

Housing Markets, Expectations and Financial Stability

An evidence-based compass for
financial stability monitoring and communication

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Real Estate and Mortgage Market Risks

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Based on research with Efthymios G. Pavlidis ([Bubbling Up?](#))
and ongoing work with colleagues at the [International Housing Observatory](#).

The views expressed in this presentation are my own and do not necessarily reflect those of the Federal Open Market Committee, its principals, or any individuals associated with the Federal Reserve Bank of Dallas or the Federal Reserve System.

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Two propositions, four steps

Housing poses financial stability challenges. We focus on a particularly difficult one: fragility and correction risks associated with housing bubbles.

Proposition 1: Real-time monitoring of bubble symptoms is feasible.

1 Identify bubble-related vulnerabilities

Distinguish financial and macroeconomic fragility from shocks and losses.

2 Detect bubble symptoms as they emerge

Seek timely, real-time signals—not a complete model of the causes.

Proposition 2: Evidence can support financial stability communication.

3 Bring expectations into the picture

Use prices and beliefs together to inform monitoring and the message.

4 Make room for financial stability communication

Add evidence-based risk communication to rates and prudential tools.

► [Go directly to expectations](#)

► [Technical appendix](#)

Key point: Detect bubble symptoms early for monitoring and communication on financial stability—to help anchor expectations before exuberance builds.

Vulnerabilities build before a risk materializes

VULNERABILITY

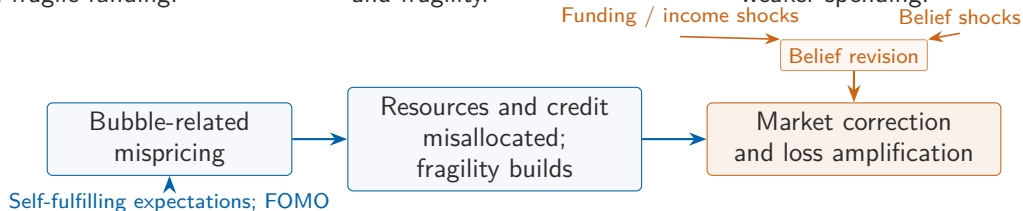
Misallocated resources and credit; leverage, weak buffers and fragile funding.

RISK

A possible correction and its losses, conditional on shocks and fragility.

INSTABILITY

Realized losses: falling collateral, impaired credit and weaker spending.



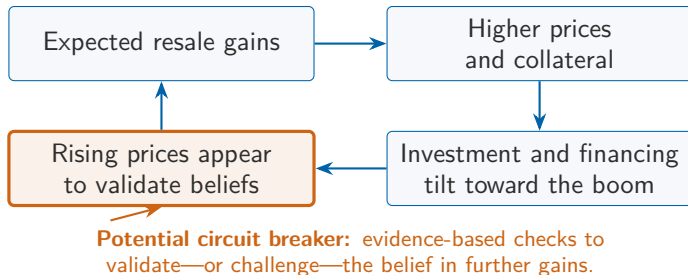
Sources: [Martínez García \(2023, speech\)](#).

► Roadmap

Key point: Mispricing can build fragility before a bust; that fragility can magnify the losses when a shock triggers a correction.

The costs can begin well before the price correction

A self-fulfilling prophecy



Sources: [Martínez García \(2023, speech\)](#). [Martínez García \(2024\)](#).

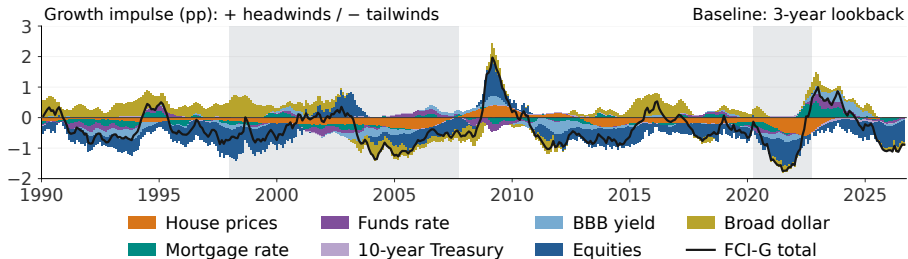
► Belief feedback

► Communication loop

► Roadmap

Key point: Housing mispricing can impair price discovery and capital allocation—even before a bust.

Housing eased conditions during exuberant periods



Average housing contribution (pp)	Exuberance	Other months
Jan. 1990–Mar. 2026	–0.267	–0.063

Sources: [Board of Governors \(FCI-G\)](#); [Haver Analytics](#) (Sept. 21, 2026 export). Monthly, Jan. 1990–Aug. 2026; baseline three-year lookback.

Notes: Gray: explosive U.S. real-price dynamics (IHPD lag-1 BSADF; 95%; at least four quarters).

► Transmission channels

► All conditional means

► 2020–26 detail

► Roadmap

Key point: Housing supplied a larger average tailwind during exuberance: about 0.20 percentage point more than in other months.

Build a thermometer, then read the symptoms

First-generation exuberance tests: three price-based indicators

$$\underbrace{P_t^H / P_t}$$

real prices

$$\underbrace{P_t^H / Y_t}$$

affordability

$$\underbrace{P_t^H / R_t}$$

investment valuation

- **Detect, then date:** a statistical toolkit locates shifts into mildly explosive dynamics—a bubble symptom. GSADF accommodates multiple episodes; BSADF dates them after detection.
- **Cross-check:** ratios give simple controls. [PSY-IVX](#) tests a multivariate fundamentals residual, but remains model-dependent.
- **Timeliness:** quarterly IHPD / IHO monitoring, monthly nowcasts and ongoing daily price measurement.

Observe symptoms → cross-check → assess exposures

Sources: [IHPD](#); [IHO](#); [Vasilopoulos, Pavlidis and Martínez-García \(2022\)](#), [exuber](#).

► Surveillance approaches

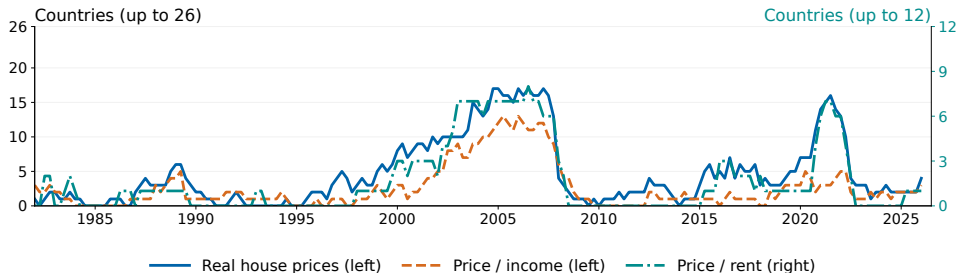
► Valuation anchors

► Testing and timeliness

► Roadmap

Key point: A useful thermometer detects abnormal dynamics without first settling on a complete model of their causes.

