Bubbling Up?

What Consumer Expectations Reveal About U.S. Housing Market Exuberance

Enrique Martínez García
Federal Reserve Bank of Dallas

Efthymios G. Pavlidis
Lancaster University

Workshop on Global Housing Markets and the Macroeconomy
University of Alicante | March 27, 2026

Motivation

- Housing boom–bust cycles have first-order consequences for macro and financial stability.
- Standard bubble diagnostics typically rely on one of two approaches:
  - observable fundamentals or price-to-fundamental ratios to characterize misalignment—but those measures can be sensitive to model specification and omitted fundamentals;
  - explosive behavior in prices and related valuation anchors—but that evidence can also reflect dynamics inherited from fundamentals rather than purely a bubble.
- This paper asks a different question: can **survey expectations** reveal non-fundamental housing market exuberance more cleanly?

Key point: If realized house price growth repeatedly and persistently outpaces expected price growth, evidence of exuberance in the cumulative expectational error is consistent with non-fundamental bubble behavior.

Main Contributions

1. We use one-year-ahead home price expectations from the University of Michigan Survey of Consumers to test for speculative bubbles in the U.S. housing market after the global financial crisis.
2. We apply two complementary right-tailed unit root procedures to cumulative expectational errors:
   - recursive least-squares GSADF tests (Phillips et al., 2015a,b),
   - right-tailed quantile-based unit root tests (Koenker and Xiao, 2004; Pavlidis, 2024).
3. We study both aggregate expectations and expectations by demographic and socioeconomic group.
4. We validate the baseline findings with the New York Fed's Survey of Consumer Expectations.

Asset Pricing Framework

The analysis builds on the standard present-value model decomposition:

$$P_t = P_t^* + B_t,$$

where

- P_t^* is the fundamental component of house prices,

$$P_t^* = \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} \mathbb{E}_t(R_{t+j}),$$

  with constant discount rate r and housing rents R_{t+j},
- B_t is a rational bubble component.

In this setting, the bubble term satisfies

$$\mathbb{E}_t(B_{t+1}) = (1+r)B_t,$$

so it is explosive in expectation.

Blanchard (1979) illustration

Why Expectations Help

Instead of specifying observed fundamentals directly, we use cumulative forecast errors:

$$P^f_{t+h} = \sum_{i=1}^{t} (P_{i+h} - P^e_{i+h}).$$

- Explosiveness in P^f_{t+h} implies systematic underprediction consistent with a non-zero collapse (bust) probability, providing evidence of a non-fundamental bubble.
- This approach is agnostic about the exact model of intrinsic value.
- It exploits forward-looking information already embedded in survey expectations.

Key point: During bubble episodes, realized future prices systematically exceed expectations because agents assign some probability to the bubble collapsing.

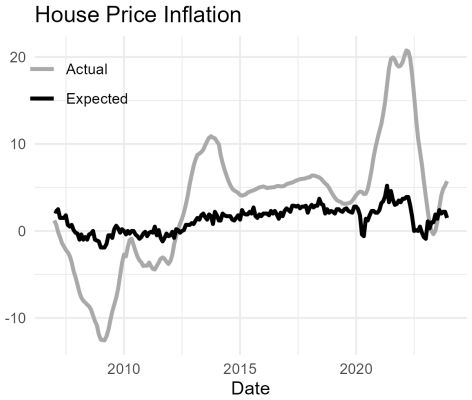
Data

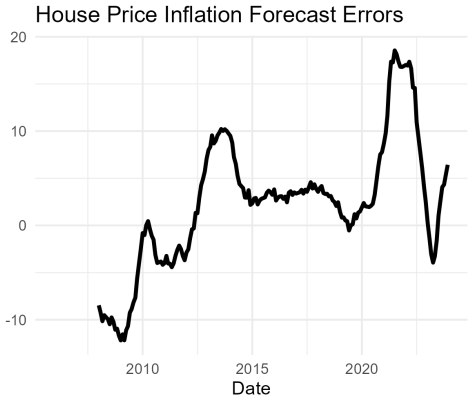
Baseline dataset: Michigan Survey of Consumers

- Monthly one-year-ahead home price inflation expectations, January 2007–December 2023.
- Actual prices: S&P CoreLogic Case-Shiller U.S. national house price index.
- Aggregate expectation series plus micro-level breakdowns by:
  - age,
  - gender,
  - marital status,
  - education,
  - income,
  - stock market wealth.

