Does a Frozen Power-Law Floor Hold?

A Pre-Registered Out-of-Sample Test of Four Bitcoin Floor Definitions, 2011 to 2026

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Claims used: C1.1, C1.3, C1.4 (Observatory Claims Registry v2.7). New claims: C7.1 to C7.6. Pre-registrations: `research/P18-preregistration.md` *(commit 34d2e1b) and, for the forward test,* `research/P18-forward-preregistration.md` *(commit df69873). Registered under the working title Paper 18 and published as Paper 20, because the site's Paper 18 is* The Formula, Month by Month. *v1.1 added the Observatory floor definition; v1.2 applies an independent review. See the Revision notes.*

Abstract

A power-law floor drawn on Bitcoin's whole history looks almost unbroken, but that says little about a floor drawn at any given date. We test that directly. At 172 month-ends from July 2011 to October 2025, we fit four floors on the data available, freeze them and carry them forward to November 2026:

- the 1st- and 5th-percentile quantile-regression lines;
- the OLS trend times its lowest-1% multiple;
- the OLS trend times the published 0.42.

A floor is breached on any day that closes below it, and its nominal rate is the share of the fitting data below it: 1% for the 1% line. Under pre-registered criteria, a floor is reliable if, after the first full cycle, its median breach rate is at most twice nominal and it held for four years at 90% or more of freeze dates.

No floor passes.

- **The 1% line, which Paper 19 uses refit monthly,** was breached on a median 14% of later days (nominal 1%) and held for four years at 5 of 94 freeze dates.
- **The trend times its lowest-1% multiple** was breached on 0% of later days at the median and held at 72 of 94 (77%).

The fitted slope has come down in steps during the 2015 and 2022 bear markets, from 7.25 at the 2011 low to 5.95 today for the 1% line. A bending path still forecast worse than a straight line at 65% to 82% of dates.

A floor is better judged the way the Observatory now defines it: a level price spends little time below and climbs back above quickly. On that measure (at most 5% of days below, no visit over 180 days), the trend times its lowest-1% multiple passed at 85 of 94 freeze dates and the 1% line at 41. That rule was proposed after the results, so it is now under a pre-registered forward test.

Keywords: Bitcoin, power law, quantile regression, out-of-sample validation, pre-registration, model stability, forecast evaluation.

Key findings

1. **Before the 2015 low is in the data, every floor is meaningless.** A floor needs at least one full cycle from low to low. Earlier, fitted slopes range from 5.5 to 12.3, and a median 64% to 79% of later closes fall below the frozen floor (Figure 2, Table 2).
2. **Quantile floors are not calibrated out of sample.** The 1% and 5% lines were breached on a median 14% and 21% of later days. They held for the next four years at 5% and 2% of freeze dates (Figures 3 to 5).
3. **The trend times its lowest-1% multiple is the most stable floor.** It was breached on 0% of later days at the median and held for four years at 77% of freeze dates. That still falls short of the pre-registered 90% (Figure 5).
4. **The slope falls in bear markets, not at every low.** The 1% line fell by 0.71 from the 2011 to the 2015 low, by 0.44 more during the rest of 2015, and by 0.14 across the 2022 low. The 2018 low did not move it, and the 2026 drawdown lowered it by 0.04 (Figure 6).
5. **A straight log-log line forecast better than a bending one in this walk-forward test.** The quadratic won at 18% to 35% of forecast dates. Its trend forecasts won mainly from 2021 and 2022, whose four-year windows run through the weak years after the 2022 low (Figure 7).
6. **The full-history fit bends down, but not significantly.** The curvature coefficient is -0.88, with a 95% bootstrap interval of -2.25 to 0.56 (Figure 8).
7. **The published floor (0.42 × trend, slope 5.688) has had short, rare visits below it.** Since 2010: 3.7% of days, in 23 visits, none longer than 86 days. Since 2016: 0.3% of days, and the longest visit lasted 7 days. It was fitted with hindsight, so this is a description, not a test (Figure 9).
8. **Judged by time below and recovery, the trend times its lowest-1% multiple works** (v1.1, post hoc). Under the rule of at most 5% of days below and no visit over 180 days, it passed at 85 of 94 freeze dates. Most visits below every floor are short, but the quantile lines spend too much time below (Figure 11).

1. Introduction

1.1 The problem

Every Observatory tool that quotes a floor draws it on the whole price history. A line fitted on all the data will, by construction, sit under almost all of it. The useful question is different. **If you had fitted the floor at a past date and used it from then on, would it have held?**

That question matters for three reasons.

- **Planning tools treat the floor as a worst case.** If a floor fitted today is too high tomorrow, plans built on it are too optimistic.
- **Allocation rules use the floor's future path.** Paper 19's Kelly rule sizes Bitcoin from the floor four years ahead. A floor that drifts down makes that input too optimistic.
- **The Observatory's floor claims are untested out of sample.** Claim C1.4 used to say the floor had never been sustained below. A 2026 recount found 223 of 5,951 daily closes (3.7%) below 0.42× trend. That claim has now been restated (Section 4.4).

What "floor" means here. A floor is not a boundary. Price can and does go below it. The Observatory defines a floor as a level price spends only a small share of its time below, and climbs back above quickly when it does (`research/floor-definition.md`). Sections 2 to 3.8 report the pre-registered tests, which were written before this definition was adopted. Section 3.9 judges every floor by the definition.

1.2 What this paper does

1. **A freeze-and-forward test** of four floor definitions at 172 freeze dates (Section 2).
2. **Pre-registered criteria,** committed before the new analyses were run, with an explicit list of what had already been seen (Section 2.6).
3. **How much history a floor needs** before it settles (Section 3.1).
4. **Calibration and four-year holds** for each floor, and a verdict under the pre-registered rule (Sections 3.2 to 3.4).
5. **Whether the growth path is bending:** how the slope has moved across cycles, a walk-forward forecast comparison of straight and bending models, and a curvature test (Sections 3.5 and 3.6).
6. **A prospective test:** a frozen copy of the most stable floor, now tracked month by month (Section 7).

1.3 Related work

- **The power law:** the corridor was popularised by Burger (2019) and Santostasi (*The Physics of Bitcoin*, n.d.). The Observatory's fit ($\beta = 5.688$) and its out-of-sample R^2 of 0.546 are in Paper 12.
- **Quantile regression:** Koenker and Bassett (1978). Our 1% and 5% floors are linear quantile regressions of $\log_{10}$ price on $\log_{10}$ days.
- **Forecast evaluation:** a quantile forecast is scored consistently by the piecewise-linear (pinball) loss, and a mean forecast by squared error (Gneiting, 2011).
- **Dependent data:** the moving-block bootstrap (Künsch, 1989) resamples blocks of residuals to preserve their autocorrelation.
- **Pre-registration:** fixing hypotheses and criteria before seeing outcomes is the standard defence against analysis chosen after the fact (Nosek, Ebersole, DeHaven and Mellor, 2018).
- **Real-time refits of the trend:** Paper 18 (*The Formula, Month by Month*) refits the OLS trend at every month-end since July 2011. It finds the exponent settled in 2016, and that a 0.42× floor drawn on each month's own trend held afterwards in only 13% of months from January 2016. Our OLS42 result is similar over a fixed four-year window: it held at 19 of 94 freeze dates (20%) (Table 3).
- **Allocation:** Paper 19 uses the 1% floor, refit monthly, as the input to Kelly sizing. This paper tests that floor's stability directly.

2. Data and Method

2.1 Data

- **Bitcoin:** `bitcoin-powerlaw-site/shared/datasets/btc_historical.json`, 5,951 daily closes from 2010-07-18 to 2026-11-01 (SHA-256 `4aa06d9ec7f4c495…` at the pre-registration commit). The cut-off was fixed at pre-registration.
- **Age:** *d* is the number of days since 2009-01-03.
- **Published model (reference):** $\log_{10}(P) = -16.493 + 5.688 \cdot \log_{10}(d)$ (C1.1). Official floor: 0.42× trend (C1.3).