International exuberance comes in waves



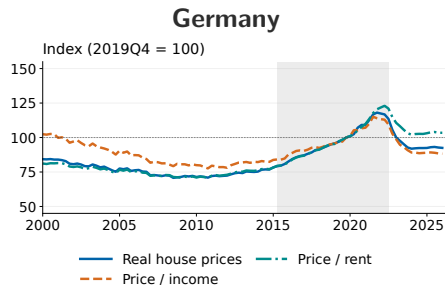
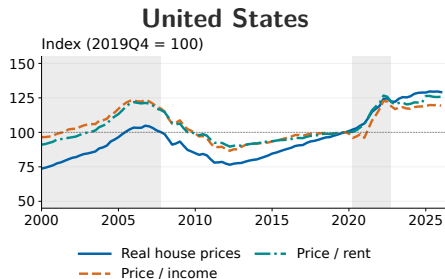
Sources: [Dallas Fed IHPD, 2026Q1](#); [International Housing Observatory, 2026Q1](#). Published BSADF paths; author's aggregations.

Notes: Counts on both axes: 26 countries on the left; 10–12 reporting P/R countries on the right (11 at 2026Q1). No duration filter.

► Roadmap

Key point: Synchronized exuberance may reflect common drivers or contagion risk—both make cross-country monitoring important.

U.S. and German valuations adjusted differently



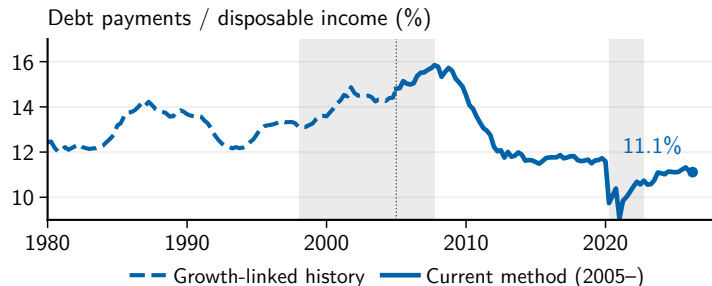
Sources: [Dallas Fed IHPD, 2026Q1](#); [International Housing Observatory, 2026Q1](#); [Martínez García and Spits \(2024\)](#).

Notes: Level indices, 2019Q4 = 100. Shading: real-price BSADF windows with a net price run-up (95%, at least four quarters).

► Roadmap

Key point: Germany adjusted through lower real prices; U.S. dynamics still depend more on expected disposable income catching up—with different costs for owners and entrants.

High valuations need not mean high debt service



Sources: Federal Reserve Board: [current DSR](#), [historical DSR](#), [methodology](#); [Martínez García and Pavlidis \(2026\)](#).

Notes: Pre-2005 history growth-linked at 2005Q1 using prior-method data. Seasonally adjusted; real-price exuberance shaded.

Existing owners: higher equity can support consumption and ease collateral constraints; a correction can reverse both.

New buyers: high prices and financing costs can block entry despite contained aggregate debt service.

Renters: pay for shelter without a housing-equity gain.

► Splice and definitions

► Roadmap

Key point: Not everyone benefits whether house prices rise or fall: existing debt burdens, housing wealth and access to ownership can diverge.

Why a surviving bubble can outrun its forecast

Second generation: same tests; expectations replace a fitted fundamental model.

Price: $P_t = \underbrace{P_t^*}_{\text{latent fundamentals}} + \underbrace{B_t}_{\text{bubble component}}.$

↓ **The survey forecast averages continuation and collapse.**

$$S_{t,1} = \mathbb{E}_t P_{t+1}^* + \underbrace{\pi B_{t+1}^S + (1 - \pi) B_{t+1}^C}_{\text{continuation / collapse average}} + \eta_{t,1}.$$

↓ **On the surviving branch, subtract that average.**

$$\begin{aligned} e_{t,1}^S &= u_{t,1}^F - \eta_{t,1} + (1 - \pi)(B_{t+1}^S - B_{t+1}^C) \\ &= \underbrace{u_{t,1}^F - \eta_{t,1}}_{\text{other news / belief differences}} + \underbrace{R_t(z)(\pi_t(z)^{-1} - 1)B_t(z)}_{\text{inherits the bubble's dynamics}}. \end{aligned}$$

Signal z :
Less noise may
temper bubble
values.

Sources: [Martínez García and Pavlidis \(2025\)](#). [Blanchard \(1979\)](#).

Notes: All terms condition on z : $R = R_t(z)$, $\pi = \pi_t(z)$, $B_t = B_t(z)$; $B_{t+1}^S = (R/\pi)B_t$, $B_{t+1}^C = 0$. η : survey wedge; u^F : fundamental news.

► Survey wedge

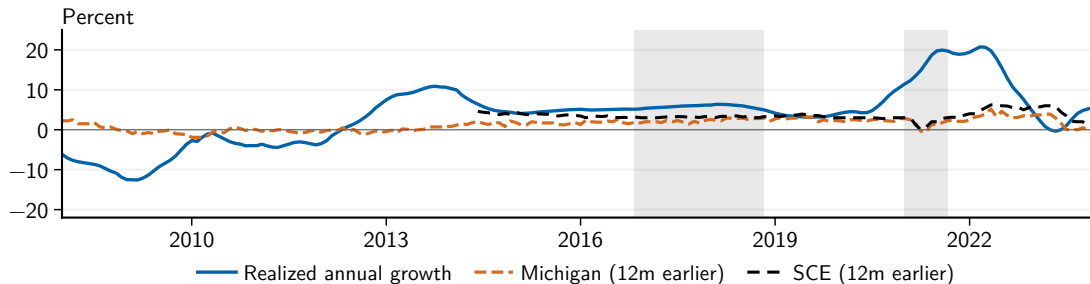
► Derivation

► Information channel

► Roadmap

Key point: Surviving bubbles can make cumulative forecast errors explosive. Information can change continuation beliefs—where communication may matter.

Realized prices often outran forecasts made a year earlier



Sources: [Michigan Survey of Consumers](#); [New York Fed Survey of Consumer Expectations](#); [S&P Case-Shiller](#).

