			HP	I for Co	unties (All-Tra	ansactions	Index)						
1		Experin	nental Inde	xes Sho	wing Cumulati	ve (Nomina	I) Annual Appreciat	tion					
ė.		* T(, a sa a			. J J								
							ard FHFA HPIs, revisions I nraisal values and sales nr						
	reflect the impact of new data or technical adjustments. Indexes are calibrated using appraisal values and sales prices for mortgages bought or guaranteed by Fannie Mae and Freddie Mac. As discussed in the Working Paper 16-01, in cases where sample sizes are small for the												
	county area, an index is either not reported if recording has not started or a missing value is reported with a period ("."). Index values always												
	reflect the native county index, i.e. they are not made with data from another area or year. Three HPI values are provided and, since the indexes reflect cumulative appreciation since a certain period, the values reflect the base year being used (annual appreciations are the												
	same). Column A is the state, Column B is the county name, Column C is the county's FIPS code, Column D is the year, Column E is the annual change, Column F is the index value with a base of 100 when first recorded, Column G is the index value with a base of 100 in 1990, an												
							lue in Column F in 1990 or a						
3		will have blank values in				- 100 market							
		"For tracking and feedt	oack purposes,	please cite	Working Paper 16-0	1 when using the	se data. A suggested form	is: Bogin, A., Doerner, W.					
							ederal Housing Finance Ag						
4		The working paper is ac		://www.fhfa.	govłpapers/wp1601.a	aspx.							
5		Last updated: February 2	23, 2017.	110000000									
6	District Co.				Seasonally Adju								
7	State	County			nnual Change (HPI with 2000 base					
30977	MD	Prince Georges	24033	1975		100.00	35.58	32.11					
30978	MD	Prince Georges	24033	1976	3.99	103.99	37.00	33.39					
30979	MD	Prince Georges	24033	1977	4.32	108.48	38.60	34.83					
30980	MD	Prince Georges	24033	1978	9.52	118.81	42.27	38.15					
30981	MD	Prince Georges	24033	1979	11.13	132.04	46.98	42.39					
30982	MD	Prince Georges	24033	1980	13.30	149.59	53.23	48.03					
30983	MD	Prince Georges	24033	1981	4.75	156.70	55.75	50.31					
30984	MD	Prince Georges	24033	1982	6.57	167.00	59.42	53.62					
30985	MD	Prince Georges	24033	1983	1.60	169.66	60.37	54.48					
30986	MD	Prince Georges	24033	1984	5.44	178.89	63.65	57.44					
30987	MD	Prince Georges	24033	1985	6.35	190.26	67.69	61.09					
30988	MD	Prince Georges	24033	1986	6.81	203.22	72.31	65.25					
30989	MD	Prince Georges	24033 24033	1987 1988	8.10	219.69 244.82	78.17	70.54					
30990	MD	Prince Georges Prince Georges	24033	1989	11.44 9.89	269.03	87.11 95.72	78.61 86.38					
30992	MD		24033	1990			100.00	90.24					
30993	MD	Prince Georges Prince Georges	24033	1991	2.16	281.05 287.11	102.16	92.19					
30994	MD	Prince Georges	24033	1992	1.07	290.18	103.25	93.17					
30995	MD	Prince Georges	24033	1993	-0.01	290.15	103.23	93.16					
30996	MD	Prince Georges	24033	1994	-0.18	289.63	103.05	93.00					
30997	MD	Prince Georges	24033	1995	0.50	291.09	103.57	93.46					
30998	MD	Prince Georges	24033	1996	1.24	294.69	104.85	94.62					
30999	MD	Prince Georges	24033	1997	-0.32	293.74	104.51	94.32					
31000	MD	Prince Georges	24033	1998	1.27	297.48	105.84	95.51					
31001	MD	Prince Georges	24033	1999	1.18	300.99	107.09	96.64					
31002	MD	Prince Georges	24033	2000	3.47	311.45	110.81	100.00					
31003	MD	Prince Georges	24033	2001	6.78	332.55	118.32	106.78					
31004	MD	Prince Georges	24033	2002	9.45	363.97	129.50	116.86					
31005	MD	Prince Georges	24033	2003	9.93	400.13	142.37	128.47					
31006	MD	Prince Georges	24033	2004	19.42	477.82	170.01	153.42					
31007	MD	Prince Georges	24033	2005	23.59	590.54	210.11	189.61					
31008	MD	Prince Georges	24033	2006	16.84	689.97	245.49	221.54					
31009	MD	Prince Georges	24033	2007	3.40	713.40	253.83	229.06					
31010	MD	Prince Georges	24033	2008	-9.51	645.57	229.70	207.28					
31011	MD	Prince Georges	24033	2009	-19.82	517.62	184.17	166.20					
31012	MD	Prince Georges	24033	2010	-10.20	464.85	165.40	149.26					
31013	MD	Prince Georges	24033	2011	-7.78	428.68	152.53	137.64					
31014	MD	Prince Georges	24033	2012	-3.45	413.90	147.27	132.90					
31015	MD	Prince Georges	24033	2013	4.38	432.05	153.72	138.72					
31016	MD	Prince Georges	24033	2014	9.59	473.50	168.47	152.03					
31017	MD	Prince Georges	24033	2015	6.48	504.20	179.40	161.89					
31018	MD	Prince Georges	24033	2016	5.53	532.07	189.31	170.84					

What is the trough-topeak recovery in Prince George's County?