2.2 Floor definitions

Table 1 lists the four floors and the benchmark.

Table 1. The four floors tested, each fitted on all daily closes up to the freeze date and then frozen, plus the published benchmark.

Code	Floor	Nominal share of closes below
QR01	Quantile regression of $\log_{10}$ price on $\log_{10}$ days, $\tau = 0.01$ (the Paper 19 headline floor)	1%
QR05	The same at $\tau = 0.05$	5%
OLSK	OLS power-law trend × *k*, where *k* is the 1st percentile of price / trend over the fitting closes	1%
OLS42	OLS power-law trend × 0.42. The slope is fitted at each date; the multiple is the published one, chosen with hindsight.	Its in-sample share below at the freeze date
PUB	Benchmark: 0.42 × the published trend. Fitted on the full history and not frozen.	n/a

OLSK and OLS42 share the same OLS trend and differ only in the multiple. OLSK's multiple is the lowest 1% of history and ranged from 0.25 to 0.35 after 2015, so it sits well below 0.42.

2.3 Freeze dates and bands

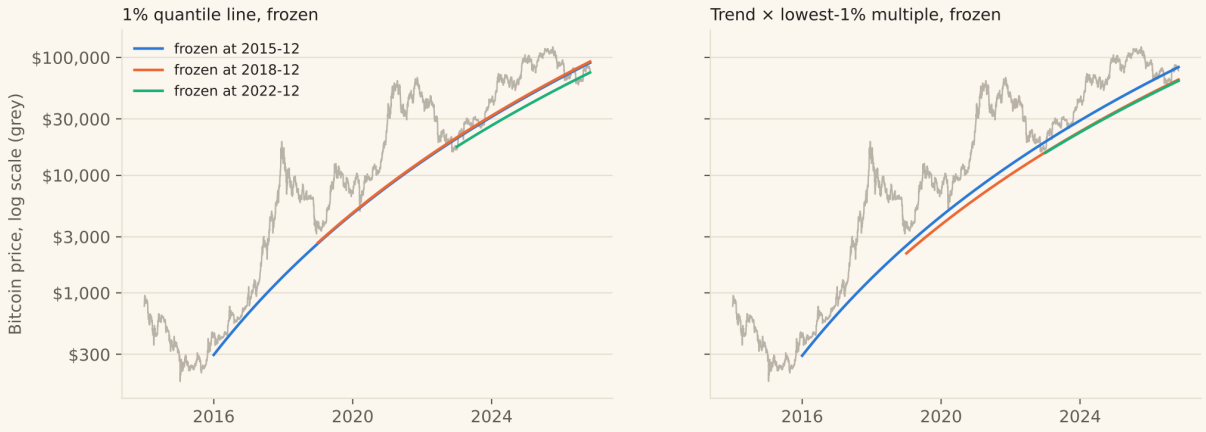
We freeze each floor at every month-end from July 2011 (one year of data) to October 2025, 172 dates in all. The November 2011 low is in the data from late 2011, but a full cycle from low to low is only complete at the January 2015 low. Freeze dates are grouped by the later lows already in the data:

- **L0:** before the January 2015 low (42 dates);
- **L1:** from January 2015 to before the December 2018 low (47);
- **L2:** from December 2018 to before the November 2022 low (47);
- **L3:** from November 2022 (36).

Figure 1 shows the idea at three freeze dates.

Figure 1. Freeze a floor, carry it forward, and see how often price closes below it

Each line is a floor fitted on all daily closes up to the freeze date, then never refit. All three 1% quantile lines were later breached (9%, 14% and 6% of later closes). Of the trend × multiple floors, only the one frozen in 2015 was, in 2020, 2022–23 and 2026 (5% of later closes).



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 1. Three freeze dates for the 1% quantile line and for the trend times its lowest-1% multiple, each drawn forward from the freeze date. Note that the 1% lines frozen in 2015 and 2018 sit almost on top of each other, and price later fell through both.

2.4 Pre-registered criteria

1. **Calibration (M1):** the share of daily closes after the freeze that fall below the frozen floor, compared with its nominal share. We also count breach episodes lasting seven days or more.
2. **Four-year hold (M2):** the lowest value of price / frozen floor over the four years after the freeze. The floor "held" if that minimum is at least 1. Freeze dates up to October 2022 have a full four-year window (94 dates after L0). We also report two years.
3. **Revision (M3):** the frozen floor's value four years after the freeze, divided by the same floor type refit on data up to that later date. Above 1 means the frozen floor turned out too high.
4. **Slope stability (M4):** the slope at the freeze minus the slope refit four years later.

Decision rule. A floor definition is out-of-sample reliable if, over freeze dates in bands L1 to L3, both of these hold:

- 1. its median breach share is at most twice its nominal share;
- 1. it held over the following four years at 90% or more of freeze dates with a full window.

2.5 Tests of the growth path

1. **Forecast comparison.**
   - Monthly from January 2015 to October 2022 (94 dates), we fit a straight and a quadratic log-log model on the data up to each date.
   - We score each model on the daily closes of the next four years: pinball loss at τ = 0.01 and 0.05 for the floors, squared error of $\log_{10}$ price for the OLS trend.
   - The windows overlap, so we report shares and averages, not p-values.
2. **Curvature.** We fit an OLS model with a quadratic term in $\log_{10}$ days to all daily closes. A moving-block bootstrap of the residuals (365-day blocks, 2,000 draws, seed 20261106) gives the interval for the quadratic coefficient.

3. **Slope by cycle.** The slopes fitted on data up to each cycle-low month (2011-11, 2015-01, 2018-12, 2022-11) and up to October 2026. Section 3.5 adds the month-ends after each bear market, where the slope actually moved.

2.6 What was already seen

The criteria were registered after an exploratory sweep, `research/floor-freeze-sweep.md`, that reported two floors at all 172 freeze dates:

- the breach shares, slopes at every freeze date, levels against the October 2026 fit, and trading results for QR01 and OLSK, including that the December 2018 low did not move the QR01 slope;
- OLS42 at three freeze dates, in an ad hoc check during the same session that was not saved to the repository.

The decision rule was therefore set knowing roughly how QR01 and OLSK behave, so it is not a blind test of those two.

Not yet run at registration:

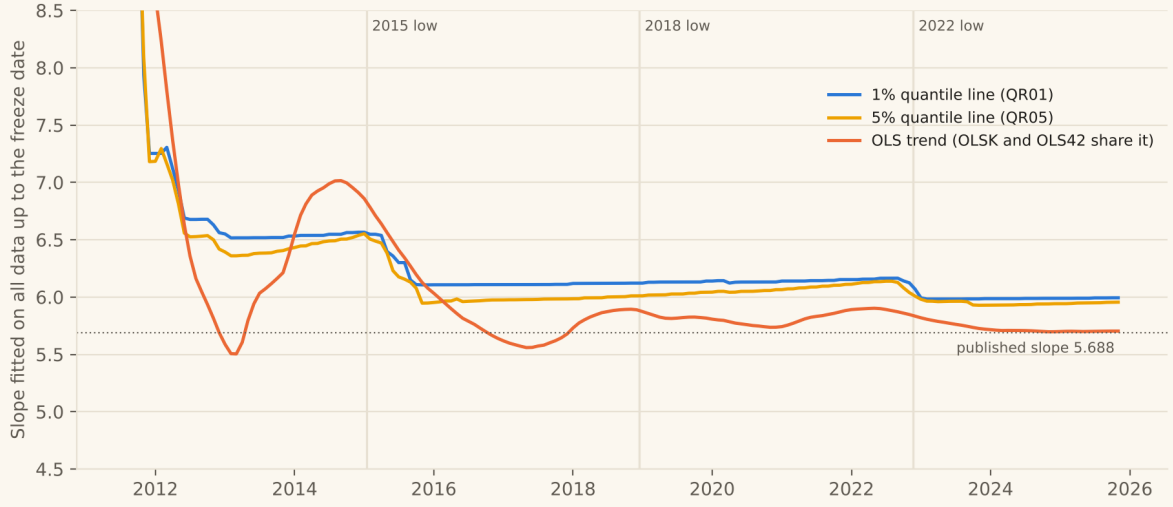
- QR05 and OLS42 at all dates;
- the four-year holds, revisions and slope changes;
- the forecast comparison and the curvature test;
- the QR05 column of the slope-by-cycle table. The QR01 and OLS slopes in that table could be read off the sweep.