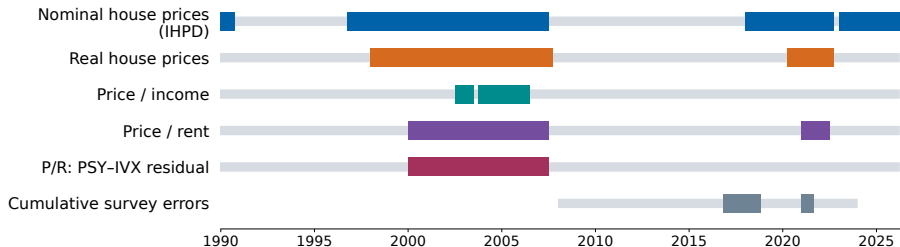
Notes: Both survey forecasts are shifted 12 months; SCE comparison begins June 2014. Shading: Michigan cumulative-error BSADF episodes (5%, longer than six months).

► Model-adjusted cross-check

► Roadmap

Key point: Expectations provide another thermometer reading: realized gains can reveal exuberance relative to participants' own earlier assessments.

U.S. diagnostics show common episodes



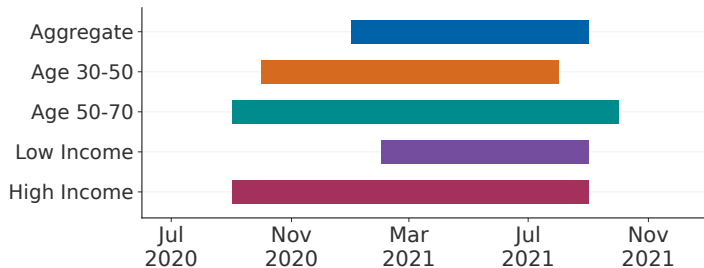
Sources: [Dallas Fed IHPD, 2026Q1](#); [International Housing Observatory, 2026Q1](#); [Martínez García and Pavlidis \(2025\)](#).

Notes: Gray tracks show diagnostic coverage. Nominal HPI: IHPD 1975Q1–2026Q1, lag-1 BSADF using the same IHPD specification and critical-value sequence. Quarterly episodes ≥ 4 quarters; monthly > 6 months.

► Roadmap

Key point: Concordance across price, valuation, residual and expectation diagnostics strengthens concern about non-fundamental dynamics.

Heterogeneity helps locate belief and information gaps



MICHIGAN GROUPS

GSADF: 11 of 12 reject.

Quantile: 12 of 12 reject.

Age, income and education describe differences in belief signals.

SCE AGGREGATE

GSADF $p = .0175$.

Quantile $p = .0030$.

Sources: [Martínez García and Pavlidis \(2025\)](#). Michigan subgroup and New York Fed SCE results.

Notes: GSADF/BSADF detect and date; quantile-root tests add detection in upper conditional tails of cumulative errors, not dates. Common prices make group results dependent; individual 5% tests, no multiplicity adjustment.

► Quantile detection

► Roadmap

Key point: Demographics locate information gaps; upper-tail persistence adds a complementary signal of exuberance beyond average dynamics.

How policy has approached bubbles

MONETARY POLICY

CLEAN UP AFTER THE BUST

Real-time identification is difficult; rates may be too blunt. Address the macroeconomic consequences after a correction.

Beyond instruments: strategy sets guardrails and principles for implementation. Communication conveys reliable evidence effectively—a potentially underappreciated margin when beliefs sustain the boom. Information can help people reassess its premises.

Sources: Clean up: [Greenspan \(2002\)](#), [Bernanke \(2002\)](#); lean: [Borio and Lowe \(2002\)](#); resilience: [Yellen \(2014\)](#).

LEAN AGAINST IMBALANCES

Credit and asset-price imbalances can build with stable inflation. Earlier action may reduce later losses, at a near-term cost.

PRUDENTIAL POLICY

BUILD RESILIENCE

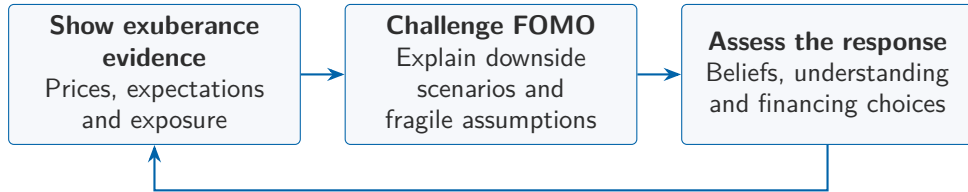
Prudential policy: underwriting, capital and liquidity buffers. Target exposures and loss amplification.

► Strategy and responsibilities

► Roadmap

Key point: Rates and prudential safeguards are not the whole framework: credible financial stability communication can complement both.

Use evidence to interrupt the self-reinforcing belief loop



A potential “kill switch” on expectations: use reliable signals to check whether recent gains justify further gains. In the benchmark, households’ forecasts already allow for collapse. Making that downside visible may weaken FOMO before leverage and misallocation build.

Sources: [Martínez García \(2023, speech\)](#). [Martínez García \(2024\)](#).

► Belief feedback

► Valuation channel

► Roadmap

Key point: Like taking a temperature, credible monitoring makes a risk visible; communicating that evidence may temper the behavior that reinforces a boom.

Conclusions: a compass for monitoring and communication

1. MONITOR FRAGILITY BEFORE A POSSIBLE BUST

Bubble-related mispricing can distort investment and credit; fragility influences how shocks and corrections propagate.

2. COMBINE PRICES, VALUATIONS AND EXPECTATIONS

Fundamental-model agnosticism is conditional, not assumption-free: interpretation requires fundamental news and survey wedges not to drive the explosive signal.

3. COMMUNICATE BEFORE BELIEFS BECOME ENTRENCHED

Use credible evidence to explain exposures and challenge self-fulfilling expectations—a potential circuit breaker alongside policy and prudential tools.

[▶ Comments and questions](#)[▶ Appendix](#)[▶ Roadmap](#)

Key point: Uncertainty about a possible bubble does not mean we lack actionable information: better signals strengthen financial stability monitoring and credible communication.