Year	HPI
2012	413.90
2016	532.07

Common questions from data users



What is the average market appreciation over a period?
 Use the HPI to compute the percentage change from 2012 to 2016.

$$\frac{New - Old}{Old} * 100\% = \frac{532.07 - 413.90}{413.90} * 100\%$$
$$= 0.2855 * 100\% \approx 29\%$$

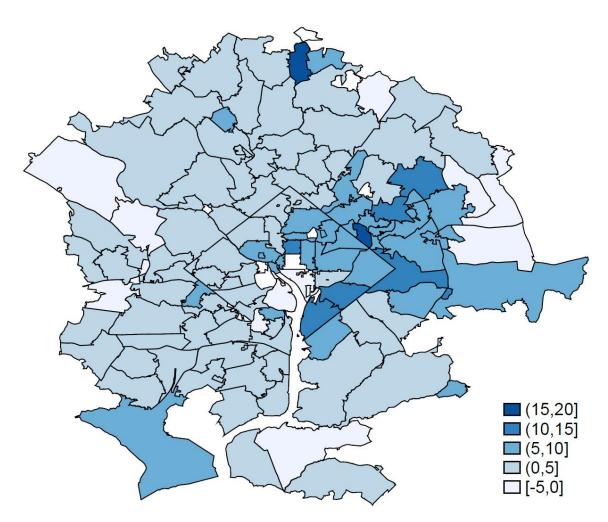
2) How can the HPI be used to adjust an average house price? Imagine a house sold for \$200,000. Multiple that by the increase!

$$$200,000 * (1.2855) = $257,100$$

Common questions from data users



3) Where are the largest percentage gains over the last year?



What areas are covered by our HPIs?



Already provide quarterly:

- Nation
- Census Divisions
- States
- Metropolitan statistical areas (MSAs)
- ZIP3 areas

Now provided annually:

- NEW: Counties, ZIP codes, Census tracts
- MORE: CBSAs
- ALSO: Nation, States, ZIP3 areas

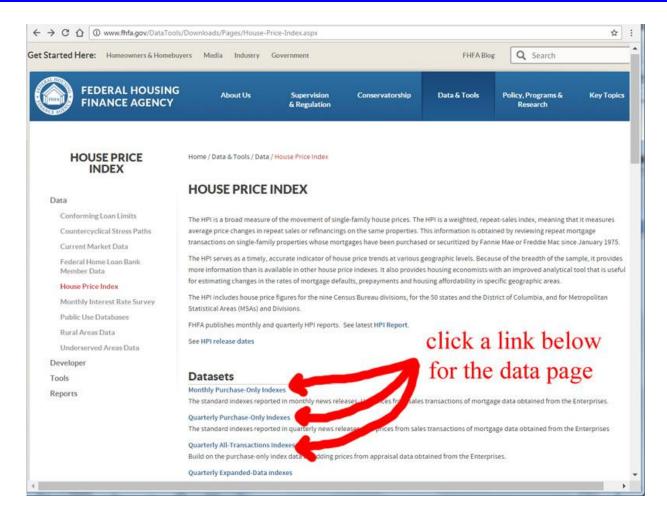
FHFA's HPIs are currently made from around 100 million transactions going back to the 1970s.

Where you can download the data?



https://www.fhfa.gov/hpi

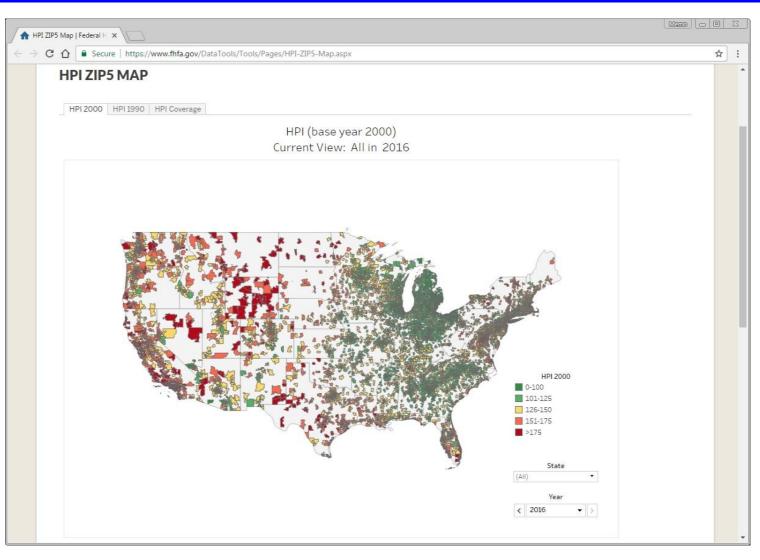
https://www.fhfa.gov/papers/wp1601.aspx



Want to interact with the data?



https://www.fhfa.gov/DataTools/Tools/Pages/HPI-ZIP5-Map.aspx

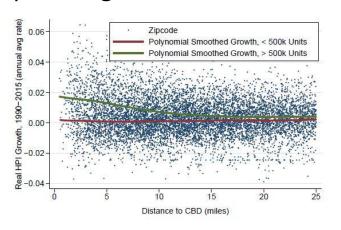




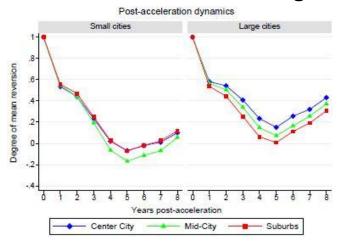
Our recent research on local HPIs

Our recent working papers on local HPIs

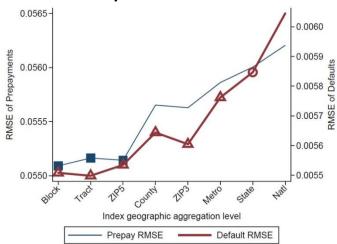
1. House price gradients are shifting upward again



