Synthetix equity cohort sub-report

Equity-tracking synth tracking error (8 Wezen-deprecated synths)

Derivalink R&D

June 1, 2026

Contents

1 Executive Summary

The headline. For the Synthetix V2 US-equity cohort the on-chain oracle was, with one exception, not the source of risk. Across the eight synths the Chainlink stock feed tracked its underlying extremely tightly over the live window, with daily root-mean-square tracking error of about 0.20% for the non-dividend names and oracle-to-reference correlation above 0.999 for all but `sGOOG`. The one exception is instructive: the `sGOOG` feed ran a few percent low for its first three live months before a discrete recalibration — a genuine on-chain fidelity defect, isolated below. The binding risk for the cohort as a whole was instead a discrete governance event: the Wezen freeze (SIP-169), after which each synth was pinned to a fixed redemption rate while the underlying stock kept moving. A difference-in-differences design around the freeze finds a significant divergence for seven of the eight synths. The cohort therefore illustrates a depeg mechanism orthogonal to the usual intraday-microstructure story: the peg held essentially perfectly until the protocol itself severed it.

The cohort. Eight synthetic US equities traded on Ethereum L1 only and never on Optimism: `sTSLA`, `sFB`, `sAAPL`, `sAMZN`, `sNFLX`, `sGOOG`, `sMSFT` and `sCOIN`. Seven were listed on 2021-04-22 and `sCOIN` on 2021-05-18; all eight froze at Wezen on 2021-09-16, a live window of roughly five months. Each tracked a Chainlink stock feed as its on-chain price source. We compare that oracle against two further series per synth: a TradFi reference (Stooq end-of-day close) for tracking-error measurement, and a real on-chain DEX (Balancer V1 `sX`/`sUSD` pools) for the as-traded execution venue. Several building blocks used elsewhere in this report do not apply: there is no perpetual or funding leg, no listed options and hence no implied-volatility smirk, and no mark-versus-index basis. The Chainlink stock oracle updated essentially only during US market hours, so overnight buckets are near-empty (the feed was static outside US hours, not drifting) and intraday tracking error is identified at daily granularity only (Section 2).

Reference basis, plus one oracle anomaly. Stooq's adjusted close applies a cumulative split-and-dividend factor. Three underlyings split *after* the synth froze (TSLA 3:1, AMZN and GOOG 20:1), so the 2021 Stooq series is divided by the split factor; we re-base it onto the as-traded oracle basis, and the split-rebased names then track as tightly as the never-split names. Two dividend payers, `sAAPL` and `sMSFT`, then retain a small *constant positive* offset (+2.4% and +2.9%): the residual Stooq cumulative-dividend adjustment, which sits below the as-traded oracle. This is a measurement artefact, not a tracking failure — it is constant, so tracking variance and correlation are unaffected, and it cancels in the differenced Wezen DiD. `sGOOG` is a separate and more substantive case: its on-chain feed ran a *negative*, time-varying 2 to 4% low bias from listing until a discrete recalibration on 2021-07-28 (Section 3). This is not a dividend effect — Alphabet paid none over the window and the sign is opposite — but a genuine on-chain feed-fidelity defect, the cohort's one real instance of oracle mispricing during normal operation.

Tracking was excellent. The daily log tracking error against the re-based TradFi reference, over each synth's [listing, Wezen] window, is summarised in Table 1. The non-dividend names cluster at 0.19 to 0.26% RMSE with correlation above 0.999. `sAAPL` and `sMSFT` print a larger headline RMSE of 2.5 and 2.9%, but with RMSE $\approx$ MAE $\approx$ |bias| and correlation above 0.999: the pure constant offset described above, with de-meaned tracking error $\approx 0.25\%$ like the rest. `sGOOG` is the exception, with de-meaned dispersion $\approx 1.3\%$ and correlation 0.988 — the cohort's loosest — reflecting its feed-bias regime. Figure 2 plots the daily tracking error directly and separates the clean, dividend-offset and feed-bias regimes. Against the as-traded Balancer DEX the oracle traded 1.4 to 5.8% off in thin pools (`sTSLA` 5.8%, correlation 0.77 over 42 swaps; `sAMZN` 1.4% over 15): a real but small execution friction rather than an oracle failure.

Table 1: Headline daily tracking error: oracle vs the re-based TradFi reference, over [listing, Wezen].