3. Results

3.1 How much history does a floor need?

Figure 2. Before the 2015 low the slope is meaningless; after it, it steps down

Slope of $\log_{10}$ price on $\log_{10}$ days, fitted on all daily closes up to each month-end from July 2011 to October 2025. Fits with about one to one and a half years of data run above the chart (slopes of 8.6 to 12.3).



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 2. Slope fitted on all data up to each freeze date. Note the collapse from slopes above 7 before 2013, and the steps down during the 2015 and 2022 bear markets.

At least one full cycle from low to low. Figure 2 shows the slope at every freeze date, and Table 2 the results by band. Before the January 2015 low (band L0), every floor failed:

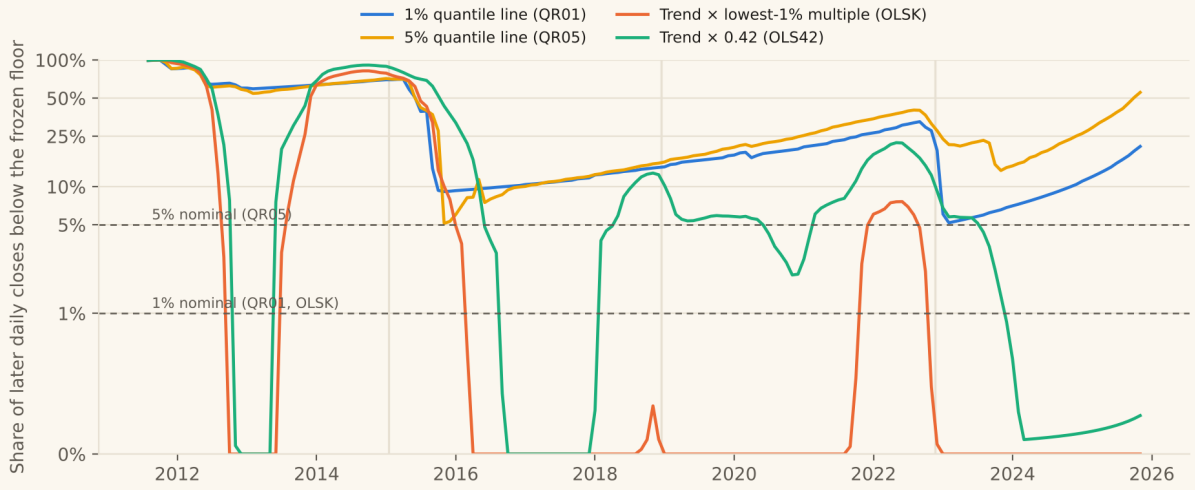
- slopes ranged from 5.5 to 12.3;
- a median 64% to 79% of later closes fell below the frozen floors;
- no quantile floor held for the next four years at any L0 freeze date.

A floor fitted on one cycle's rise has no defensible slope.

3.2 Calibration

Figure 3. Quantile floors are breached far above their nominal rate; trend floors rarely

Share of daily closes from the month after the freeze to November 2026 that fell below the frozen floor. Vertical lines mark the 2015, 2018 and 2022 cycle lows. Breaches come in a few long episodes, so these shares are not independent draws.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 3. Share of later daily closes below each frozen floor. Note that both quantile lines stay above their nominal rates for every freeze date after 2015 (the 5% line by at least 1.4 times), while the trend times its lowest-1% multiple is at 0% for most of them.

Table 2. Results by band. “Breach” is the median share of later closes below the frozen floor. “Held 4y” and “Held 2y” are the shares of freeze dates where the floor held for the next four or two years. “Revision” is the median M3.

Floor	Band	Breach (nominal)	Episodes of 7+ days (median)	Held 4y	Held 2y	Revision after 4y
QR01	L0	65% (1%)	6	0%	0%	2.01×
QR01	L1	11% (1%)	7	11%	62%	0.97×
QR01	L2	20% (1%)	6	0%	13%	1.26×
QR01	L3	8% (1%)	2	n/a	71%	n/a
QR05	L1	12% (5%)	9	4%	51%	0.92×
QR05	L2	25% (5%)	7	0%	13%	1.13×
QR05	L3	22% (5%)	5	n/a	17%	n/a
OLSK	L0	70% (1%)	7	26%	33%	3.34×
OLSK	L1	0% (1%)	0	81%	81%	0.89×
OLSK	L2	0% (1%)	0	72%	74%	1.12×
OLSK	L3	0% (1%)	0	n/a	100%	n/a
OLS42	L1	6% (8%)	5	40%	45%	1.01×
OLS42	L2	6% (5%)	3	0%	17%	1.12×
OLS42	L3	0.2% (3.5%)	0	n/a	71%	n/a

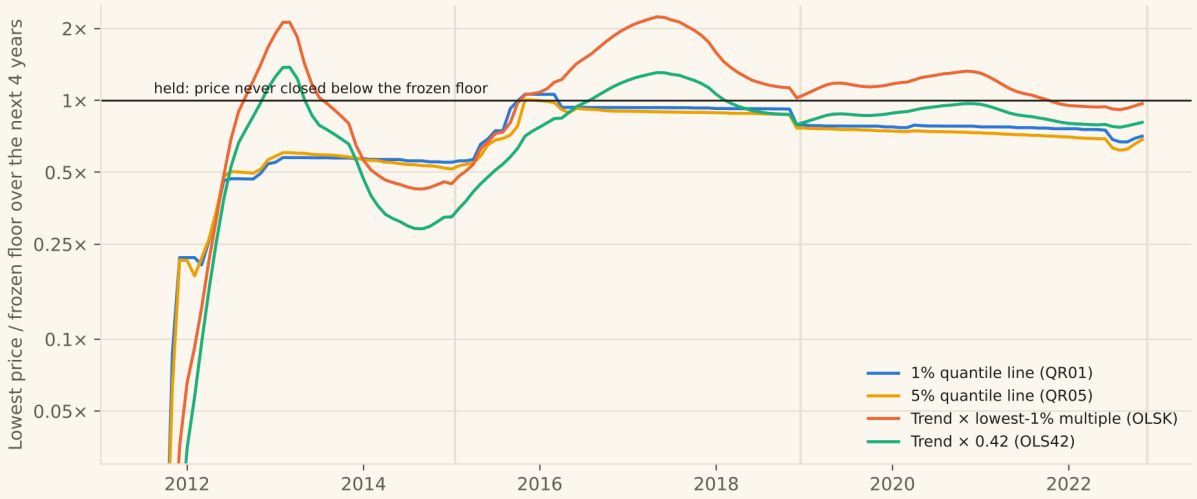
Figure 3 shows every freeze date. L0 rows for QR05 and OLS42 are in `analysis/p18_results.json`. Both failed as QR01 and OLSK did.