2. Quick growth is most sustainable in CBDs of large cities



3. Best valuation accuracy and model fit with city & ZIP5 HPIs



Our recent working papers on local HPIs





The New York Times



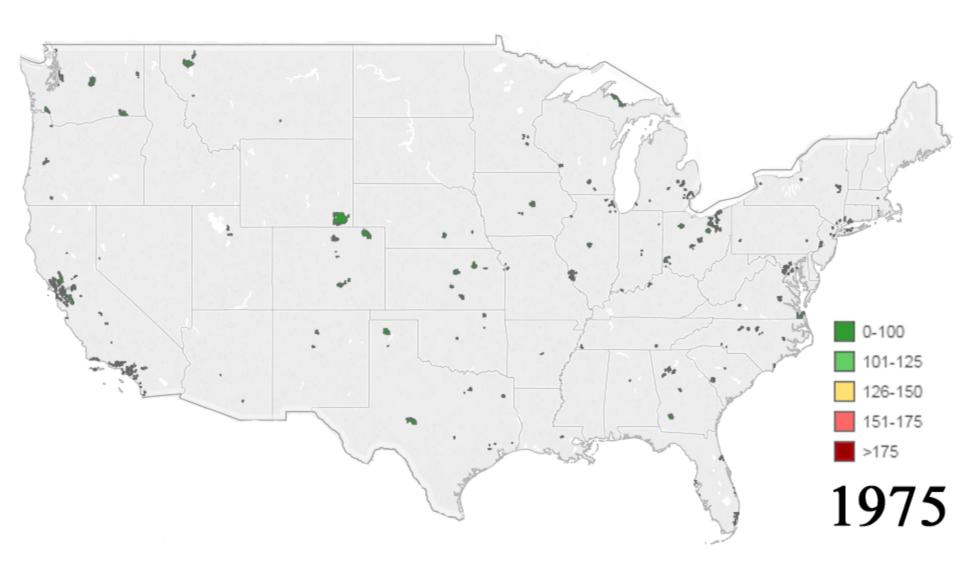


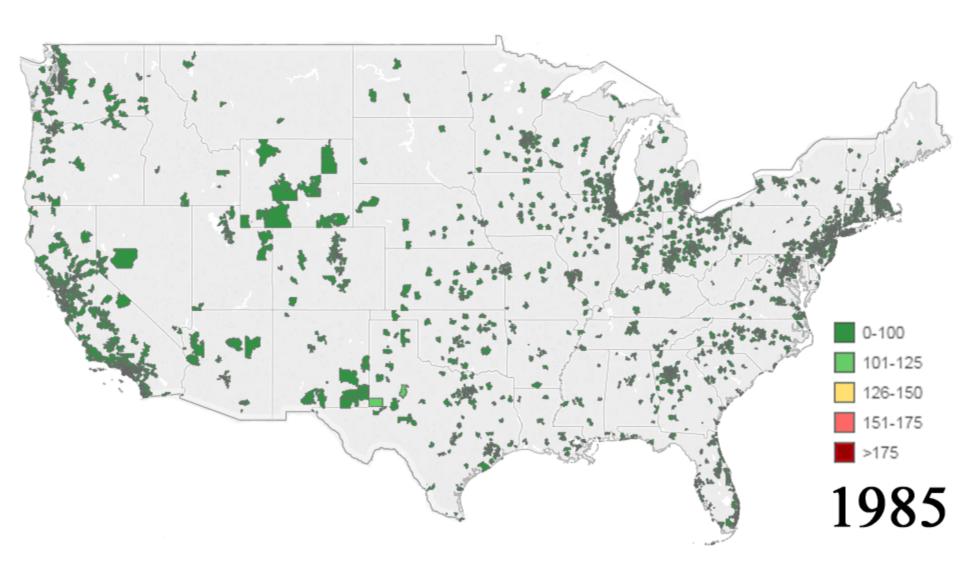


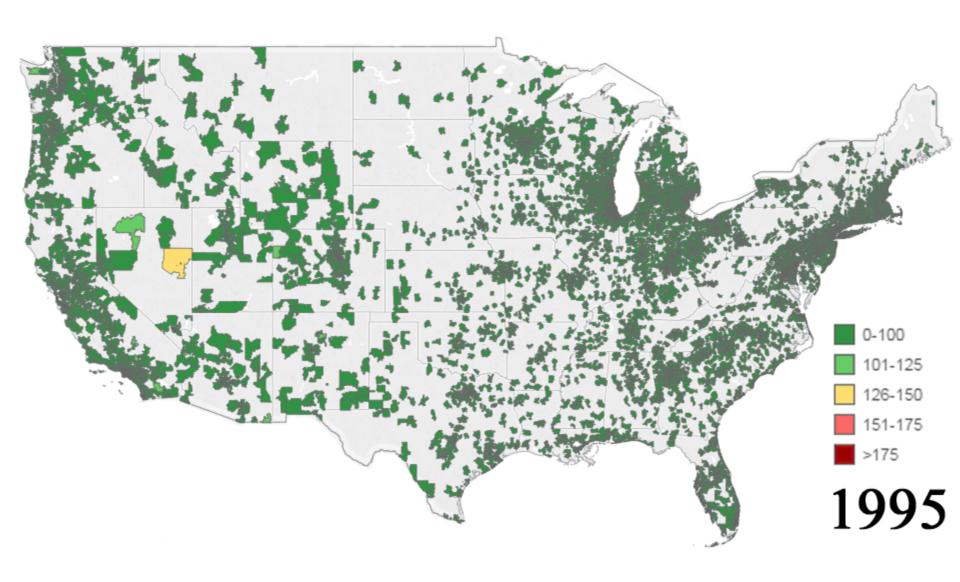
What indices are available?