Thank you

Comments and questions welcome

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► Open appendix

Appendix

Methods, evidence and implementation

Financial conditions | Expectations | International monitoring

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Supporting material: choose a detail

Question	Open supporting material
Financial transmission	▸ Channels ▸ FCI-G averages ▸ Recent FCI-G
Surveillance and measurement	▸ Tool taxonomy ▸ Valuation anchors ▸ Tests
Fundamentals and expectations	▸ PSY-IVX ▸ Belief signal ▸ Derivation
Survey wedge and implementation	▸ Overview ▸ Expectation objects ▸ Implementation
Communication and responsibilities	▸ Valuation channel ▸ Feedback ▸ Framework
Debt-service history	▸ Splice and definitions

[▸ Roadmap](#)

Key point: Open the supporting evidence or derivation, then return to the main slides.

Policy, financial conditions and the real economy

Financial variable	How policy influences this margin	Effects on activity and inflation
Short (FFR) / long (10-year) rates	Rate-path expectations, term premia; duration and discounting.	Spending across time; investment; interest income.
Mortgage / BBB yields	Funding costs for business investment and homebuyers; credit premia.	Debt service, refinancing; housing and business investment.
Broad dollar	Cross-border relative expected returns; currency-risk premia.	Expenditure switching, imported inflation and currency exposures.
Equity prices	Discounting and duration of earnings; risk premia.	Equity wealth effects on consumption; investment and sentiment.
House prices	Financing; discounting and duration of rents / resale values.	Housing wealth effects on consumption; collateral, construction and sentiment.

Sources: [Ajello et al. \(2023\)](#), [FCI-G](#).

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Key point: House prices connect financial valuations to consumption, collateral and investment—one important channel among several.

Average FCI-G contributions during real-price exuberance

Contribution (percentage points)	Exuberance	Other months	Difference
Federal funds rate	−0.012	−0.010	−0.002
10-year Treasury yield	0.016	0.004	0.012
Mortgage rate	−0.017	−0.023	0.006
BBB yield	−0.057	−0.023	−0.034
Equity prices	−0.303	−0.328	0.025
House prices	−0.267	−0.063	−0.204
Broad dollar	0.033	0.188	−0.155
Total FCI-G	−0.607	−0.255	−0.352
Months	147	288	

Sources: [Board of Governors \(FCI-G\)](#); [Haver Analytics](#) (Sept. 21, 2026 export). [IHDP](#); author's averages.

Notes: Jan. 1990–Mar. 2026; three-year lookback. Exuberance: sustained real-price BSADF windows. Negative = growth tailwind. Descriptive averages, not a significance test.

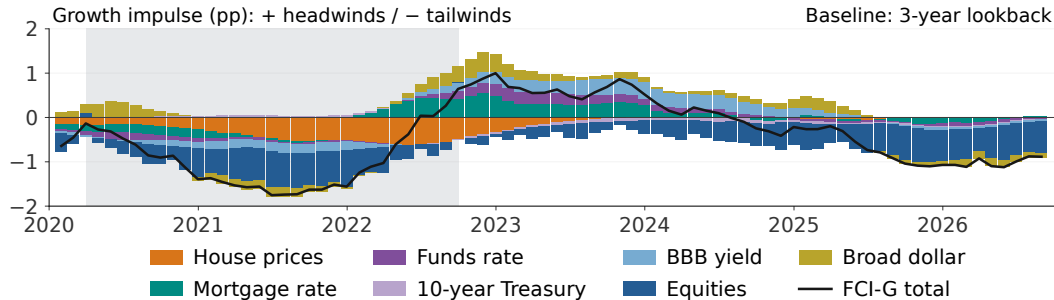
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Key point: Housing's average contribution is about 0.204 percentage point more expansionary in exuberant months; this does not identify a policy-rate response.

Housing cushioned tightening; its support has since faded



Sources: [Board of Governors \(FCI-G\)](#); [Haver Analytics](#) (Sept. 21, 2026 export). Monthly, Jan. 2020–Aug. 2026; three-year lookback.

Notes: House-price support was substantial in 2022 but near zero by August 2026. Same real-price explosive-dynamics shading as the main chart.

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Existing surveillance and the additional diagnostic lens

Question	Established monitoring tools	What they tell us
Valuation pressure	Price-to-income / rent ratios; model-based valuation gaps	How stretched prices look relative to a benchmark.
Exposure & fragility	Leverage, underwriting, debt service, lender concentration	Who is vulnerable and where losses may be amplified.
Resilience	Stress tests; downside scenarios; capital and liquidity buffers	How the system might absorb an adverse shock.
Additional lens	Recursive exuberance tests; prices and survey beliefs; timely monitoring	Whether price dynamics show signs of becoming self-reinforcing.

Sources: [Federal Reserve Financial Stability Reports](#); [ECB Financial Stability Reviews](#); [International Housing Observatory, 2026Q1](#). [Vasilopoulos, Pavlidis and Martínez-García \(2022\)](#), *exuber*.

A stylized taxonomy: institutions' toolkits differ and may already address expectations and bubble-like dynamics.

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Key point: The exuberance tools assess potentially unsustainable price dynamics; they complement, rather than replace, exposure and resilience analysis.

A symptom checker need not begin with a full valuation model

First-generation exuberance tests: three price-based indicators

REAL HOUSE PRICES

$$P_t^H / P_t$$

House prices relative to the general price level: remove inflation.

PRICE TO INCOME

$$P_t^H / Y_t$$

An affordability anchor: purchase prices relative to disposable income.

PRICE TO RENT

$$P_t^H / R_t$$

Investment valuation: the housing counterpart of price to dividend.

Build a thermometer: look for explosive dynamics in three price-based indicators.

Price explosiveness can be inherited from explosive fundamentals. Ratios offer simple controls; [PSY-IVX](#) controls for several drivers jointly and tests the residual, but remains model-dependent.

Observe symptoms → cross-check → assess exposures

Sources: [Martínez García \(2024\)](#); [Dallas Fed Economics \(2022\)](#); [Martínez García and Pavlidis \(2026\)](#).

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Key point: Ratios partly control for fundamentals; expectations add another diagnostic without requiring a complete model of intrinsic value.

Detect, date-stamp, and improve timeliness

- **Detect shifts into mildly explosive dynamics:** a statistical symptom of a bubble. GSADF varies both window endpoints and accommodates multiple episodes within the sample.
- **Date-stamp conditional on detection:** BSADF threshold crossings locate episodes; minimum-duration rules screen short-lived excursions.
- **Cross-check the signal:** test real prices, income / rent ratios, and PSY-IVX residuals; survey errors add information without selecting a full fundamental model.
- **Improve timeliness:** IHPD / IHO quarterly monitoring; monthly nowcasts; ongoing daily repeat-sales measurement. Track publication lags and revisions.