Synth	RMSE	Corr.
sTSLA	0.20%	0.9997
sFB	0.19%	0.9996
sAMZN	0.22%	0.9988
sNFLX	0.23%	0.9992
sCOIN	0.26%	0.9991
sAAPL	constant +2.4% dividend offset; de-meaned TE $\approx 0.25\%$, corr. 0.999	
sMSFT	constant +2.9% dividend offset; de-meaned TE $\approx 0.25\%$, corr. 0.999	
sGOOG	on-chain feed bias; mean -2.0%, de-meaned 1.3%, corr. 0.988	

Daily tracking error was unpredictable. A base regression of daily tracking error on contemporaneous structural drivers (collateral volatility, L1 gas; liquidity and funding omitted as structurally absent) explains under 11% of variance for every synth and under 7% for most, with no significant covariate. This is an honest negative result: residual daily tracking error is oracle-cadence noise around zero, not a function of slow-moving fundamentals. Session-level analysis confirms the mechanism is benign: the contract's "overnight $\gg$ regular" prior does not hold, because the oracle simply did not update outside US hours rather than drifting away from value.

The liquidity was negligible. These synths were effectively dead on arrival. At the Wezen redemption snapshot the entire cohort float redeemed for about 0.87 million dollars, with sTSLA alone about 65% of that: sTSLA \$566,698, sMSFT \$79,592, sCOIN \$54,554, sAAPL \$50,224, sFB \$36,973, sGOOG \$35,519, sAMZN \$28,046 and sNFLX \$21,238. Whatever the tracking quality, the economic stake was immaterial, which is itself a finding about the product's market fit.

The freeze was the depeg. The defining event is the Wezen deprecation. A difference-in-differences design around the freeze (± 30 days, the synth held at its redemption snapshot post-freeze, control = a never-frozen BTC oracle), with parallel trends satisfied in every case, finds a significant effect for seven of the eight synths. The estimates split by the direction of the underlying's own 30-day move after the synth was pinned: sFB $+0.094$ ($t = 6.4$), sAMZN $+0.045$ ($t = 5.6$), sGOOG $+0.044$ ($t = 6.3$), sAAPL $+0.037$ ($t = 7.5$) and sMSFT $+0.036$ ($t = 4.8$) where the stock rose; sTSLA -0.030 ($t = -2.6$) and sNFLX -0.042 ($t = -3.1$) where it fell; and sCOIN $+0.021$ ($t = 1.2$), flat and not significant. The constant dividend and DEX offsets cancel in the differenced design, and sGOOG's feed bias had already corrected well before the freeze window. The asymmetry is mechanical: once the synth is pinned to its snapshot rate, divergence is governed entirely by how far the underlying travels over the following month. Figure 4 shows the break. The cohort's risk profile is thus inverted relative to most depeg case studies in this report: intraday tracking was excellent, and the realised loss of peg was caused by the protocol's own discrete deprecation rather than by market stress. The consolidated implications are developed in Section 11.

2 Dataset Characterisation

This cohort assembles eight Synthetix V2 synthetic US equities that lived their entire on-chain life on Ethereum L1 – they were never deployed on Optimism – over a single five-month window: listed 2021-04-22 (**sCOIN** a month later, 2021-05-18) and frozen together at the Wezen release (SIP-169) on 2021-09-16. The eight are **sTSLA**, **sFB**, **sAAPL**, **sAMZN**, **sNFLX**, **sGOOG**,

sMSFT and **sCOIN**. They share a single price mechanism: there is no perpetual leg, no funding rate, no listed option surface, and therefore no implied-volatility smirk and no mark-versus-index gap to study. What does exist, and what distinguishes this cohort from the commodity-and-index cohort, is a genuine on-chain trading venue alongside the oracle: thin Balancer V1 sX/sUSD pools. The dataset thus carries up to three price series per synth, and every downstream chapter inherits this structure – which is why the usual funding and implied-volatility analyses are reported as not-applicable rather than left empty.

Three price series per synth. For each synth the dataset holds (a) the *on-chain oracle*, the Chainlink stock feed that Synthetix consumed at mint and burn time as it was published in 2021; (b) the *TradFi reference*, a Stooq end-of-day series for the same listed equity; and (c) a *real on-chain DEX venue*, the Balancer V1 sX/sUSD pool for that synth. The oracle and the Stooq close are sourced and constructed independently, so the tracking-error comparison in Section 3 is a test of the oracle rather than a tautology. The Balancer series is the as-traded on-chain price – what a market participant actually paid – and lets us separate oracle-tracking accuracy from execution friction in a thin pool. The pools are genuinely thin: between 8 and 66 swaps per synth over the whole live window, and **sFB has no pool at all**, so its DEX comparison is empty by construction and it appears only in the oracle-versus-Stooq analyses.