Robustness dataset: New York Fed Survey of Consumer Expectations.

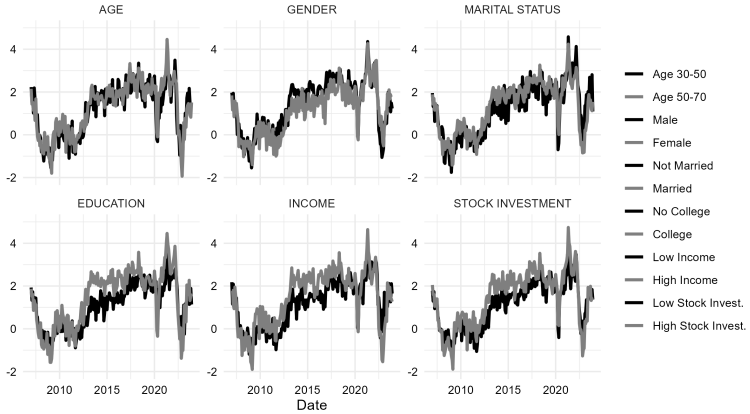
Michigan Survey: Aggregate Expectations and Forecast Errors





Key point: Expectations comove with actual prices—remain much smoother, generating large and persistent forecast errors during the post-GFC and pandemic expansions.

Expectations by Demographic and Socioeconomic Group



Key point: Heterogeneity exists across groups, but group-specific expectation series closely track the aggregate pattern.

Right-Tailed Unit Root Tests

We use two complementary procedures:

1. **GSADF test**
   - Recursive ADF regressions over flexible subsamples.
   - Designed to detect periodically collapsing bubbles.
   - Also provides date-stamping of exuberance episodes.
2. **Quantile-based unit root test ($\mathbf{QKS}_t$)**
   - Tests for explosiveness in **upper conditional quantiles** of the distribution.
   - Focuses on the right tail, where unusually large positive realizations occur.
   - Bubble dynamics typically appear in these upper states rather than in the mean.
   - Particularly useful when exuberance is episodic or short-lived.
   - More robust to outliers and non-normality.

Implementation Details

GSADF test

- Lag length selected with BIC, allowing up to $k = 6$.
- Minimum window follows the Phillips–Shi–Yu rule of thumb.
- Finite-sample critical values obtained by bootstrap (2,000 replications).
- Minimum bubble duration filter: six months.

Quantile-based test ($\mathbf{QKS}_t$)

- Lag length selected with BIC, allowing up to $k = 6$.
- Quantile range: $\mathcal{T} = [0.8, 0.95]$ with step size 0.01.
- Finite-sample critical values obtained by bootstrap (2,000 replications).

Baseline Evidence: Michigan Survey

Series	lag (k)	GSADF	p-value	QKS_t	p-value
House Prices	2	4.020	0.041	3.723	0.006
Aggregate	3	5.095	0.014	5.043	0.000
Age 30–50	4	5.308	0.010	5.333	0.000
Age 50–70	3	5.673	0.006	4.298	0.001
Male	3	5.306	0.011	4.021	0.000
Female	3	5.010	0.028	4.787	0.000
Not Married	4	4.305	0.076	4.864	0.000
Married	3	5.517	0.007	4.164	0.002
No College	3	5.576	0.007	5.029	0.000
College	3	5.318	0.007	4.791	0.000

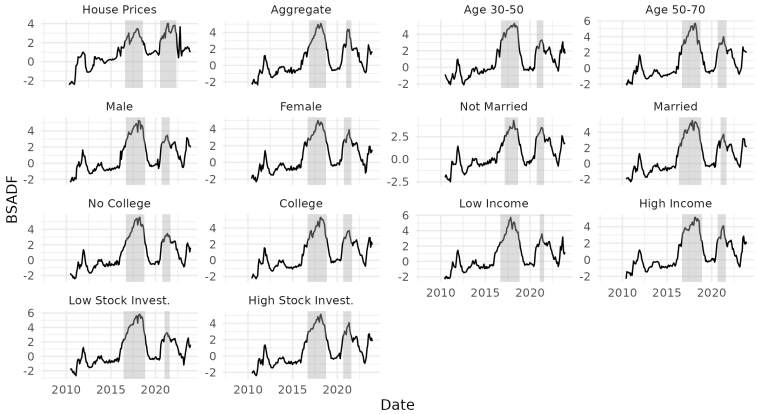
Key point: The null of no bubbles is rejected for the aggregate series and almost all subgroup series, with especially strong quantile-based evidence.