- **The quantile lines are not calibrated.** After the first cycle low, the 1% line was breached on a median 8% to 20% of later days, depending on the band. The 5% line was breached on 12% to 25%.
- **The breaches are long.** They fall in a few sustained episodes, not scattered days: November 2022 to January 2023, August to October 2023, February to April 2026, and May 2026 to the end of the data. The median longest run below the 1% line, for freeze dates from 2015 on, is 169 days. Most of that is the 2026 run, which was still open at the cut-off.
- **OLS42 is calibrated in share but not in timing.** Its breach share roughly matches its in-sample share (6% against 5% to 8%), but it held for four years at only 20% of freeze dates.

3.3 Four-year holds

Figure 4. Over the following four years, only the trend × lowest-1% floor usually held

Minimum of daily price divided by the frozen floor over the four years after each freeze date (freeze dates to October 2022, the last with a full window). Above 1× the floor held; below 1× price closed under it at least once.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 4. The lowest price relative to each frozen floor over the four years after the freeze. Note that from 2016 the trend times its lowest-1% multiple stays above 1× for most freeze dates, while the quantile lines sit below it.

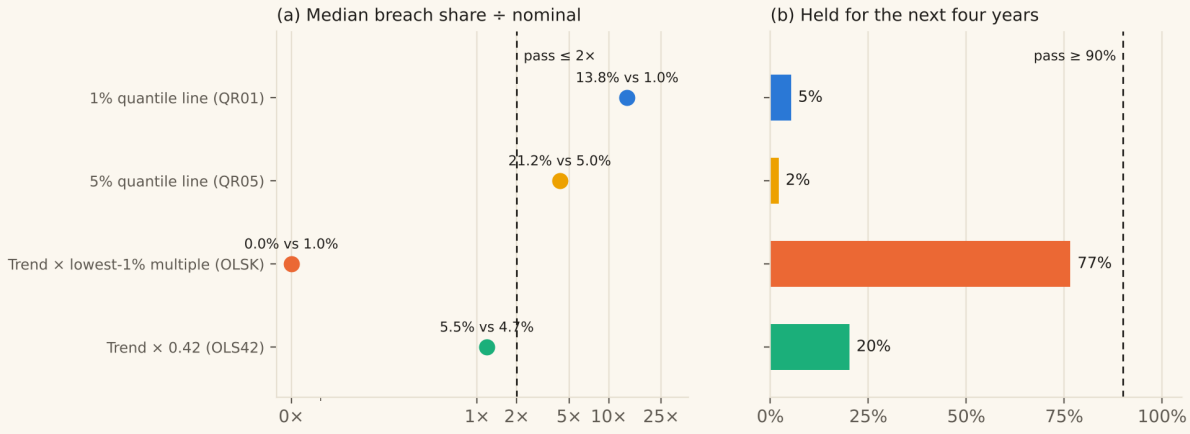
Figure 4 shows the lowest price relative to each frozen floor. The trend times its lowest-1% multiple failed the four-year hold at 22 of 94 freeze dates, in two clusters:

- **January to September 2015.** The trend still carried the steep slope of the 2013 bubble (6.2 to 6.8). Price fell as low as 0.48× the floor frozen in January 2015, at the turn of 2018 and 2019.
- **October 2021 to October 2022.** Price closed 2% to 9% below these frozen floors. The deepest close came at the November 2022 low for floors frozen up to May 2022, and in June and July 2026 for those frozen from June to October 2022 (lowest: 0.91× the floor frozen in July 2022).

3.4 Verdict under the pre-registered rule

Figure 5. No floor definition passes the pre-registered reliability rule

Freeze dates with at least one cycle low in the data (2015-01 to 2025-10; 94 with a full four-year window). A floor passes if its median breach share is at most twice its nominal share and it held for four years at 90% or more of freeze dates.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 5. The two pre-registered criteria for each floor over freeze dates with at least one cycle low in the data. Note that the trend times its lowest-1% multiple passes criterion (a) but not (b).

Table 3. Pre-registered decision rule, bands L1 to L3 (130 freeze dates; 94 with a full four-year window).

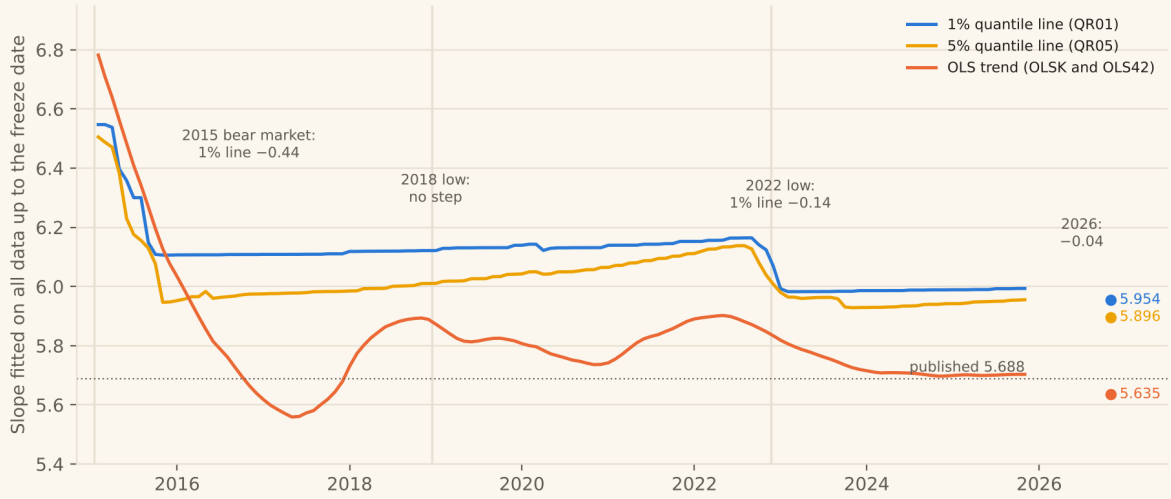
Floor	Median breach (nominal)	(a) at most 2× nominal	Held 4 years	(b) at least 90%	Reliable
QR01	13.8% (1%)	No	5 of 94 (5%)	No	**No**
QR05	21.2% (5%)	No	2 of 94 (2%)	No	**No**
OLSK	0.0% (1%)	Yes	72 of 94 (77%)	No	**No**
OLS42	5.5% (4.7%)	Yes	19 of 94 (20%)	No	**No**

Table 3 and Figure 5 give the verdict. **No floor definition is out-of-sample reliable by the standard we set in advance.** The trend times its lowest-1% multiple comes closest. It is rarely breached and holds most of the time, but one freeze date in four saw price close below it within four years.

3.5 How the slope has moved

Figure 6. The slope steps down in bear markets; the 2018 low left it unchanged

Slopes fitted on all daily closes up to each month-end from January 2015 to October 2025; dots at the right are the fits to October 2026. The 1% line fell by 0.44 during 2015, not at all at the 2018 low, by 0.14 across the 2022 low and by 0.04 in 2026.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 6. Slopes fitted on all data up to each freeze date from 2015, with the fit to October 2026 at the right. Note that the 1% line falls during the 2015 and 2022 bear markets and stays flat in between, while the OLS trend rises and falls with the cycle.

Table 4. Fitted slope by the data available, at the cycle-low months and at the end of each bear market.

Data up to	1% quantile line	5% quantile line	OLS trend
2011 low (November 2011)	7.252	7.181	9.359
2015 low (January 2015)	6.547	6.505	6.782
End of the 2015 bear market (October 2015)	6.106	5.947	6.127
2018 low (December 2018)	6.121	6.010	5.873
Before the 2022 low (October 2022)	6.124	6.039	5.847
2022 low (November 2022)	6.069	6.008	5.834
After the 2022 low (January 2023)	5.983	5.964	5.806
October 2025	5.993	5.955	5.703
October 2026	5.954	5.896	5.635

Figure 6 and Table 4 show how the slopes moved.