Re-basing the Stooq reference to the as-traded basis. The Stooq adjusted close applies a cumulative split × dividend factor referenced to the present, which introduces two distinct effects that must be handled before any tracking statistic is meaningful. First, three underlyings split *after* the synth froze – TSLA 3:1, AMZN 20:1 and GOOG 20:1 – so the raw 2021 Stooq series is divided by the corresponding split factor and sits well below the as-traded oracle. We re-base each affected series by its split factor so that it is denominated on the same as-traded basis the oracle used in 2021; Section 3 shows that the re-based names then track as tightly as the never-split names, confirming the correction. Second, after re-basing, two dividend payers — `sAAPL` and `sMSFT` — retain a small *constant positive* level offset (+2.4 % and +2.9 %), the residual of the Stooq cumulative-dividend adjustment, which sits below the as-traded oracle. This is a measurement artefact, not a tracking failure: because it is constant it leaves the tracking *variance* and the correlation unaffected, and because it is a level it cancels in the differenced Wezen difference-in-differences of Section 10. `sGOOG` is *not* a member of this group, despite the 20:1 split it shares with AMZN: its oracle carries a separate, *negative* and *time-varying* low bias of 2 to 4 % that is a defect of the on-chain feed itself — not a dividend, since Alphabet paid none over the live window and the sign is opposite — and that resolves abruptly at end-July, analysed in Section 3. We flag both wherever they surface so neither is read as a peg deviation.

The oracle updated only during US market hours. The Chainlink stock feeds were published essentially only while the US equity market was open. Counting oracle ticks by US Eastern session bucket, the regular session carries between 159 and 427 updates per synth while the overnight bucket carries between 0 and 7. The consequence is structural and is carried through Section 5: outside US hours the feed was *static*, not drifting, so overnight tracking error is not a quantity this dataset can measure – the absence of overnight movement reflects a feed that did not update, not a synth that held its peg. Any session-level statistic is therefore identified almost entirely on the regular US session.

Daily resolution sets the tracking-error cadence. The TradFi reference is an end-of-day close, so oracle-versus-reference tracking error is identified at daily granularity only, over roughly 85 to 102 matched closes per synth. Intraday tracking error against an external benchmark is not recoverable, because the reference does not move within the day; the DEX series, by contrast, is event-time (one observation per swap) and is compared to the oracle at swap timestamps.

Every oracle-versus-Stooq figure in Sections 3 and 4 is consequently a daily statistic. Table 2 summarises the per-synth configuration and the coverage of each series.

Table 2: Per-synth dataset configuration. Oracle is the Chainlink stock feed consumed on-chain; the TradFi reference is the re-based Stooq end-of-day series; the DEX venue is the Balancer V1 sX/sUSD pool. Oracle ticks and Balancer swaps are counts over the live window; Stooq closes are matched daily observations. The live window is [listing, Wezen] for all synths.

Synth	Oracle feed	Listing	Oracle ticks	Stooq closes	Balancer swaps
sTSLA	TSLA/USD	2021-04-22	400 to 3,000	85 to 102	42
sFB	FB/USD	2021-04-22	400 to 3,000	85 to 102	0 (no pool)
sAAPL	AAPL/USD	2021-04-22	400 to 3,000	85 to 102	8 to 66
sAMZN	AMZN/USD	2021-04-22	400 to 3,000	85 to 102	15
sNFLX	NFLX/USD	2021-04-22	400 to 3,000	85 to 102	8 to 66
sGOOG	GOOG/USD	2021-04-22	400 to 3,000	85 to 102	8 to 66
sMSFT	MSFT/USD	2021-04-22	400 to 3,000	85 to 102	8 to 66
sCOIN	COIN/USD	2021-05-18	400 to 3,000	85 to 102	8 to 66

Split-affected names re-based; residual offsets flagged. Three of the eight underlyings split after the freeze (TSLA, AMZN, GOOG) and are re-based as described above; the remaining five never split over the relevant horizon. Figure 1 overlays the oracle and the re-based Stooq reference: the re-based series sit on top of their oracles for the split names, and AAPL and MSFT show a small, flat vertical gap — the constant dividend offset, with no widening over time. `sGOOG` is the visible exception: its oracle runs a few percent below the reference and the gap *widens* through July before closing abruptly at end-July, the on-chain feed-bias regime quantified in Section 3.