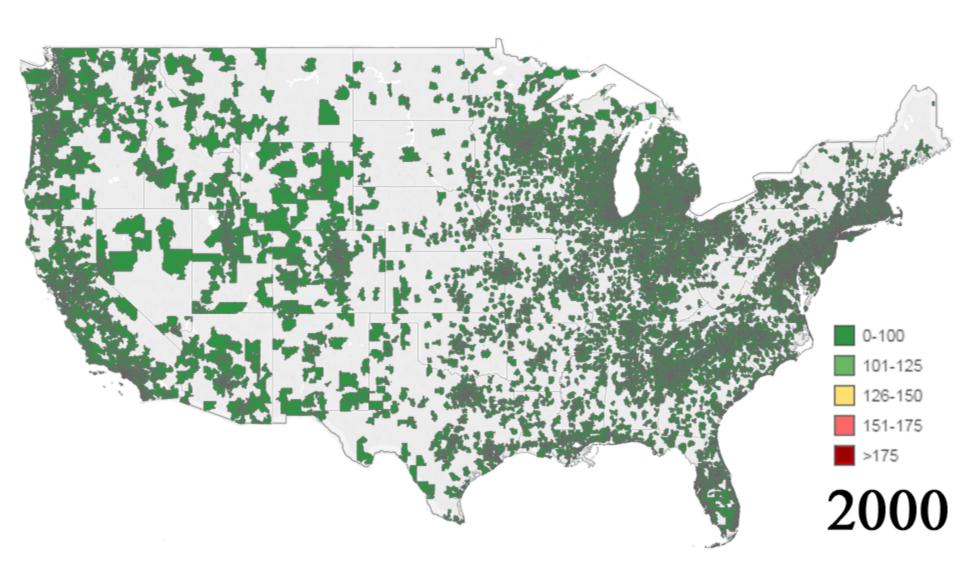


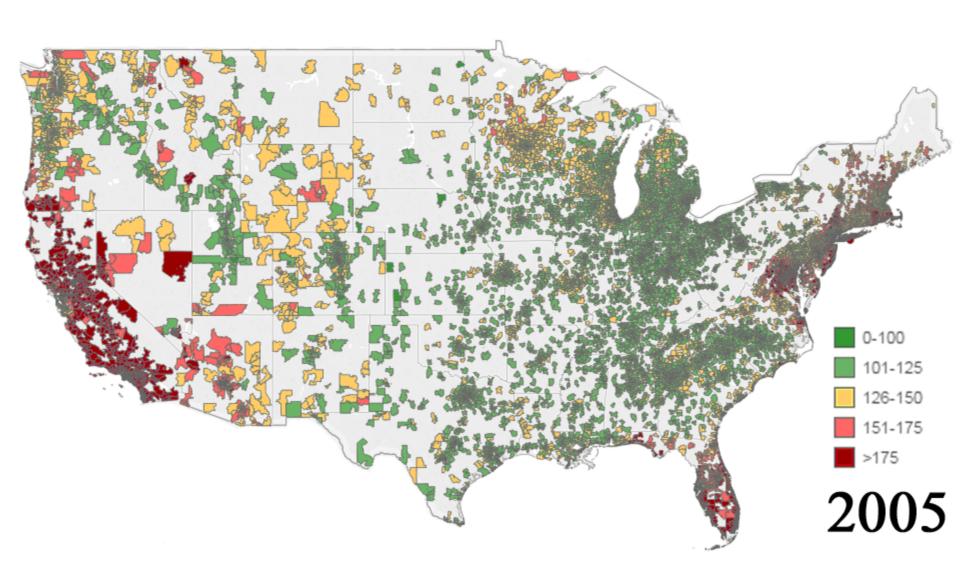
Index	Geography	Count	Frequency	Start
S&P/Case-Shiller	CBSA	20	Monthly	1987
FHFA	CBSA	401	Quarterly	1975
Freddie Mac	CBSA	367	Quarterly	1975
FHFA	ZIP3	885	Quarterly	1995
Zillow (Value)	ZIP5	12,988	Monthly	1996
This Paper:	CBSA	914	Annual	1975
1000	County	2,742	Annual	1975
	ZIP3	879	Annual	1975
	ZIP5	17,936	Annual	1975