Sources: [Dallas Fed IHPD, 2026Q1](#); [Mack and Martínez-García \(2011\)](#). [International Housing Observatory, 2026Q1](#). [Vasilopoulos, Pavlidis and Martínez-García \(2022\)](#), [exuber](#). [Aanenson et al. \(2026\)](#).

Notes: International charts retain 2026Q1 published statistics; higher-frequency measurement is a separate workstream.

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Key point: Multiple-episode tests and faster data make emerging symptoms observable; a complete causal model is not the starting point.

PSY–IVX: model-adjusted monitoring complements expectations

- A log-linear present-value relation motivates a benchmark for the price-to-rent ratio:

$$p_t - r_t \simeq \frac{k}{1 - \rho} + \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j \Delta r_{t+1+j} - \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j (i_{t+j} + \xi_{t+j}) + b_t.$$

- Fit observable drivers, construct a benchmark, and test the residual for explosive dynamics. IVX addresses persistent predictors; it does not eliminate omitted-variable uncertainty.
- The dashboard export includes the log price-to-rent ratio, fitted log ratio, residual, rent, long rate, BSADF paths and flags through 2026Q1. Its fit is preserved, not re-estimated here.
- The historical illustration trained through 2019Q4. That date is shown as a pre-pandemic reference on the new charts, *not* asserted to be the current export's estimation cutoff.

Sources: [International Housing Observatory, 2026Q1](#). [Vasilopoulos, Pavlidis and Martínez-García \(2022\)](#), [exuber](#).

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Key point: Model-adjusted residuals and survey forecast errors impose different, complementary restrictions.

Add an observable belief instead of guessing intrinsic value

$$P_t = \underbrace{P_t^*}_{\text{latent fundamentals}} + \underbrace{B_t}_{\text{bubble component}} .$$

- Prices can reflect rents, discount rates, supply and amenities—or speculation / fear of missing out (FOMO).
- Even optimistic expectations may allow for a correction: the forecast averages across continuation and collapse.
- When the bubble survives, realized gains can exceed that forecast repeatedly; the expectation error may inherit explosive dynamics.

Sources: [Martínez García and Pavlidis \(2025\)](#). [Martínez García \(2024\)](#).

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Key point: A surviving boom can outrun expectations that already allow for a correction—a useful signal in the joint behavior of prices and beliefs.

The survey wedge and the communication channel

- **Rational benchmark** $\mathbb{E}_t$; **survey beliefs** $\mathbb{E}_t^S$: for reported forecast $S_{t,h}$,

$$\eta_{t,h} \equiv S_{t,h} - \mathbb{E}_t P_{t+h} = (\mathbb{E}_t^S - \mathbb{E}_t) P_{t+h} + m_{t,h}.$$
- **Submartingale**: $\mathbb{E}_t B_{t+1} = R B_t \geq B_t$ for $R = 1 + r > 1$, $B_t \geq 0$. Conditional on survival,

$$P_{t+h} - S_{t,h} = \underbrace{P_{t+h}^* - \mathbb{E}_t P_{t+h}^*}_{u_{t,h}^F: \text{fundamental news}} + R^h (\pi^{-h} - 1) B_t - \eta_{t,h}.$$
- **Communication**: information z must reach price-setting decisions, not only survey answers.
 With zero value after collapse,

$$B_t(z) = \frac{\pi_t(z) B_{t+1}^S(z)}{R_t(z)}.$$

Sources: [Martínez García and Pavlidis \(2025\)](#). Author's information-conditioned pricing extension.

Notes: m : reporting / aggregation; $\pi_t(z)$: price setters' survival belief; $B_{t+1}^S(z)$: conditional continuation value; $R_t(z)$: required gross return. Fixed z , $R_t = R$, $\pi_t = \pi$ recover the benchmark.

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Key point: Communication can change survival odds, continuation gains and required returns; it matters when those changes affect valuation and behavior.

One notation from the manuscript to the communication extension

- **Prices:** $P_t = P_t^* + B_t$; P_t^* is latent fundamental value. The companion note's V_t is the same object. $R = 1 + r$ is the benchmark gross required return; $R_t(z)$ permits repricing after information z .
- **Forecasts:** the manuscript's market-pricing benchmark is $P_{t+h}^e = \mathbb{E}_t P_{t+h}$. The reported survey is
$$S_{t,h} = P_{t+h}^e + \eta_{t,h}.$$
- **Wedge:** $\eta_{t,h}$ is the manuscript's survey-to-benchmark discrepancy (called $q_{t,h}$ in the companion note). $u_{t,h}^F = P_{t+h}^* - \mathbb{E}_t P_{t+h}^*$ is fundamental news.
- **Information:** z is observed at the forecast origin. $\pi_t(z)$ is the survival belief, $B_{t+1}^S(z)$ the conditional continuation value, and $B_{t+1}^C(z)$ the collapsed value. Superscripts S, C label branches; $S_{t,h}$ denotes survival through h periods. A fixed regime uses $R(z)$ and $\pi(z)$ constant across those periods.

Sources: [Martínez García and Pavlidis \(2025\)](#). Companion expectation-based restrictions note; author's notation crosswalk.

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Key point: The signal extends the benchmark's conditioning information; it does not change the economic meaning of the bubble or survey wedge.

Define the survey wedge

- **Rational benchmark:** $\mathbb{E}_t[\cdot] = \mathbb{E}[\cdot \mid \mathcal{F}_t]$ is the model's conditional expectation, not a central-bank forecast.
- **Survey beliefs:** $\mathbb{E}_t^S$ represents respondents' subjective expectations. The reported forecast adds measurement and aggregation differences $m_{t,h}$:

$$S_{t,h} = \mathbb{E}_t^S[P_{t+h}] + m_{t,h}.$$

$$\eta_{t,h} \equiv S_{t,h} - \mathbb{E}_t[P_{t+h}] = \underbrace{(\mathbb{E}_t^S - \mathbb{E}_t)[P_{t+h}]}_{\text{belief / information differences}} + \underbrace{m_{t,h}}_{\text{reporting / aggregation}}.$$

Sources: [Martínez García and Pavlidis \(2025\)](#). Author's operator decomposition.

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Key point: The survey wedge separates reported beliefs from the rational benchmark; it is not the realized forecast error.

Survey respondents and market price setters can differ

- $\mathbb{E}_t^M$ summarizes marginal price setters' beliefs. They need not equal the survey average.

$$\eta_{t,h} = \underbrace{(\mathbb{E}_t^S - \mathbb{E}_t^M)[P_{t+h}]}_{\text{survey-market mismatch}} + \underbrace{(\mathbb{E}_t^M - \mathbb{E}_t)[P_{t+h}]}_{\text{market-benchmark mismatch}} + m_{t,h}.$$

- A smaller wedge can reflect better reporting without any change in demand or market prices.
- Communication affects valuation when participants use the information in price-setting, investment or financing decisions.