- **The 1% line moves in bear markets.**
  - It fell by 0.71 from the 2011 to the 2015 low, then by 0.44 more during the rest of 2015, as later lows undercut the line.
  - The 2018 low left it unchanged (6.106 to 6.121).
  - It fell by 0.14 across the 2022 low (October 2022 to January 2023), and by 0.04 in the 2026 drawdown.
- **The OLS trend moves with the whole cycle.** It falls in bear markets and long flat periods and rises in bull markets: 6.78 at the 2015 low, 5.56 in April 2017, 5.89 in October 2018, then down to 5.70 by October 2024 and 5.635 by October 2026.
- **The OLS slope to October 2026 (5.635) is below the published 5.688.** It was last below 5.688 at freeze dates in late 2016 and 2017.

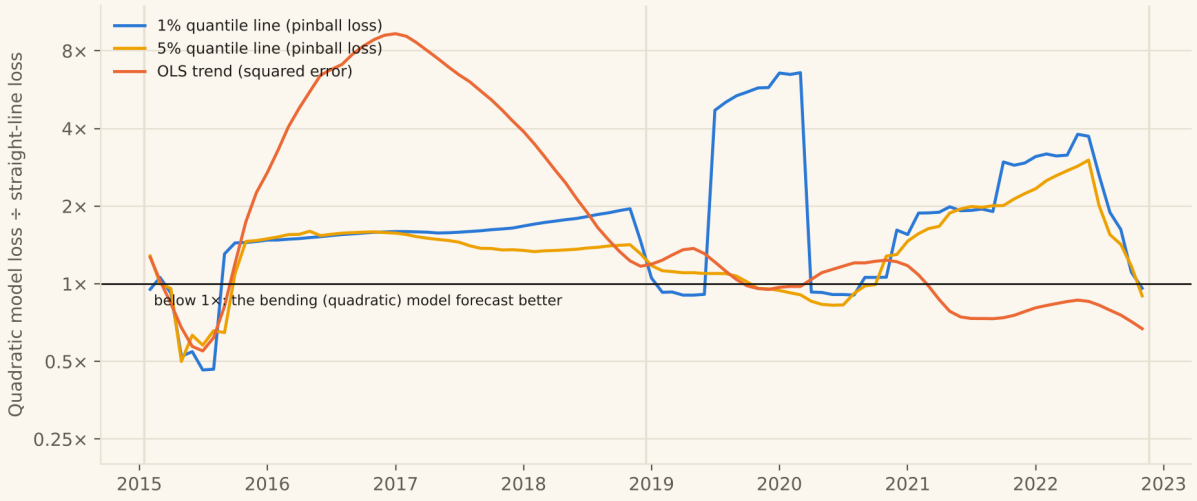
The steps have not shrunk steadily: 0.71 from the 2011 low to the 2015 low and 0.44 more by October 2015, nothing in 2018, 0.14 in 2022 and 0.04 so far in 2026. Bitcoin has been below all 84 of the 1% floors frozen between 2015 and 2021 since at least May 2026, and below the eight frozen from January to August 2015 since between May 2022 and February 2026 (Section 3.9).

3.6 Is the growth path bending?

A slope that falls with every new low could mean that the log-log line is bending down. That is, Bitcoin's growth could be decelerating faster than a power law allows. We test this two ways: a forecast comparison (Figure 7, Table 5) and a curvature test (Figure 8).

Figure 7. A bending growth path forecast worse than a straight line at most dates

Walk-forward, monthly from January 2015 to October 2022: fit straight and quadratic log-log models on data to date, score the next four years of daily closes. The quadratic won 18% (1% line), 20% (5% line) and 35% (trend) of dates; its trend wins cluster in 2021 to 2022.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 7. Four-year forecast loss of the quadratic model divided by that of the straight line, by forecast date. Below 1× the quadratic did better. Note that the quadratic trend's wins cluster in 2021 and 2022, whose windows run through the weak years after the 2022 low.

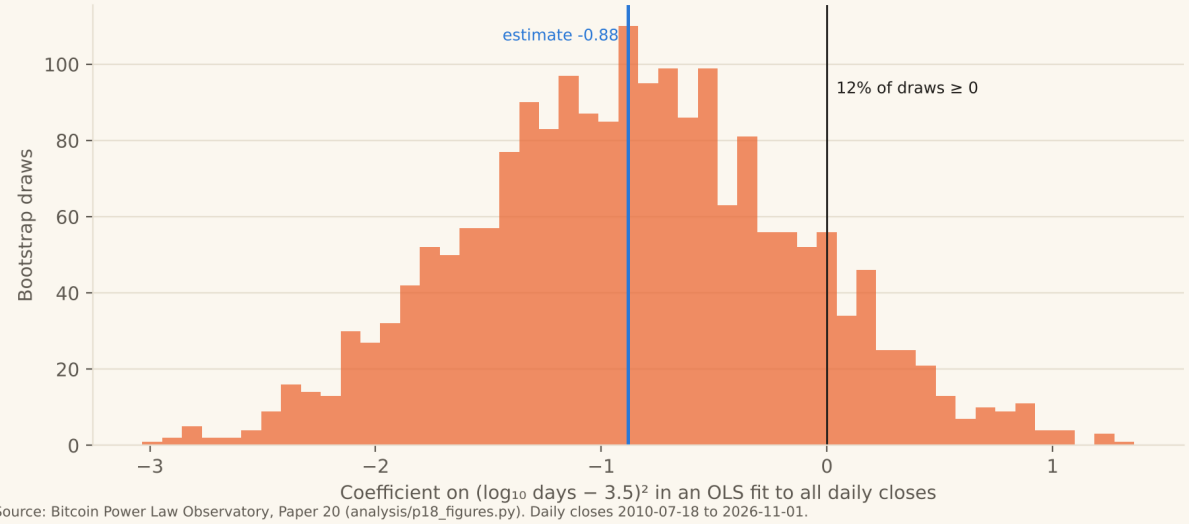
Table 5. Walk-forward forecast comparison, 94 monthly forecast dates from January 2015 to October 2022, each scored on the next four years of daily closes.

Model	Loss	Straight line	Quadratic	Quadratic better at
1% floor	Pinball, $\tau = 0.01$	0.0107	0.0183	18% of dates
5% floor	Pinball, $\tau = 0.05$	0.0244	0.0324	20% of dates
OLS trend	Squared error, $\log_{10}$ price	0.082	0.191	35% of dates

- **The bending model forecast worse.** It lost on average for all three models.
- **For the trend, its wins are recent.** The quadratic trend won at 92% of the 2021 forecast dates and all of the 2022 dates. Those windows end in 2025 and 2026; only those from late 2021 on include the 2026 drawdown. The quantile quadratics did not win recently: the 1% version won at 0 of 12 dates in 2021 and 1 of 10 in 2022.
- **The fitted bend is not consistent.** The quadratic trend bent down at 92 of 94 forecast dates (median coefficient -1.19). The quantile fits bent up at many dates, mostly from 2019 to 2022: 36 of 94 for the 1% floor and 26 of 94 for the 5% floor.

Figure 8. The full-history fit bends downward, but not by enough to rule out a straight line

2,000 moving-block bootstrap draws of the residuals (365-day blocks). 95% interval -2.25 to 0.56. A negative coefficient means the log-log slope declines with age; at today's age the quadratic implies a slope of 4.85, against 5.635 for the straight line.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 8. Bootstrap distribution of the quadratic coefficient in an OLS fit to all daily closes. Note that the estimate is negative but the interval crosses zero.

The full-history curvature is -0.88, with a 95% bootstrap interval of -2.25 to 0.56; 12% of draws are zero or above. At today's age the quadratic fit implies a slope of 4.85, against 5.635 for the straight line.