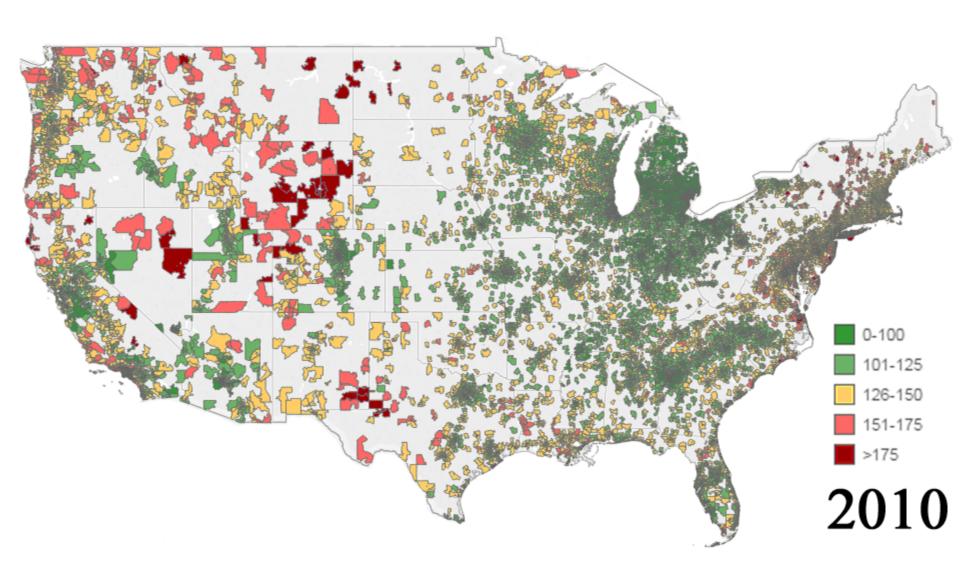


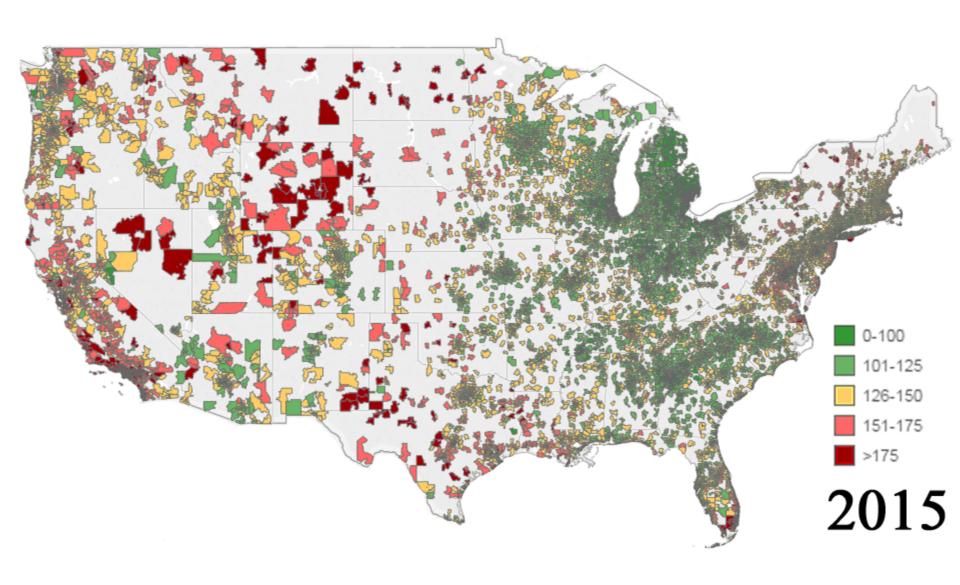






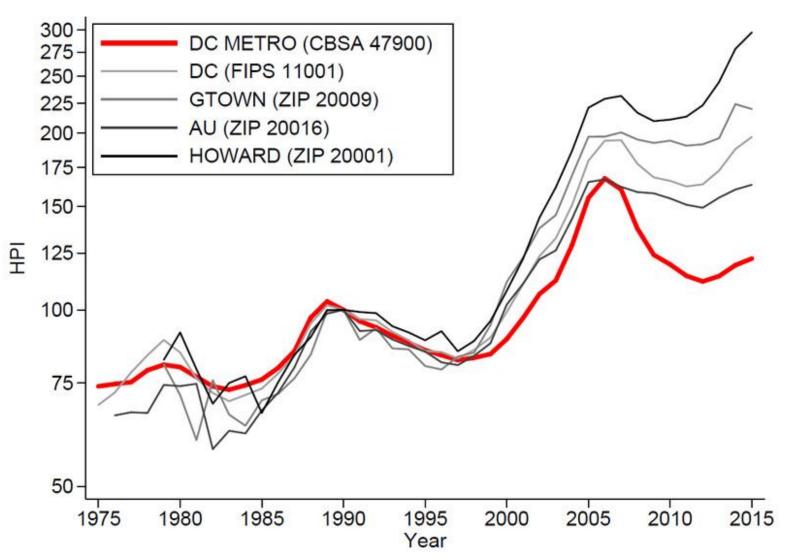






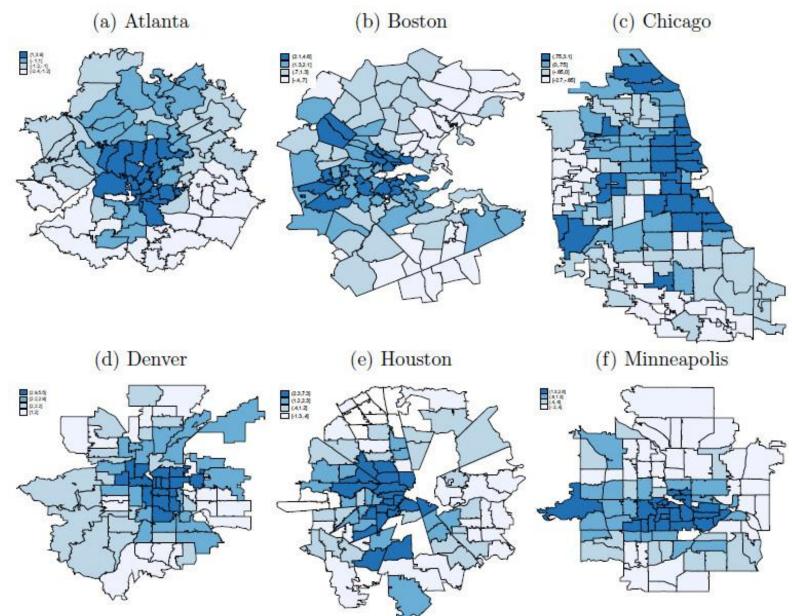
Is there really local house price variation?