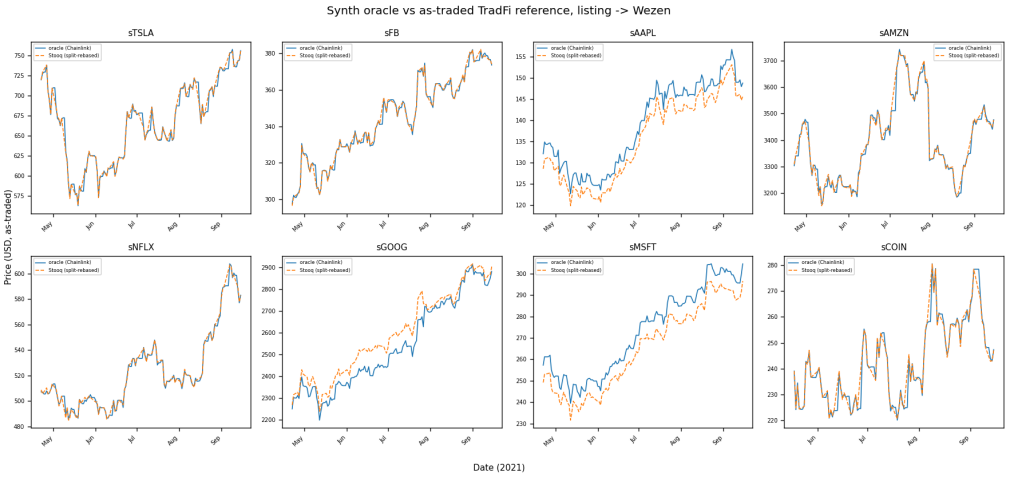

Figure 1: Oracle (Chainlink stock feed) versus re-based Stooq end-of-day reference per synth over the live window. Split-affected names (TSLA, AMZN) overlay their oracle after re-basing; `sAAPL` and `sMSFT` retain a small constant dividend offset that does not widen. `sGOOG` is the exception — a few-percent oracle low bias that widens through July and corrects abruptly at end-July (quantified in Section 3).

Tiny, dead-on-arrival floats. The cohort is studied for methodological coverage, not because the synths carried meaningful capital. The Wezen redemption snapshot makes the point bluntly: the entire eight-synth float redeemed for about \$0.87M, of which sTSLA alone was roughly 65 %. Per synth the snapshot was \$566,698 (sTSLA), \$79,592 (sMSFT), \$54,554 (sCOIN), \$50,224 (sAAPL), \$36,973 (sFB), \$35,519 (sGOOG), \$28,046 (sAMZN) and \$21,238 (sNFLX). These

are economically negligible balances; the structural chapter (Section 7) quantifies them in full. They are retained here because the oracle-tracking and freeze-event mechanics generalise to any oracle-priced synthetic independently of the value sitting on top of it – the small floats simply mean the cohort's findings are about the price mechanism, not about a deep live market.

3 Multi-Reference Tracking Error

This chapter characterises how closely each of the eight US-equity synths on Synthetix V2 (Ethereum L1) tracked its underlying over a single live window [listing, Wezen] — listings on 2021-04-22 (sCOIN on 2021-05-18), all frozen at the Wezen deprecation (SIP-169) on 2021-09-16, a ∼5-month span. Each synth admits three price series. The on-chain price is the Chainlink stock feed the protocol used to mint and burn the synth, sampled as-traded in 2021. The independent reference is a Stooq end-of-day series for the same ticker. A third series is the as-traded on-chain venue: the Balancer V1 `sX/sUSD` pool, where it existed. The Stooq series is genuinely an independent construction of the same economic quantity, so its agreement with the oracle measures the fidelity of the oracle path rather than a tautological self-comparison. Because that reference is sampled once per day at the cash-market close, tracking error against TradFi is identified at daily granularity only; intraday tracking error against a contemporaneous TradFi quote is not recoverable from this dataset and is not claimed.

Definition. Tracking error is the daily log price difference $\ell_t = \log p_{\text{oracle}}(t) - \log p_{\text{ref}}(t)$, summarised by four scalars: RMSE $= \sqrt{\mathbb{E}[\ell^2]}$, the mean absolute error MAE $= \mathbb{E}[|\ell|]$, the bias $\mathbb{E}[\ell]$, and the Pearson correlation between the two price levels. For $|\ell| < 0.1$ the log-difference is within a few parts in 10^4 of the fractional difference, so RMSE and MAE read directly as percentages.