The 365-day blocks are shorter than a four-year cycle, so the true uncertainty is probably wider than this interval. **The data do not establish that the power law is bending.** The most recent data lean that way: the OLS slope fitted to October 2026 (5.635) is the lowest since 2017.

3.7 The published floor

Figure 9. The published floor, fitted with hindsight, has had only brief visits below it since 2016

Share of daily closes below it: 8.9% (2010 to 2014), 4.7% (2015 to 2018), 0.4% (2019 to 2022), 0.3% (2023 to 2026).
Orange: closes below the floor. The line was fitted on the whole history, so this is a description, not an out-of-sample test.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 9. Price divided by the published floor, 0.42 × the trend with slope 5.688, since 2010. Orange marks closes below 1×. Note the near-miss in 2020 and the brief breaches at the 2022 low and in July 2026.

Table 6. The published floor through time. It was fitted on the full history, so this is a description, not an out-of-sample test.

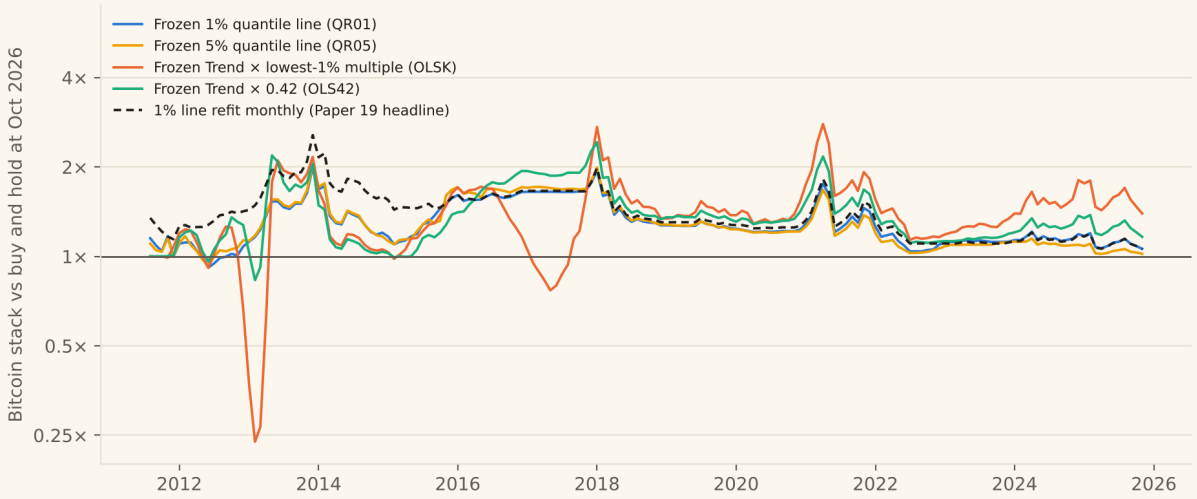
Period	Share of daily closes below	Lowest price / floor
2010 to 2014	8.9%	0.48×
2015 to 2018	4.7%	0.87×
2019 to 2022	0.4%	0.99×
2023 to November 2026	0.3%	0.98×

Figure 9 and Table 6 show its record. At the end of October 2026, price was 1.16× the published floor. It has had only brief visits in the last two cycles: 0.4% and 0.3% of days, the longest 7 days. This is expected: the line was chosen to fit those cycles, and the out-of-sample OLS42 results in Table 3 show what the same multiple did on slopes fitted at the time.

3.8 Illustration: timing with frozen floors

Figure 10. Kelly timing with a frozen floor beat holding even when the floor itself failed

Illustration only, not a pre-registered criterion. Full floor-Kelly from the month after each freeze date to October 2026, with the floor frozen (colours) or refit monthly (black). Freeze dates after late 2022 have windows shorter than one cycle.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 10. Paper 19's full Kelly rule run from each freeze date to October 2026 with each frozen floor, and with the 1% floor refit monthly. This is an illustration, not a pre-registered criterion. Note that the rule beat holding from almost every freeze date even with floors that failed the reliability test.

Table 7. Bitcoin stack against buy and hold at October 2026, freeze dates in bands L1 to L3 (130). The monthly-refit 1% floor has a median of 1.30× and beat holding at 100% of these dates.

Frozen floor	Median stack vs hold	Beat holding	Beat the monthly refit
QR01	1.24×	100%	25%
QR05	1.23×	100%	24%
OLSK	1.42×	94%	80%
OLS42	1.34×	98%	89%

Figure 10 and Table 7 show the result. A floor does not need to be reliable for the timing to work. The rule needs price to swing around it, not to respect it. Trading was pre-registered as an illustration only, and the QR01 and OLSK trading results had already been seen in the exploratory sweep.

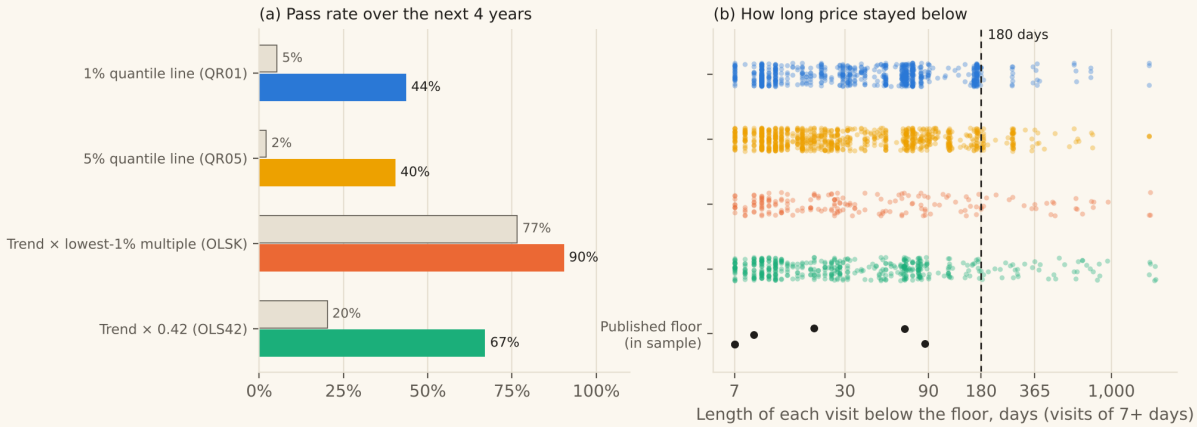
3.9 Time below and recovery (added in v1.1)

The pre-registered "held" criterion asks for no close below the floor for four years. That tests a boundary, which is not what a floor is meant to be. The Observatory definition asks instead how much time price spends below and how fast it returns.

- **A visit** is a run of consecutive daily closes below the floor.
- **The rule:** at most 5% of days below and no visit longer than 180 days.
- **Post hoc.** The rule was proposed after the results in Sections 3.1 to 3.8 were known. It is now pre-registered for a forward test (Section 7).

Figure 11. Judged by time below and recovery, the trend × lowest-1% floor works

Post-hoc, added in v1.1. (a) 94 freeze dates from 2015 with a full window. Grey: no close below (pre-registered); colour: visit rule, at most 5% of days below and no visit over 180 days. (b) visits of 7+ days below each frozen floor after its freeze date; one market episode appears once per freeze date it follows. Black: the published floor's own visits since 2010.



Source: Bitcoin Power Law Observatory, Paper 20 (analysis/p18_figures.py). Daily closes 2010-07-18 to 2026-11-01.

Figure 11. (a) The share of freeze dates where each frozen floor passed over the next four years, under the pre-registered "no close below" criterion and under the visit rule. (b) The length of every visit of seven days or more below each frozen floor, against the published floor's own visits. Note that most visits are short for every floor, and that the quantile lines fail mainly on time below rather than visit length.