Sources: [Martínez García and Pavlidis \(2025\)](#). Author's operator decomposition.

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Key point: Survey evidence reveals beliefs; changing survey answers is not the same as changing the beliefs that set market prices.

From annual expectations to price-level errors

Implementation: construct the data before testing.

$$\hat{S}_{t-12,12} = P_{t-12} \left(1 + \frac{g_{t-12,12}^e}{100} \right), \quad e_t = P_t - \hat{S}_{t-12,12}, \quad C_t = \sum_{s \leq t} e_s.$$

- **Construct the object:** convert annual growth expectations into price-level forecasts; match outcomes 12 months later.
- **Align coverage:** compare Michigan and SCE beliefs with Case–Shiller prices; track wording, geography and release dates.
- **Apply two complementary tests:** GSADF detects explosiveness in C_t and BSADF date-stamps it; quantile-root tests examine upper-tail persistence.
- **Respect dependence:** annual errors overlap; retain explicit lag, critical-value and duration rules.

Sources: [Martínez García and Pavlidis \(2025\)](#).

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Key point: Test explosive dynamics in cumulative price-level forecast errors—not optimism alone or a simple run of forecast misses.

Quantile tests provide a different lens on persistence

- A quantile autoregression can be written as

$$Q_{\tau}(C_t | \mathcal{F}_{t-1}) = a(\tau) + \rho(\tau)C_{t-1} + \sum_{j=1}^k \gamma_j(\tau)\Delta C_{t-j}.$$

The upper-tail procedure tests a unit-root restriction against explosive behavior over a quantile range. The implementation uses a supremum-type statistic across $\tau \in [.80, .95]$, with a .01 grid. Upper conditional quantiles can reflect surviving expansions even when collapses dilute average persistence. This is *not* the same as testing the upper tail of individual households' belief distribution. Smaller p-values in this sample do not establish uniformly greater power or general robustness to all outliers, breaks and dependence.

Sources: [Koenker and Xiao \(2004\)](#); [Pavlidis \(2024\)](#); [Martínez García and Pavlidis \(2025\)](#).

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The forecast averages the surviving and collapsed branches

- Fix information z and hold $R(z) > 1$ and $0 < \pi(z) < 1$ constant over the horizon. Let $\mathcal{S}_{t,h}$ mean survival for all h periods; collapse has no restart.

$$\Pr_t(\mathcal{S}_{t,h} \mid z) = \pi(z)^h, \quad B_{t+h}^S(z) = \left[\frac{R(z)}{\pi(z)} \right]^h B_t(z), \quad B_{t+h}^C(z) = 0.$$

- The forecast averages both branches:

$$\mathbb{E}_t[B_{t+h} \mid z] = \pi(z)^h B_{t+h}^S(z) + [1 - \pi(z)^h] B_{t+h}^C(z) = R(z)^h B_t(z).$$

- On the surviving branch, subtract that average:

$$\begin{aligned} B_{t+h}^S(z) - \mathbb{E}_t[B_{t+h} \mid z] &= [1 - \pi(z)^h][B_{t+h}^S(z) - B_{t+h}^C(z)] \\ &= \underbrace{R(z)^h[\pi(z)^{-h} - 1]}_{\kappa_h(z) > 0} B_t(z). \end{aligned}$$

Sources: [Martínez García and Pavlidis \(2025\)](#). [Blanchard \(1979\)](#).

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Key point: Conditional on survival in a fixed signal regime, the bubble exceeds its forecast by a positive multiple of its current value.

From the branchwise bubble gap to the observable error

- In the fixed signal regime z , define the reported forecast and fundamental news:

$$S_{t,h}(z) = \mathbb{E}_t[P_{t+h} \mid z] + \eta_{t,h}(z), \quad u_{t,h}^F(z) = P_{t+h}^* - \mathbb{E}_t[P_{t+h}^* \mid z].$$

- Conditional on survival, the observed error is

$$e_{t,h}(z) = \underbrace{u_{t,h}^F(z)}_{\text{fundamental news}} + \underbrace{\kappa_h(z)B_t(z)}_{\text{surviving bubble}} - \underbrace{\eta_{t,h}(z)}_{\text{survey wedge}}.$$

- Along a growing surviving path, with fixed h and z ,

$$\frac{u_{t,h}^F(z)}{B_t(z)} \xrightarrow{p} 0, \quad \frac{\eta_{t,h}(z)}{B_t(z)} \xrightarrow{p} 0 \quad \implies \quad \frac{e_{t,h}(z)}{B_t(z)} \xrightarrow{p} \kappa_h(z) > 0.$$

- A conditional-mean interpretation also needs mean-zero fundamental news and suitable independence from survival. Explosive news or belief wedges can mimic the signal.

Sources: [Martínez García and Pavlidis \(2025\)](#). Expectation-based restrictions note, Propositions 1–2.

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Key point: The fundamental level need not be observed; restrictions on fundamental news and the expectation proxy remain essential.

Cumulation preserves an explosive component

- Fix z and h : let $\kappa_h = \kappa_h(z)$, $\lambda = R(z)/\pi(z) > 1$, and suppress z below. On a surviving interval, $e_{t,h} = \kappa_h B_t + n_{t,h}$, $n_{t,h} = u_{t,h}^F - \eta_{t,h}$ and $B_t = \lambda B_{t-1}$.

$$C_{t,h} \equiv \sum_{s=\tau}^t e_{s,h} = \kappa_h \underbrace{\frac{\lambda B_t - B_\tau}{\lambda - 1}}_{\sum_{s=\tau}^t B_s} + \sum_{s=\tau}^t n_{s,h}.$$

- If $\sum_{s=\tau}^t n_{s,h} = o_p(B_t)$, then

$$C_{t,h} = \kappa_h \frac{\lambda}{\lambda - 1} B_t + o_p(B_t).$$

- Under an appropriate no-bubble null, weakly dependent, centered errors instead yield a unit-root-type partial sum. Overlapping horizons require suitable inference.

Sources: [Martínez García and Pavlidis \(2025\)](#). Expectation-based restrictions note, Section 4.

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Key point: Cumulation does not create the bubble signal: it retains the explosive root and supplies the partial-sum object used in the tests.