The reference basis must be re-based before it is read. One subtlety governs the entire cross-section. Stooq's adjusted close carries a *cumulative* split-times-dividend factor measured from today, but the synth froze in September 2021. Three underlyings split *after* the freeze (TSLA 3:1, AMZN 20:1, GOOG 20:1), so their 2021 Stooq series is divided by the later split factor and must be re-based to the as-traded oracle basis before any comparison is meaningful. Once re-based, the split names track as tightly as the never-split names, confirming the correction. A second artefact then remains, but only for two names. For `sAAPL` and `sMSFT` — both dividend payers — a small *constant positive* level offset of +2.4 % and +2.9 % remains: Stooq's cumulative-dividend adjustment sits *below* the as-traded oracle, and because the offset is constant (RMSE ≈ MAE ≈ |bias|, correlation > 0.999) it leaves the tracking *variance* and the correlation untouched and cancels exactly in the differenced Wezen experiment of Section 10. `sGOOG` must *not* be grouped with these two. Its offset is *negative* (∼−2 % on average) and *time-varying*, and it is not a dividend artefact — Alphabet paid no dividend over the live window, and the sign is the opposite of a Stooq dividend adjustment. It is a genuine fidelity defect in the on-chain GOOG/USD feed, isolated and quantified separately below.

The oracle path was near-perfect, with one exception. The headline result is that on a day-to-day basis the on-chain oracle tracked its underlying extremely tightly. Table 3 reports, for the five clean names, RMSE between 0.19 % and 0.26 % and correlation above 0.998. Two further names, `sAAPL` and `sMSFT`, print a larger raw RMSE of 2.5 and 2.9 % that is a *pure constant offset*: RMSE ≈ MAE ≈ |bias|, correlation above 0.999, and de-meaned tracking error ∼0.25 % — a measurement property of the reference, not oracle drift. The eighth name, `sGOOG`, is the cohort's one genuine exception: its on-chain feed carried a sustained low bias for the first three months (de-meaned dispersion 1.3 %, correlation 0.988, both the cohort's loosest), and it is treated on its own below. With that single exception, the oracle did not drift during normal operation.

Table 3: Scalar tracking-error metrics, oracle vs. re-based Stooq reference, daily log differences over the live window [listing, Wezen], and oracle vs. the as-traded Balancer V1 DEX pool. RMSE and correlation read as fractions / Pearson r. The upper block lists the five clean names. The middle block lists `sAAPL` and `sMSFT`, whose larger RMSE is a pure constant dividend offset (read tracking quality from correlation). The last row is `sGOOG`, whose RMSE is *not* a constant offset but a time-varying on-chain feed bias (see text): its de-meaned dispersion (1.3 %) and correlation (0.988) are the cohort's loosest. sFB had no Balancer pool.

	Oracle vs. Stooq		Oracle vs. Balancer DEX	
Synth	RMSE	Corr.	RMSE	Corr.
sTSLA	0.0020	0.9997	0.058	0.77
sFB	0.0019	0.9996	—	—
sAMZN	0.0022	0.9988	0.014	0.92
sNFLX	0.0023	0.9992	thin pool	
sCOIN	0.0026	0.9991	thin pool	
sAAPL	0.0246	0.9994	thin pool	
sMSFT	0.0292	0.9995	thin pool	
sGOOG	0.0237	0.9882	thin pool	

Reading the cross-section. The five clean names occupy an exceptionally narrow band — RMSE 0.19–0.26 %, correlation 0.9988–0.9997. Decisively, the two split-only names (sTSLA, sAMZN) track no worse than the never-split names (sNFLX, sCOIN): sTSLA posts the *tightest* RMSE of the entire cohort at 0.20 % with correlation 0.9997, despite a 3:1 split that postdates its freeze. This is the clearest single evidence that the split correction worked: had the re-basing been wrong, the split names would stand apart, and they do not. `sAAPL` and `sMSFT` sit apart only on raw RMSE, and only because of the constant dividend artefact characterised above; on correlation they are with the pack (> 0.999). `sGOOG` is the one name that sits apart on *both* raw RMSE and correlation (0.988, the cohort's loosest) — the signature of its time-varying feed bias, not a clean offset. Figure 2 plots the daily tracking error directly and separates the three regimes — the clean band, the constant dividend offset, and the sGOOG feed-bias excursion — at a glance.