Table 8. Frozen floors judged by time below and recovery, freeze dates from 2015 (bands L1 to L3). Visits are counted from the freeze date to November 2026; pass rates use the four years after each of the 94 freeze dates with a full window.

Floor	Time below (median)	Visits of 7+ days per freeze date	Typical visit (median)	1 in 10 visits lasted at least	Passes the visit rule over 4 years	Fails on time below / on visit length
QR01	13.8%	5.8	42 days	169 days	41 of 94 (44%)	53 / 5
QR05	21.2%	7.2	25 days	169 days	38 of 94 (40%)	56 / 17
OLSK	0.0%	1.4	27 days	333 days	85 of 94 (90%)	9 / 5
OLS42	5.5%	3.7	28 days	170 days	63 of 94 (67%)	31 / 10

Figure 11 and Table 8 give the results. A floor can fail on both counts, so the two failure counts can add up to more than the total failures.

- **Most visits are short for every floor.** The median visit of a week or more lasted 25 to 42 days.
- **The quantile lines fail mainly on time below.** Visits below them are short, but there are many: about six a freeze date for the 1% line.
- **The trend times its lowest-1% multiple works on this measure.** Its nine failures are the eight freezes from January to August 2015 and the one from July 2022, which spent 5.1% of the next four years below it.
- **The published floor, in sample, fits the definition best of all.** Bitcoin spent 3.7% of days below it in 23 visits since 2010, none longer than 86 days. The longest since 2016 lasted 7 days (28 December 2022 to 3 January 2023).

- **The current visit is the one to watch.** At the cut-off, price was below all 84 of the 1% floors frozen between 2015 and 2021. For 76 of them the visit began in May 2026 and had lasted 163 to 179 days, so it passes 180 days between 3 and 19 November 2026 if price stays below. The other 8 are already past 180 days.

4. Discussion

4.1 What a power-law floor is

The results separate three things the word “floor” can mean.

- **A boundary price cannot cross.** No definition tested here behaves like one out of sample. Even the most stable one, the trend times its lowest-1% multiple, saw price close below it within four years at 23% of freeze dates. The Observatory no longer uses the word this way.
- **A level price spends little time below and leaves quickly.** This is the Observatory definition. The published floor fits it on its own history, and the trend times its lowest-1% multiple fits it out of sample at 85 of 94 freeze dates (Section 3.9; a post-hoc result). The quantile lines do not, because price spends too long below them.
- **An estimate that moves.** All four floors are revised once a full cycle is in the data. Four years on, the band medians of M3 range from 0.89× to 1.26×, but single freeze dates range from 0.52× (May 2017) to 3.30× (January 2015). Floors frozen between the 2015 and 2018 lows were revised up or barely changed (median 0.89× to 1.01×); those frozen between the 2018 and 2022 lows were revised down (median 1.12× to 1.26×).

A power-law floor is therefore an estimate with a revision history and a visit record, and it should be presented with both.

4.2 Why the trend times a deep multiple is more stable

Two features make it stable.

1. **The multiple is deep.** At 0.25 to 0.35 of trend, it leaves room for slope errors of the size Table 4 shows. This is the main reason.
2. **Its trend is revised less over four years.** The OLS slope swings with the cycle (Table 4), but four years after a freeze its slope had changed by a median of 0.11 in either direction, against 0.14 for the 1% line.

The cost is that it sits far below price. At the October 2026 close, price was 1.74× this floor, against 1.10× the refit 1% line. A floor that is rarely breached is a floor that says little about where price will go. That is a trade-off to state, not a flaw to hide.

4.3 Is the power law bending?

There are two readings of the falling slope.

- **Early steepness, converging.** Fits on short histories are steep, and each bear market corrects them. The small recent steps of the 1% line (0.14 in 2022, 0.04 so far in 2026) and the poor forecasts of the bending models support this reading.

- **Genuine deceleration.** Bitcoin's growth is slowing faster than a power law allows. The negative full-history curvature, the OLS slope's drift below 5.688, and the quadratic trend's recent forecast wins support this reading.

The evidence does not settle it. A test that would: whether the next bear market lowers the slope again, and by how much. Section 7 sets that up.

4.4 Implications for claim C1.4

C1.4 used to say the floor had never been sustained below. The data do not support that wording:

- every frozen floor here was breached after at least one freeze date;
- the published floor itself has 3.7% of closes below it, mostly before 2015.

The owner has restated C1.4 (Registry v2.6) as a visit record under the Observatory definition. Since July 2010, Bitcoin closed below the published floor on 3.7% of days, in 23 visits, none longer than 86 days. Since 2016, it did so on 0.3% of days, with the longest visit lasting 7 days. This resolves open question OQ15.

4.5 Implications for Paper 19

Paper 19's headline uses the 1% floor refit monthly. That floor fails calibration, yet the timing worked. The reason is that the rule needs the floor's shape and its swings, not its exact level.

A frozen trend times its lowest-1% multiple traded at least as well in the illustration (Table 7). It is now a prospective track in Paper 19's record. That is a test it can fail, not a result.

5. Limitations

1. **One history.** Bitcoin has three or four cycle lows. Freeze dates within a band share the same future, so the 94 four-year windows are far from independent.
2. **Days are not events.** Breach shares count days, and breaches come in a few long episodes.
3. **Partial pre-registration.** The decision rule was set after QR01 and OLSK had been seen in the exploratory sweep, including their slopes at every freeze date (Section 2.6). New after registration: QR05 and OLS42 at all dates, the holds and revisions, the forecast comparison and the curvature test.
4. **The thresholds are choices.** Twice nominal and 90% are judgements. With 80% instead of 90%, the trend times its lowest-1% multiple would still fail (77%). With 75%, it would pass.
5. **Revisions are measured against later fits, not the truth.** The refit four years later is the best estimate then, and it will move again at the next low.
6. **The bootstrap understates uncertainty.** Its 365-day blocks are shorter than a cycle (Section 3.6).
7. **One alternative shape.** The quadratic is only one way a growth path can bend. Paper 19 also tested exponential and rolling forms in a trading context.
8. **The model's predictive power is limited.** The power law's out-of-sample R^2 is 0.546, against 0.956 in sample (S097).
9. **The visit rule is post hoc.** The 5% and 180-day thresholds were proposed after Sections 3.1 to 3.8 were known, and the 85 of 94 pass rate for the trend times its lowest-1% multiple (Section

3.9) should be read with that in mind. It is now pre-registered for a forward test (Section 7). The owner may still change the thresholds until 9 December 2026, when the November close is recorded; any change is logged, and after that they are fixed.

10. **The floor is a level, not a boundary.** Visits below the published floor are expected. Since 2016 it was visited 6 times in 10.8 years, none for longer than 7 days (`analysis/p18_visits.json`). On a Poisson model at that rate, at least one visit within 30 years is close to certain, and a visit of a week or more has a probability of about 94% (one such visit since 2016). The Observatory's standard caveat R026 puts the 30-year breach probability at 85% under a Poisson model; it predates the floor definition, and its source analysis is not in this repository. This paper shows that visits below frozen floors are more common still.

6. Implications

- **For Observatory tools:**
  - Describe a floor by its time below and its visits, as in `research/floor-definition.md`, never as a boundary.
  - Quote floors as estimates with a fit date and a revision history.
  - Where a "safety" floor is needed, the trend times its lowest-1% multiple is the most stable definition tested. It is still not inviolable (R026, Section 5).
  - Label the 1% quantile line as a fitted percentile, not a floor price cannot cross.
- **For the Claims Registry (done in v2.6):**
  - C1.4 restated as a visit record (OQ15 resolved).
  - The stability results added as claims C7.1 to C7.6.
- **For Paper 19:** its result rests on the floor's shape, not its calibration. The TREND track in its prospective record tests the more stable floor forward.
- **For users:** a floor fitted today may be revised down in the next bear market. Plans should survive a floor about a fifth lower than today's estimate. For freeze dates between the 2018 and 2022 lows, the 1% floor refit four years later was about a fifth below the frozen one. Paper 18 finds a larger margin for the 0.42× multiple: a floor about 30% lower (0.30× of a real-time trend) held after 98% of the months it tests.