Baseline Evidence: Additional Michigan Groups

Series	lag (k)	GSADF	p-value	QKS_t	p-value
Low Income	3	5.748	0.009	5.189	0.000
High Income	3	5.123	0.014	2.645	0.012
Low Stock Invest.	3	5.831	0.006	5.477	0.000
High Stock Invest.	3	5.128	0.014	3.793	0.002

Key point: Bubble dynamics are not confined to one narrow slice of the population; exuberance appears broad-based across demographic and socioeconomic groups.

Date-Stamping the Bubble Episodes



Key point: Two main post-GFC episodes emerge: a first episode in the late 2010s and a second episode centered on early 2021.

Chronology of Exuberance

Series	Start	End	Duration
House Prices	2016-08	2018-08	25 months
House Prices	2020-07	2022-05	23 months
Aggregate	2016-11	2018-10	24 months
Aggregate	2021-01	2021-08	8 months
Male	2016-09	2018-11	27 months
Male	2020-09	2021-08	12 months
Female	2016-09	2018-10	26 months
Female	2020-10	2021-08	11 months
Low Income	2016-09	2018-11	27 months
Low Income	2021-02	2021-08	7 months
High Income	2016-09	2018-12	28 months
High Income	2020-09	2021-08	12 months

Key point: Survey-based exuberance during the Covid housing boom fades by mid-2021, well before house price growth itself fully turns.

Interpretation of the Covid Episode

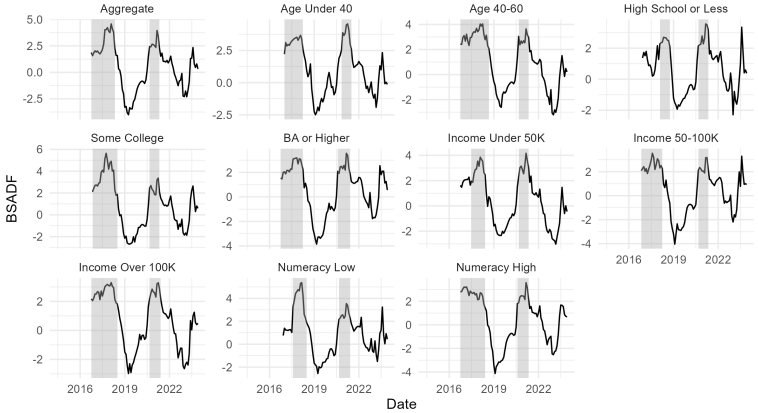
- House-price-based measures identify a longer exuberance phase running well into 2022.
- Expectation-based measures identify a shorter phase, ending around July/August 2021.
- This divergence suggests that **bubble dynamics cooled before prices peaked**.
  - realized prices continued to rise due to momentum and fundamentals.
- The continued price growth likely reflects:
  - low mortgage rates and accommodative financial conditions,
  - supply constraints in housing,
  - strong income and wealth effects during the recovery.
- Survey expectations therefore help separate:
  - ongoing price increases driven by fundamentals,
  - from genuinely bubble-like dynamics based on extrapolative beliefs.

Robustness: New York Fed Survey of Consumer Expectations (SCE)

Series	lag (k)	GSADF	p-value	QKS_t	p-value
Aggregate	2	4.575	0.018	4.218	0.003
Age Under 40	5	4.567	0.040	2.679	0.043
Age 40–60	2	4.041	0.048	3.591	0.006
High School or Less	4	3.566	0.080	4.966	0.000
Some College	3	5.642	0.002	3.260	0.011
BA or Higher	2	3.565	0.068	3.770	0.010
Income Under 50K	2	4.163	0.046	3.470	0.022
Income 50–100K	3	3.538	0.064	5.911	0.000
Income Over 100K	2	3.297	0.112	2.882	0.037

Key point: The New York Fed SCE provides an independent validation of the main findings.