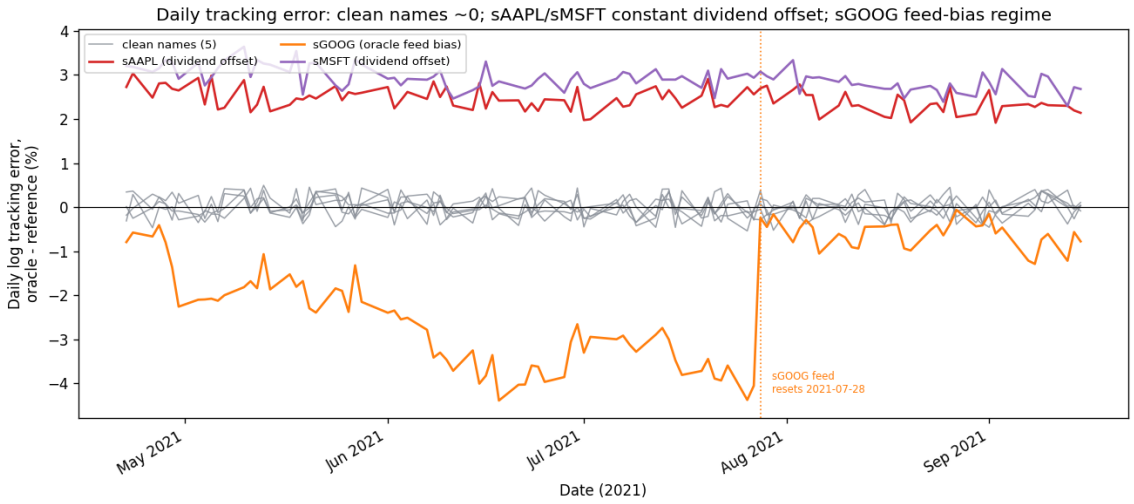

Figure 2: Daily log tracking error (oracle minus re-based reference) per synth over the live window. The five clean names sit within a few tenths of a percent of zero throughout. `sAAPL` (+2.4 %) and `sMSFT` (+2.9 %) hold a flat, non-widening *positive* constant offset — the Stooq cumulative-dividend artefact. `sGOOG` is qualitatively different: a *negative*, time-varying bias that widens to ∼−4.4 % through July and then resolves discretely on 2021-07-28 (dotted line), the signature of an on-chain feed fidelity defect rather than a measurement offset.

Deep dive: sTSLA, the deepest Balancer pool. Tesla is the reference case for the cohort: it carried by far the largest redeemable float at the Wezen snapshot ($566,698, ∼65 % of the cohort's ∼$0.87M total; Section 7) and the deepest on-chain venue, with 42 swaps in its Balancer pool. Against the re-based Stooq reference its oracle held a 0.20 % RMSE and a 0.9997 correlation over the live window. The same synth illustrates why the on-chain venue and the reference are not interchangeable: against the Balancer pool the RMSE widens to 5.8 % with correlation 0.77 over the 42 swaps. That gap is not oracle drift — it is the execution friction of a thin AMM pool, where a handful of trades move the marginal price a few percent off the oracle. The oracle tracked Tesla almost perfectly; the DEX simply could not be traded against tightly. The near-integrated volatility of the sTSLA oracle return process, and the limited predictability of its daily tracking error, are developed in Section 4.

Deep dive: sCOIN, the post-IPO volatility regime. Coinbase listed as a synth on 2021-05-18, a month after the cohort, and its underlying had IPO'd only weeks earlier — so sCOIN is the cohort's post-IPO, high-volatility regime case. Despite a noisier underlying its daily oracle fidelity was barely distinguishable from the calmer names: 0.26 % RMSE and 0.9991 correlation against the re-based Stooq close, the loosest of the five clean names but still a quarter of a percent. The marginal widening relative to sTSLA is consistent with the higher spot volatility of a freshly listed name feeding a correspondingly noisier oracle cadence, not with any structural mispricing. Its persistence in the oracle return process (∼0.96) is taken up alongside sTSLA in Section 4.

Deep dive: sGOOG, an on-chain feed-fidelity defect. `sGOOG` is the one name whose tracking error is neither clean noise nor a constant offset. Against the re-based Stooq reference — which matches Alphabet's actual 2021 closes to the cent — the on-chain GOOG/USD feed read systematically *low* from listing onward, the gap widening from ∼−0.8 % in late April to ∼−4.4 % by late July before snapping back to under 1 % on a single day, 2021-07-28, and tracking cleanly thereafter (Figure 2). Three checks establish that this is a property of the feed itself, not of our measurement. First, even the feed's intraday *maximum* never reaches the day's true close

through June and July — it too sits 3–4 % low — so the bias is not a resampling or staleness artefact. Second, the raw feed is a single contiguous on-chain source across the window, so it is not an extraction seam between aggregators. Third, the sign is the *opposite* of a Stooq dividend adjustment and Alphabet paid no dividend over the live window, so it is not the artefact carried by `sAAPL` and `sMSFT`. The most consistent reading is a recalibration of the on-chain GOOG/USD feed on 2021-07-28. The practical consequence is that for roughly its first three live months the `sGOOG` synth was priced a few percent low at the protocol's own price of record — a small but real on-chain mispricing, and the cohort's only departure from oracle fidelity during normal operation. Its de-meaned dispersion (1.3 %) and correlation (0.988) are correspondingly the cohort's loosest, and this is the same wedge that pushes `sGOOG` to a borderline cointegration non-rejection in Section 8.