7. Prospective test

Three things are now tracked forward.

1. **A frozen floor.** On 2026-11-06 the trend times its lowest-1% multiple was fitted on data to October 2026 and frozen:
   - slope 5.635, multiple 0.309;
   - a floor of $44,504 at the end of October 2026, with Bitcoin at 1.74× its level;
   - Paper 19's prospective record holds it as its TREND track, with a hash-checked specification.

2. **A pre-registered forward test of the definition** (`research/P18-forward-preregistration.md`, commit df69873, before any data after 1 November 2026).
    - **Floors:** five fixed at the October 2026 close (the published floor, the trend times its lowest-1% multiple, the 1% and 5% quantile lines, and the trend times 0.42), plus the 1% line refit monthly.
    - **Rule:** at most 5% of days below and no visit longer than 180 days, from 2 November 2026. The owner may change the thresholds until 9 December 2026; after that they are fixed.
    - **Live status:** published on btcpowerlaw.nl/floor-lab/, which also freezes a new floor at every month-end.
    - **Evaluation:** each November, starting November 2027, using `analysis/floor_forward_check.py`.
    - **Starting position:** at the October close, Bitcoin was 1.16× the published floor, 1.74× the trend times its lowest-1% multiple and 1.10× the 1% line. It was already below the 5% line (0.95×).
3. **A yearly re-run of this test.** Each year, extend the freeze dates, re-score the open four-year windows, and report whether the next bear market lowers the slope again. That is the observation that would settle Section 4.3.

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8. Conclusion

A power-law floor drawn on Bitcoin's whole history is rarely visited: 3.7% of days since 2010, in 23 visits, none longer than 86 days. A floor drawn at a past date and carried forward is visited far more often.

- **No floor definition passed the pre-registered test.** The 1% quantile line, which Paper 19 uses refit monthly, was breached on a median 14% of later days and held for four years at 5% of freeze dates.
- **The most stable floor is the trend times its lowest-1% multiple.** It is rarely breached and holds three times in four. Under the post hoc visit rule it passes at 85 of 94 freeze dates. That is a different test from the pre-registered one, and it is now under a forward test.
- **The slope has come down across cycles,** in steps during the 2015 and 2022 bear markets. A straight log-log line forecast better than a bending one in this walk-forward test, and the curvature is not significant.

A power-law floor is a level price visits rarely and leaves quickly, estimated from a history that is still short. Used that way, it remains a useful anchor. Used as a boundary, it overstates what the history shows.

Revision notes

v1.1 to v1.2

Change	Where
Published as Paper 20 (registered as Paper 18); the Kelly paper is now Paper 19	Throughout
Cited Paper 18, *The Formula, Month by Month*, and reconciled its real-time 0.42× floor result with OLS42	Sections 1.3, 6
Revision ranges restated: band medians 0.89× to 1.26×, single dates 0.52× to 3.30×	Section 4.1
Which 2015 floors price has been below, and since when	Section 3.5
Slope steps described without claiming they shrink steadily; added the November 2022 row to Table 4	Sections 3.5, 4.3
Slope change measured as a median absolute change (0.11 against 0.14)	Section 4.2
Visit-rule result stated as 85 of 94, separated from the pre-registered test; threshold window to 9 December 2026 noted	Sections 4.1, 5, 7, 8
Every figure and table cited in the text; dataset path and hash; figure titles aligned with the floor definition	Throughout

v1.0 to v1.1

Change	Where
Adopted the Observatory floor definition: time below and visit length, not a boundary	Sections 1.1, 4.1; `research/floor-definition.md`
Added the visit-based analysis (post hoc) with Figure 11 and Table 8	Section 3.9
C1.4 restated as a visit record; OQ15 resolved (owner decision)	Section 4.4; Registry v2.6
Pre-registered forward test of the definition for floors fixed at October 2026	Section 7; `research/P18-forward-preregistration.md`

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- Bitcoin Power Law Observatory. Paper 12: Formal Verification (out-of-sample R^2, S097).
- Bitcoin Power Law Observatory. Paper 18: The Formula, Month by Month. 184 Real-Time Refits of Bitcoin's Power Law, 2011 to 2026, v1.0.
- Bitcoin Power Law Observatory. Paper 19: Kelly Sizing With Floor-Anchored Growth, v1.3.
- Bitcoin Power Law Observatory. Caveat R026: probability of a floor breach within 30 years under a Poisson model (source analysis not in this repository).
- Bitcoin Power Law Observatory. Research Claims Registry v2.7 (`research/claims.md`).

Data and Reproducibility

Data: `bitcoin-powerlaw-site/shared/datasets/btc_historical.json`, 5,951 daily closes, 2010-07-18 to 2026-11-01; SHA-256 at the pre-registration commit `4aa06d9ec7f4c495bf092c9c4fc2ede5e16352ed1c8106ee1edd082785512a2a`. The file is appended weekly; every analysis here stops at the cut-off. Power-law parameters: logA = -16.493, β = 5.688, genesis 2009-01-03. Official floor: 0.42× trend (C1.3).

Pre-registrations: `research/P18-preregistration.md`, commit 34d2e1b, 2026-11-06 17:21 UTC; forward test `research/P18-forward-preregistration.md`, commit df69873, 2026-11-06 18:22 UTC.

Code, all in `analysis/`:

Script	Produces
`p18_experiments.py`	All pre-registered tests; writes `p18_results.json` and `p18_freeze.csv`
`p18_figures.py`	Figures 1 to 11, each with a CSV of the plotted data in `figures/p18/`
`p18_visits.py`	Section 3.9 and Table 8; writes `p18_visits.json`
`floor_forward_check.py`	The forward test (Section 7); writes `floor_forward_status.json`
`floor_freeze_sweep.py`	The exploratory sweep that preceded registration
`p17_prospective.py`	The prospective TREND track (Section 7)
`f007_backtest.py`, `f007_research.py`	Data loading, the quantile-regression floor and the Kelly engine used in Section 3.8

Seeds: bootstrap seed 20261106.

Appendix: Claim cross-reference

Claim	Statement	Status	Sections
C1.1	Power-law fit and parameters	VERIFIED	2.1
C1.3	Official floor 0.42× trend (definition)	VERIFIED (definition)	2.1, 3.7
C1.4	Floor visits are rare and short (restated v2.0): 3.7% of days below since 2010, 23 visits, longest 86 days	VERIFIED (descriptive, in sample)	1.1, 3.9, 4.4
C7.1	A floor needs at least one full cycle from low to low before it is meaningful	VERIFIED (backtest)	3.1
C7.2	Quantile floors are not calibrated out of sample	VERIFIED (backtest)	3.2, 3.4
C7.3	The trend times its lowest-1% multiple is the most stable floor tested, but fails the pre-registered 90% four-year hold	VERIFIED (backtest)	3.3, 3.4
C7.4	The fitted slope has fallen across cycles, in steps during bear markets; the 2018 low did not move the quantile slopes	VERIFIED (computation)	3.5
C7.5	Whether the growth path is bending is not established	SUPPORTED (forecast comparison and curvature test)	3.6
C7.6	Judged by time below and visit length, the trend times its lowest-1% multiple works (85 of 94); quantile floors do not	SUPPORTED (post hoc)	3.9