Date-Stamping with NY Fed SCE Data



Key point: The New York Fed SCE confirms two broad episodes of exuberance, with timing closely aligned with the Michigan Survey evidence.

Takeaways

1. Survey-based expectational errors provide direct evidence of **bubble-like dynamics**, capturing systematic underprediction consistent with a non-zero collapse probability.
2. Exuberance appears in two main episodes post-GFC:
   - a pre-pandemic phase (2016–2018),
   - a pandemic-driven boom (2020–2021).
3. The evidence is **broad-based**, spanning demographic and socioeconomic groups, suggesting aggregate—not niche—bubble dynamics.
4. Expectations-based indicators deliver **cleaner and earlier signals** than prices alone:
   - less sensitive to fundamentals or misspecification,
   - detect turning points ahead of realized prices.
5. This makes survey data a valuable complement for housing-market surveillance and early warning systems (real-time monitoring).

APPENDIX

Additional Results and Supporting Materials

Theory: Periodically Collapsing Bubble

Bubble process following Blanchard (1979):

$$B_{t+1} = \begin{cases} \frac{(1+r)}{\pi} B_t + \epsilon_{t+1}, & \text{with prob. } \pi \\ \epsilon_{t+1}, & \text{with prob. } 1-\pi \end{cases}$$

Forecast error for the bubble component:

$$B_{t+h} - \mathbb{E}_t(B_{t+h}) = (1+r)^h \left(\frac{1}{\pi^h} - 1 \right) B_t + \epsilon^*_{t+h}$$

- Rational agents anticipate collapse $\Rightarrow$ systematic forecast bias.
- During expansions, realizations exceed expectations.
- Cumulative expectational errors inherit explosiveness.

Back to framework

Full Test Results: Michigan & SCE

- GSADF and QKS_t tests reject the null of no bubbles for:
  - aggregate expectations,
  - nearly all demographic and socioeconomic groups.
- Quantile-based tests deliver stronger rejections (very low p-values).
- Results are consistent across datasets:
  - Michigan Survey (long sample),
  - NY Fed SCE (independent validation).

Key point: Evidence of bubble dynamics is robust to methodology and data source.

Full Date-Stamping Results

- Two main episodes across virtually all groups:
  - 2016–2018 (late-cycle expansion),
  - 2020–2021 (pandemic housing boom).
- Timing is highly synchronized across:
  - income groups,
  - education levels,
  - age cohorts,
  - gender and marital status.
- Duration:
  - Pre-pandemic: $\sim$2–2.5 years,
  - Covid episode: shorter (7–13 months for expectations).

Key point: Exuberance is broad-based, not concentrated in a specific subgroup.

Policy Relevance: Financial Stability Monitoring

- Survey expectations provide forward-looking signals absent in standard indicators of exuberance.
- Expectation-based measures help disentangle:
  - fundamental-driven price increases,
  - bubble (boom-bust) dynamics.
- Provides earlier detection of turning points:
  - e.g., expectations signal cooling by mid-2021.
- Complementary to traditional metrics:
  - price-to-rent ratios,
  - credit conditions,
  - valuation indicators.
- Natural input for macroprudential/financial surveillance frameworks.

Key point: Expectations-based exuberance indicators enhance early warning systems for housing market risks.

References I

Blanchard, O. J. (1979). Speculative bubbles, crashes and rational expectations. *Economics Letters*, 3(4):387–389. https://doi.org/10.1016/0165-1765(79)90017-x.

Koenker, R. and Xiao, Z. (2004). Unit root quantile autoregression inference. *Journal of the American Statistical Association*, pages 775–787. https://doi.org/10.1198/016214504000001114.

Pavlidis, E. G. (2024). Bubbles and crashes: A tale of quantiles. *Journal of Time Series Analysis*, pages 1–24. https://doi.org/10.1111/jtsa.12794.

Phillips, P. C., Shi, S., and Yu, J. (2015a). Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500. *International Economic Review*, 56(4):1043–1078. https://doi.org/10.1111/iere.12132.

Phillips, P. C., Shi, S., and Yu, J. (2015b). Testing for multiple bubbles: Limit theory of real-time detectors. *International Economic Review*, 56(4):1079–1134. https://doi.org/10.1111/iere.12131.