Communication can change survival odds and continuation values

- Let z be information and $\mathbb{E}_t^M$ price-setting beliefs. For survival event S ,

$$\pi_t(z) = \Pr_t^M(S \mid z), \quad B_{t+1}^S(z) = \mathbb{E}_t^M[B_{t+1} \mid S, z].$$

- With zero bubble value after collapse and required gross return $R_t(z) > 0$,

$$P_t(z) = P_t^*(z) + B_t(z), \quad B_t(z) = \frac{\pi_t(z) B_{t+1}^S(z)}{R_t(z)}.$$

- For two information sets at the same date, assuming positive values,

$$\frac{B_t(z_1)}{B_t(z_0)} = \frac{\pi_t(z_1)}{\pi_t(z_0)} \frac{B_{t+1}^S(z_1)}{B_{t+1}^S(z_0)} \frac{R_t(z_0)}{R_t(z_1)}.$$

- Evidence may revise survival odds, conditional speculative values or required returns. Fixed R is a special case; fundamental news can separately change P_t^* .

Sources: Author's information-conditioned pricing extension; [Martínez García and Pavlidis \(2025\)](#).

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Key point: Information can lower speculative valuation through beliefs or required returns; no single channel determines the net effect.

The same information can reprice the bubble today

- **Before and after information:** compare the same date, with $B_{t+1}^C = 0$ and positive valuations. Define $\Delta_z \log X \equiv \log X(z_1) - \log X(z_0)$.

$$\Delta_z \log B_t = \Delta_z \log \pi_t + \Delta_z \log B_{t+1}^S - \Delta_z \log R_t.$$
- The bubble valuation falls precisely when

$$\Delta_z \log \pi_t + \Delta_z \log B_{t+1}^S - \Delta_z \log R_t < 0.$$
- Lower survival odds or resale gains, or a higher required return, can reduce B_t , holding other terms fixed. The required return is not simply the policy rate.
- If B_t and R_t stay fixed, $B_{t+1}^S = R_t B_t / \pi_t$ offsets lower survival odds with higher conditional gains. With new information, B_t can instead be repriced.
- Fundamental news can separately change P_t^* : a smaller bubble need not imply an equal fall in the total house price.

Sources: Author's information-conditioned pricing extension; [Martínez García and Pavlidis \(2025\)](#).

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Key point: Communication supplies information, not a mechanical control over π or B : equilibrium changes depend on how participants value all branches.

Required returns and risk-adjusted continuation values

- **General risk pricing:** with stochastic discount factor M_{t+1} and rational pricing beliefs ($\mathbb{E}_t^M = \mathbb{E}_t$), the homogeneous pricing restriction is

$$B_t(z) = \mathbb{E}_t[M_{t+1}B_{t+1} \mid z] = \pi_t(z)\mathbb{E}_t[M_{t+1}B_{t+1} \mid S, z],$$

when the bubble is zero after collapse.

- The surviving-branch contribution contains

$$\mathbb{E}_t[M_{t+1}B_{t+1} \mid S, z] = \mathbb{E}_t[M_{t+1} \mid S, z]B_{t+1}^S(z) + \text{Cov}_t(M_{t+1}, B_{t+1} \mid S, z).$$

- Risk adjustment and covariance with payoffs matter in general. $R_t(z)$ is an effective required return, not simply the policy rate or $1/\mathbb{E}_t[M_{t+1} \mid z]$ when payoff covariance is nonzero.
- Information may change discounting, survival beliefs and continuation payoffs, as well as fundamental value. The observed market response combines these channels.

Sources: Author's pricing extension; [Martínez García and Pavlidis \(2025\)](#). Companion note, asset-pricing benchmark.

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Key point: Information can change the compensation investors require for risk, not only their perceived probability of collapse.

A lower survival probability alone need not shrink the bubble

- **Starting point:** $R_t(z_0) = R_t(z_1) = 1.04$, $\pi_t(z_0) = 0.8$ and $B_{t+1}^S(z_0) = 130$ give

$$B_t(z_0) = \frac{0.8 \times 130}{1.04} = 100.$$

- **Lower odds, unchanged continuation value:**

$$\pi_t(z_1) = 0.7, \quad B_{t+1}^S(z_1) = 130 \quad \implies \quad B_t(z_1) = 87.5.$$

- **Offsetting gains conditional on survival:**

$$B_{t+1}^S(z_1) = \frac{104}{0.7} \simeq 148.57 \quad \implies \quad B_t(z_1) = 100.$$

- With B_t fixed, lowering π raises required surviving-path growth R/π ; it does not reduce today's bubble component.

Sources: Author's numerical illustration of the preceding identity; [Martínez García and Pavlidis \(2025\)](#).

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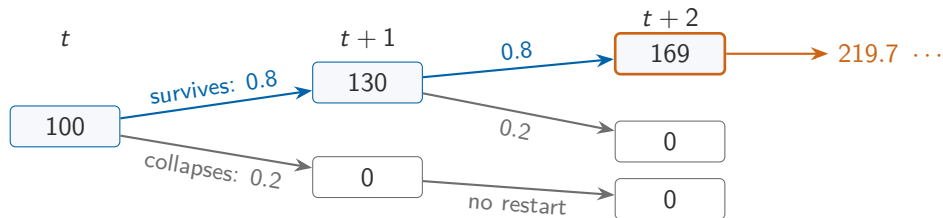
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Key point: Communication must change expected speculative value or behavior; the collapse probability by itself is not a policy lever.

A bubble can survive repeatedly—the forecast still averages collapse

- Fix an information regime z_0 : $R = 1.04$, $\pi = 0.8$, $B_t = 100$. Surviving-step growth: $R/\pi = 1.30$; collapse is absorbing.



- Forecast: $\mathbb{E}_t B_{t+2} = 0.8^2(169) = 108.16$. Two surviving steps yield 169: the gap is 60.84.
- New information can reprice both odds and continuation values before the next decision.

Sources: Author's two-period illustration; [Martínez García and Pavlidis \(2025\)](#).

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Key point: The surviving path is only one branch of the distribution: allowing for collapse makes its continuation value exceed the earlier average.

Better risk recognition need not make the forecast gap smaller

- **Measurement:** $\eta_{t,h} = (\mathbb{E}_t^S - \mathbb{E}_t)P_{t+h} + m_{t,h}$ separates survey beliefs from the rational benchmark, plus reporting / aggregation. Narrowing this wedge alone need not change prices.
- **Risk recognition:** hold $R = 1.04$, $B_{t+1}^S = 130$ and $B_{t+1}^C = 0$. Lower survival beliefs reduce $B_t = \pi B_{t+1}^S / R$, but increase the surviving-branch bubble error $(1 - \pi)B_{t+1}^S$:

Information	Survival belief	Bubble value	Surviving bubble error
Before	0.8	100	26
After	0.7	87.5	39

- **Evaluation:** assess comprehension, beliefs, leverage and liquidity choices—not just smaller survey errors. Across information regimes, the signal's loading on the bubble can change.