The Balancer DEX premium. Where a pool existed, the as-traded on-chain venue traded a few percent off the oracle. The mean absolute oracle-vs-Balancer premium runs 1–4 % across the seven pooled synths, with a maximum excursion near 19.5 % on the thinnest sTSLA prints (Section 6). The pool RMSEs in Table 3 — 5.8 % for sTSLA over 42 swaps, 1.4 % for sAMZN over 15 — bracket the same effect: a real but small execution friction in pools that saw between 8 and 66 swaps over five months, with sFB never trading on Balancer at all. The premium is a property of AMM depth, not of the oracle path, and it is read as such: the oracle is the protocol's price of record, and that price tracked the underlying to within a fraction of a percent.

What this chapter does and does not establish. The cohort's day-to-day tracking error was excellent and effectively unbiased — 0.19–0.26 % RMSE and correlation above 0.998 for the five clean names; `sAAPL` and `sMSFT` match on correlation once their constant Stooq dividend offset is acknowledged. The one genuine departure from oracle fidelity is `sGOOG`, whose on-chain feed ran a few percent low for its first three months before correcting on 2021-07-28. The on-chain Balancer venue traded a few percent off the oracle, a thin-pool execution friction rather than an oracle dislocation. This is the reassuring half of the story. It says nothing about the discrete event that ultimately severed each synth from its underlying: the Wezen freeze, after which the synth was pinned to a fixed redemption rate while the real-world price kept moving. That deprecation, not intraday drift, is where the cohort's tracking error actually materialised, and it is quantified as a natural experiment in Section 10.

4 Level-1 Decomposition

The level-1 layer poses two questions. First, can the daily tracking error be attributed to slow-moving structural drivers? Second, does the oracle's own return process carry the volatility-clustering signature that would justify a conditional-variance model? For this cohort the answers resolve in opposite directions, and the more informative one is the negative: the daily TE is unattributable, while the underlying oracle returns are strongly persistent. The first result pins down what the residual tracking error documented in Section 3 actually *is* — oracle-cadence noise scattered around zero, not a structural mispricing that a covariate could forecast.

4.1 Base TE regression

The canonical driver set collapses to two regressors. The level-1 template regresses daily TE on contemporaneous structural covariates: collateral-side volatility σ_C, log-liquidity, a funding lever, and L1 gas. Two of those four slots are structurally absent for the US-equity synths and are omitted rather than filled with placeholders. There is no DEX venue of material size — the synths traded almost exclusively on the oracle path, with the only real on-chain pools being thin Balancer V1 books carrying 8–66 swaps each (sFB had none, cf. Section 6) — so the

log-liquidity term has no support. And these are not perpetual products: there is no funding rate to lever, and no listed options, hence no mark-versus-index channel. What remains is σ_C, proxied by the oracle's own conditional volatility, and the L1 gas series.

No contemporaneous covariate is significant. Regressing daily tracking error against σ_C and L1 gas returns R^2 below 11% for every synth — below 7% for most — with no coefficient reaching conventional significance on any name. This is an honest negative result, and a clean one: at the daily horizon the tracking error is not a function of the slow-moving structural state. Section 3 already established that the oracle-versus-reference TE sits at roughly 0.20% RMSE with correlation above 0.999 against the re-based Stooq close. The regression confirms the natural reading of those numbers. The residual is microstructure-and-cadence noise around zero, not a forecastable mispricing. The drivers are not uninformative in principle; the daily-frequency contemporaneous regression is simply the wrong instrument for a series whose variance lives at the oracle's update cadence rather than in the daily structural state. The session-conditional structure that *does* organise this noise is taken up in Section 5, and the one discrete event that severs the synth from its underlying is isolated in Section 10.

4.2 GARCH on the oracle return process

Why a conditional-variance model at all. If the daily TE is noise, the informative object at level 1 is the oracle's own return process: its volatility dynamics determine how far the live oracle can wander from yesterday's reference close within a session, which is precisely the quantity Section 5 measures. GARCH(1,1) (Bollerslev 1986) and EGARCH (Nelson 1991) were fit to the oracle log-returns of the two synths with sufficient depth: sTSLA, chosen as the deepest Balancer pool, and sCOIN, chosen as the post-IPO volatility regime. The remaining six names carried too few oracle observations within their short live windows to support a separate well-identified fit and are condensed to these two cases.