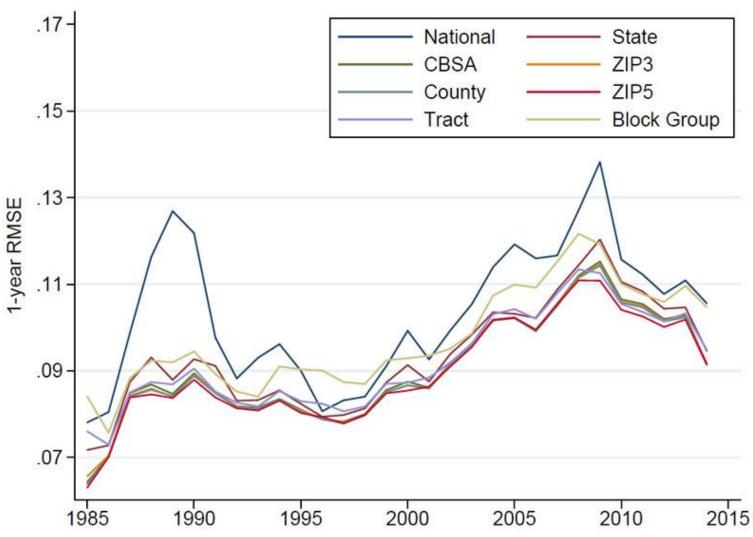
Might it be a D.C. thing?





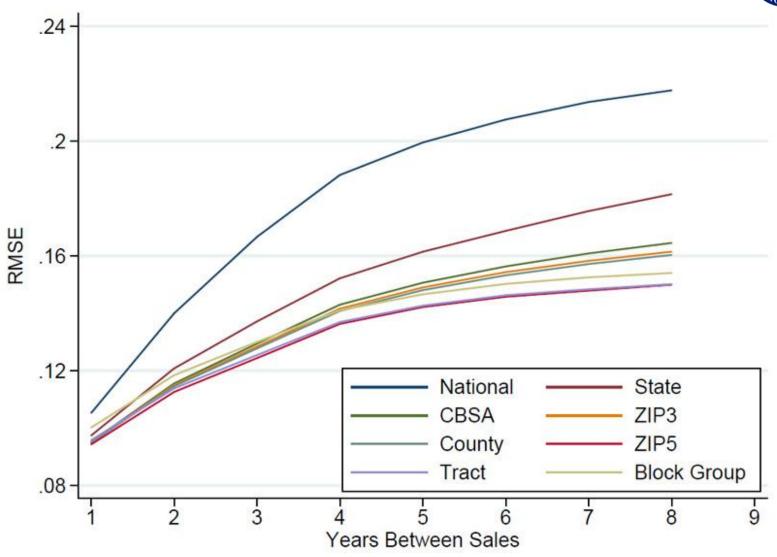
How do well do HPIs predict the next sale?





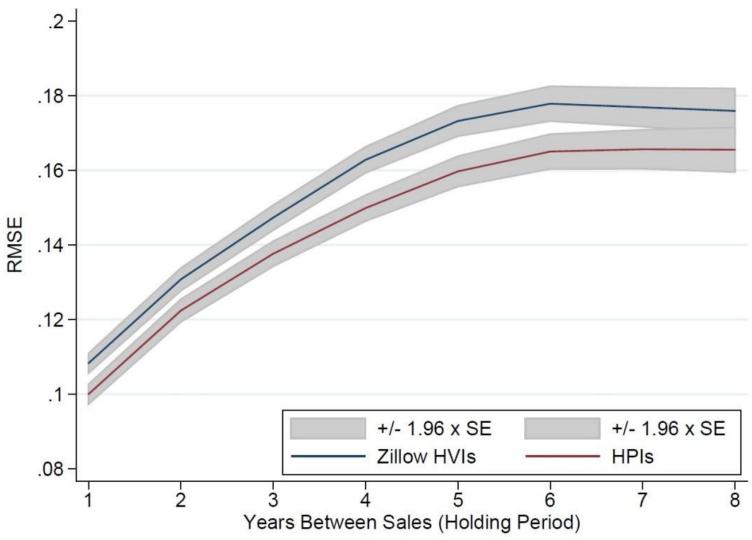
How do far out do the predictions work?





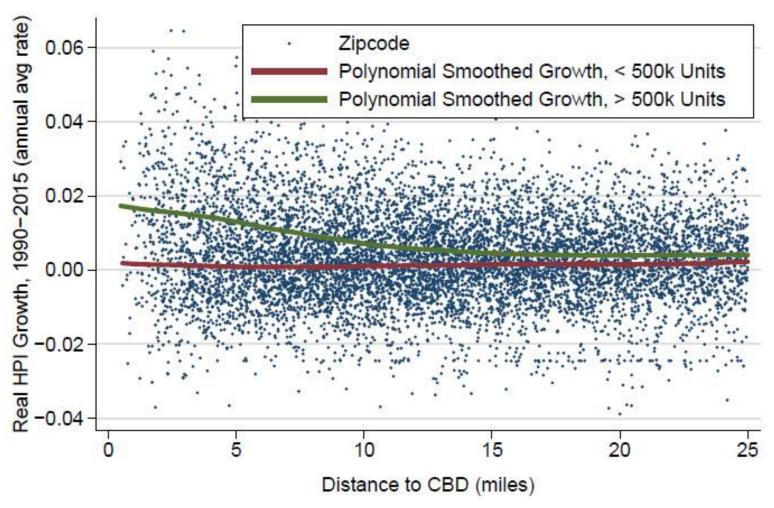
How do those predictions compare to Zillow?