Sources: Author's numerical illustration; [Martínez García and Pavlidis \(2025\)](#). [Martínez García \(2024\)](#).

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Key point: The objective is better-informed decisions and less fragility, not mechanically minimizing a diagnostic statistic.

Signal quality governs how much beliefs change

- **Survival beliefs:** if price setters update by Bayes' rule, for new evidence z ,

$$\frac{\pi_t(z)}{1 - \pi_t(z)} = \frac{\pi_t^-}{1 - \pi_t^-} \underbrace{\frac{f(z \mid S, \mathcal{I}_t^-)}{f(z \mid C, \mathcal{I}_t^-)}}_{\text{how informative the signal is}}.$$

- $\mathcal{I}_t^-$ and π_t^- denote pre-signal information and survival probability. A likelihood ratio near one barely changes those odds; evidence favoring collapse lowers them.
- The same signal may revise the conditional continuation value $B_{t+1}^S(z)$. Clear explanation also matters with inattention, learning or dispersed information.
- Clear, credible evidence can affect $B_{t+1}^S(z)$ as well as $\pi_t(z)$. The direction depends on the news; fully anticipated or uninformative news need not change either.

Sources: Author's Bayesian information illustration; [Martínez García and Pavlidis \(2025\)](#). [Martínez García \(2024\)](#).

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Key point: Communication is valuable for its information content and credibility, not because every message necessarily reduces optimism.

More informative signals can receive greater weight

- **Signal-to-noise illustration:** a continuation-value driver has prior $\theta \sim N(\mu^-, \sigma_\theta^2)$. Observe $z = \theta + \nu$, with independent $\nu \sim N(0, \sigma_\nu^2)$.

$$w = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_\nu^2}, \quad \mathbb{E}_t^M[\theta \mid z] = (1 - w)\mu^- + wz.$$

- A more precise signal receives more weight: smaller σ_ν^2 raises w . When z lies below prior beliefs, the update is downward; when it lies above them, it is upward.
- If expected speculative resale values depend on θ , this is one channel into $B_{t+1}^S(z)$. Fundamental news can also revise P_t^* ; it need not concern the bubble alone.
- Credibility, comprehension and new information are essential. Repeating information already incorporated in beliefs need not change prices or financing decisions.

Sources: Author's rendering of Gaussian updating; [Martínez García and Pavlidis \(2025\)](#). [Martínez García \(2024\)](#).

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Key point: Better evidence can influence how beliefs are updated; it does not guarantee either a particular message's effectiveness or a downward revision.

The feedback from beliefs to prices and back to beliefs

- **Local behavioral illustration.** Let x_t be a speculative price gap and a_t an expected excess resale gain:

$$x_t = \chi a_t, \quad a_{t+1} = \alpha(z)x_t + \varepsilon_{t+1}, \quad \chi > 0, \quad \alpha(z) \geq 0.$$

$$x_{t+1} = \underbrace{\chi \alpha(z)}_{\text{belief-price feedback gain}} x_t + \chi \varepsilon_{t+1}.$$

- χ : how strongly speculative beliefs move prices.
- $\alpha(z)$: how strongly rising prices reinforce those beliefs.
- Credible evidence may weaken extrapolation or FOMO by lowering α ; instruments and prudential measures may also affect χ .

Sources: Author's illustrative behavioral extension; [Martínez García \(2024\)](#).

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Key point: Information can challenge the inference that recent gains validate further gains, weakening the feedback that sustains speculation.

When an expectations circuit breaker can dampen deviations

- For a fixed message z and no new shocks, the feedback equation gives

$$x_{t+k} = [\chi\alpha(z)]^k x_t.$$

- **Amplification:** $\chi\alpha(z) > 1$ magnifies speculative deviations.
- **Damping:** $0 \leq \chi\alpha(z) < 1$ makes deviations decay.
- Evidence-based communication can act as a circuit breaker if it weakens belief reinforcement sufficiently. It need not engineer a crash or change policy rates.
- This is a local analytical condition, not evidence that a particular message can achieve it. New shocks or shifts in fundamentals may still matter.

Sources: Author's illustrative behavioral extension; [Martínez García \(2024\)](#).

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Key point: The potential channel is weaker self-reinforcing behavior; its effectiveness is conditional, not guaranteed.

Policy frameworks extend beyond instruments

STRATEGY

Commit to the mandate.
Explain the reaction function—or guiding principles when no fixed rule applies—including contingencies and trade-offs.

INSTRUMENTS

Monetary authorities: policy rates and balance-sheet tools.
Regulators / supervisors: prudential tools.
Responsibilities need not sit in the same institution.

COMMUNICATION

Convey reliable financial stability evidence effectively: make fragility and downside risks understandable.
Give people information to reassess self-reinforcing beliefs before they take hold.

Expectations can sustain a boom; credible information can challenge its premises.

Sources: [Martínez García \(2023, speech\)](#). [Martínez García \(2024\)](#). [Yellen \(2014\)](#).

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Key point: Beyond the interest-rate instrument, evidence-based communication can help shape expectations before fragile beliefs become entrenched.

Debt-service history: one growth-linked series

Let D_t^N denote the current-method ratio and D_t^O the previous-method ratio. Link at $a = 2005Q1$:

$$\tilde{D}_t = \begin{cases} D_a^N D_t^O / D_a^O, & t < a, \\ D_t^N, & t \geq a. \end{cases} \quad \frac{\tilde{D}_t}{\tilde{D}_{t-1}} = \frac{D_t^O}{D_{t-1}^O} \quad (t \leq a).$$

- Anchor: $D_a^N = 14.799802$, $D_a^O = 12.62$; scale factor 1.17272599.
- All current-method observations from 2005Q1 are unchanged. Historical quarter-to-quarter proportional changes are preserved exactly.
- The pre-2005 segment is an analytical backcast, not an official homogeneous measure. Escrow treatment and source data differ across methodologies.

Sources: Federal Reserve Board: [previous method](#); [current method](#); [methodology](#).

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Key point: The splice improves visual continuity while transparently retaining the earlier measure's growth rates and the current measure's observed levels.