What's an interesting long-term trend since the 1990s?

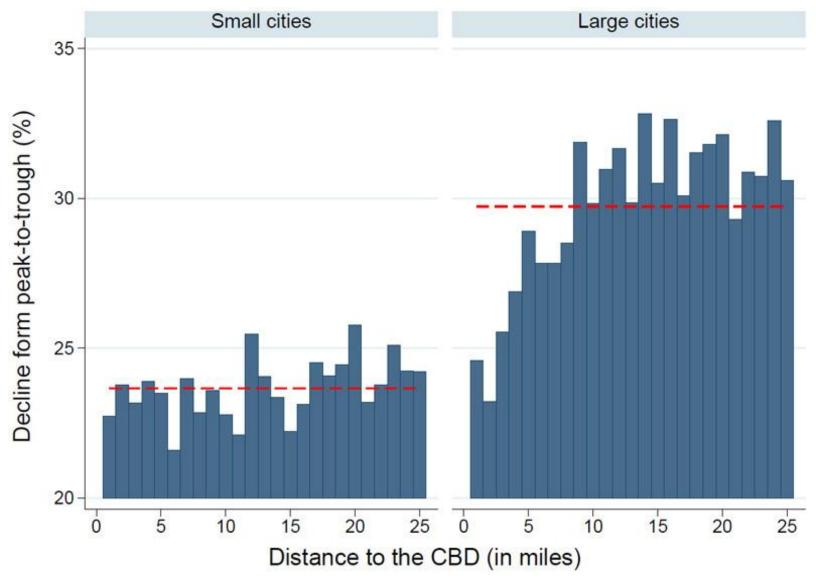




House price gradients are shifting upward again.

Do house prices decline the same everywhere?

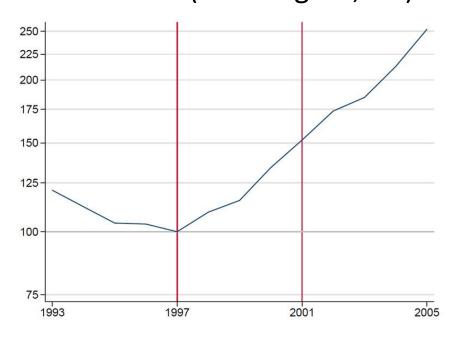




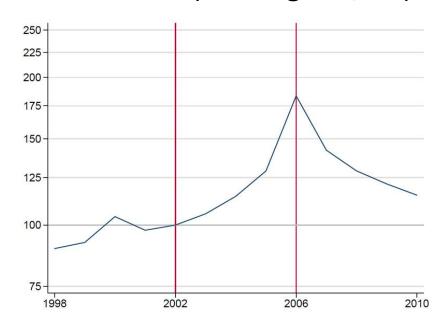
Are quick accelerations always followed by decline?



ZIP 20003 (Washington, DC)



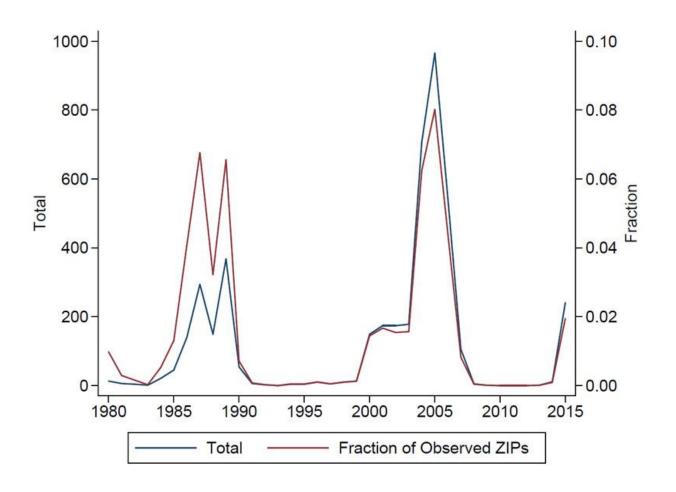
ZIP 90210 (Los Angeles, CA)



How often do major accelerations occur?



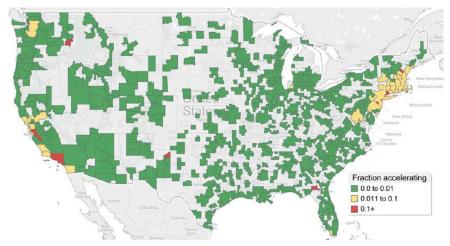
We identify extreme acceleration episodes. There are over 4,000 mutually exclusive ZIP code-level acceleration episodes between 1975 and 2015.



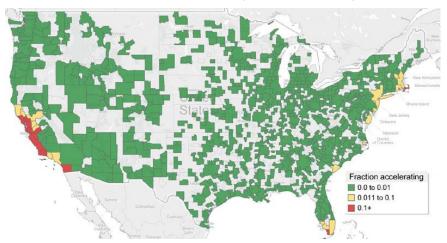
Where do major acceleration occur?



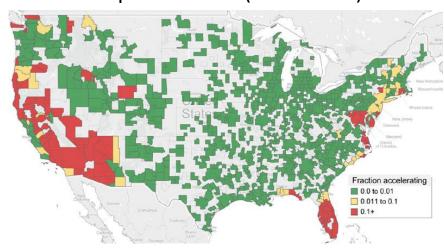
Private Equity Boom (1985-1990)



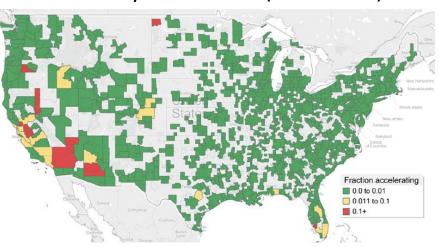
Dot Com Boom (1999-2003)



Subprime Boom (2004-2006)



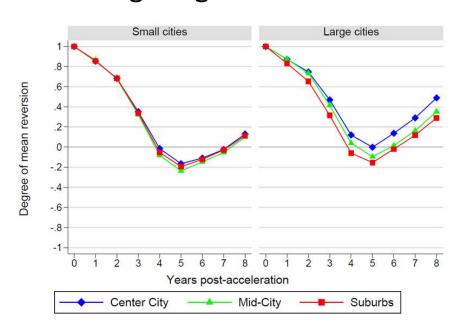
Recovery & Oil Boom (2014-2015)



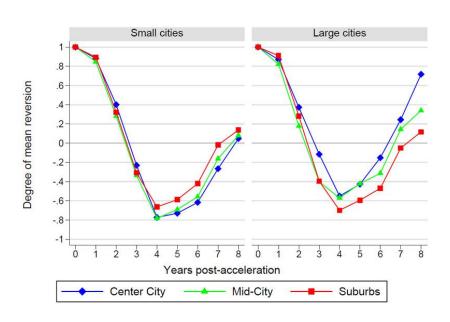
Do prices mean revert once they fall?



High regulation cities



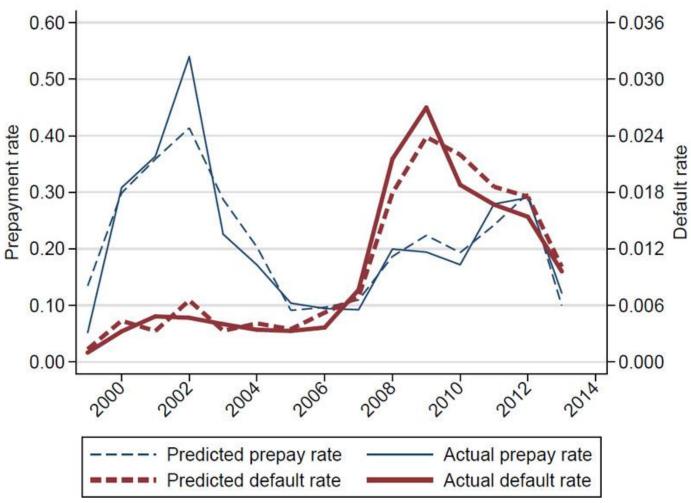
Low regulation cities



Quick growth is most sustainable in downtowns of large cities.

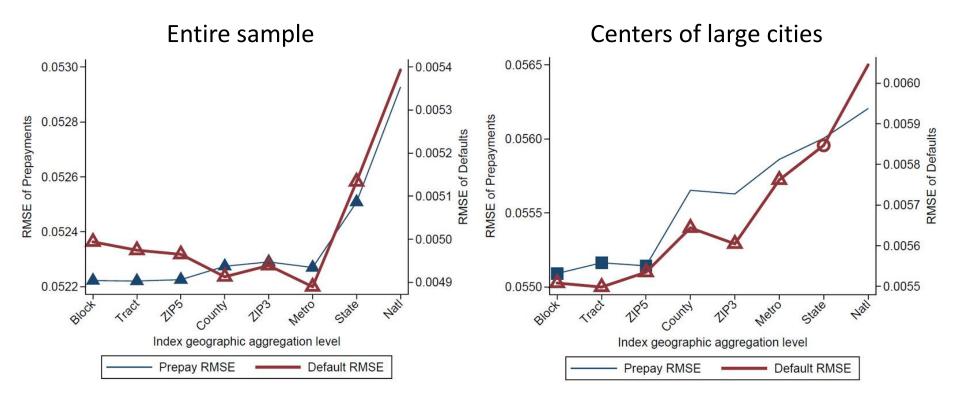
Thinking about losses...let's build a credit model!





Do more granular HPIs improve credit model fit?





Best valuation and model accuracy with city and ZIP5 HPIs.



Concluding thoughts

Takeaways from our research



- New annual local HPIs are available.
 - Free, constant-quality, long-time span, nationwide
- Proximity within a city can explain house prices.
- We're seeing interesting results with center-city prices:
 - Stable over the last 25 years
 - Contrasts suburbanization of last 1/2 of 20th century
 - Mean reversion is found across cities but center-city areas have smaller and less volatile corrections
 - Localized HPIs can improve mortgage valuation and performance modeling in center-city areas

Concluding thoughts . . .

- FHFA A
- Local HPIs offer tools to explore housing markets for realtors, mortgage bankers, policy makers, etc.
- Granularity is especially helpful in centers of large cities.

www.fhfa.gov/hpi

www.fhfa.gov/papers/wp1601.aspx

www.fhfa.gov/papers/wp1602.aspx

www.fhfa.gov/papers/wp1604.aspx

Local data can improve decision making and inform public discussions about the future of real estate!

Thanks!