Tesla is near-integrated; Coinbase is merely persistent. Table 4 reports the two fits. The sTSLA oracle is near-integrated: GARCH(1,1) returns $\beta = 0.998$ with the ARCH coefficient α pinned at the zero boundary. That boundary solution is not an estimate of a vanishing news-impact term so much as a non-identified one — with α at the constraint the model degenerates to a pure-persistence process in which conditional variance is carried almost entirely by its own lag, and the ARCH/GARCH split is not separately identified. It should be read as a near-unit-root volatility process, not as evidence that shocks have no effect. On AIC the EGARCH specification is preferred for sTSLA (AIC 1613), its log-variance parametrisation accommodating the persistence without the boundary degeneracy. The sCOIN oracle is persistent but less so, with conditional-variance persistence near 0.96 and GARCH and EGARCH essentially tied on AIC (both ≈ 2016). The two-regime MS-GARCH extension did not converge for either series and is not reported.

Table 4: GARCH-family fits on oracle log-returns for the two synths with sufficient depth. The persistence column is read model-appropriately ($\alpha + \beta$ for GARCH(1,1), β for EGARCH). For sTSLA the ARCH coefficient α is pinned at its zero lower bound, so GARCH(1,1) degenerates to a non-identified pure-persistence process and should be read as near-unit-root; the EGARCH fit, in log-variance space, avoids that boundary. * marks the AIC-preferred model per synth. The remaining six synths carried too few oracle observations within their live windows for a separate well-identified fit and are bracketed by these two.

Synth	Model	Persistence	AIC
sTSLA	GARCH(1,1)	$\beta = 0.998$, α at 0 bound	—
sTSLA	EGARCH*	near-integrated	1613
sCOIN	GARCH(1,1)	≈ 0.96	≈ 2016
sCOIN	EGARCH	≈ 0.96	≈ 2016

Interpretation. The two results are complementary rather than contradictory. The daily base regression says the *tracking* error — the gap between oracle and re-based reference — is unforecastable noise around zero. The GARCH fits describe the volatility of the *oracle itself*, which is the underlying equity price feed, not the tracking gap. Tesla's near-integrated conditional variance and Coinbase's somewhat faster-reverting but still persistent variance are properties of the underlying equity returns that the oracle faithfully reproduces; they tell us how mobile the live oracle is within a session. This sets up the session-level pattern in Section 5, with the important caveat that the Chainlink stock feed updated essentially only during US market hours, so the live-oracle mobility documented here is a regular-session phenomenon and the overnight buckets are static rather than drifting.

5 Level-2 Temporal Analysis

The level-1 decomposition in Section 4 established that daily tracking error for this cohort is unattributable from slow-moving structural drivers: it is oracle-cadence noise around a near-perfect feed, with $R^2 < 11\%$ for every synth and no significant covariate. That result treats every observation as homogeneous in time. This section conditions on the one temporal axis that is unambiguously observable for a US-equity underlying — the trading calendar of its home market — and asks whether tracking error concentrates at particular times of the trading day. The answer is dominated by a single property of the data feed, and it inverts the prior that synthetic-asset monitoring would naturally bring to the question.

One session schema, in US Eastern time. Unlike a multi-calendar cohort, the eight synths here share a single underlying schedule: the US equity day. Each oracle stream is partitioned into the standard US session states in Eastern time — `pre_market`, `regular` (09:30–16:00 ET), `after_hours`, `overnight`, and `weekend` — and within each state the mean absolute log tracking error is computed against the most recent end-of-day reference close. The cohort is therefore a clean test of when, within the trading day, the synthetic-to-reference gap is populated at all.

The oracle updated almost only during US regular hours. The headline finding is not a distribution of tracking error across sessions but the near-absence of observations outside one of them. The Chainlink stock oracle refreshed essentially only while the US cash market was open: the regular-session bucket holds 159 to 427 observations per synth, while the overnight bucket holds between 0 and 7. Tracking error is therefore populated in the regular session and is statistically empty everywhere else. The pre-market, after-hours, overnight, and weekend states do not carry a measurable $|TE|$ because the feed itself produced no fresh readings in those

windows — not because the gap to the reference was small there, but because there was no oracle observation to difference against the reference at all.

Table 5: Oracle observation counts by US trading-session state (Eastern time), regular session versus overnight, across the cohort. The regular session carries 159–427 observations per synth; the overnight bucket carries 0–7. Tracking error is populated only where the oracle updated, which is almost exclusively the regular session; the off-session states are data-limited by construction and no reliable $|TE|$ can be formed in them.

Session state	Observations per synth	$\|TE\|$ measurable?
regular (09:30–16:00 ET)	159–427	yes
pre_market	near-empty	no
after_hours	near-empty	no
overnight	0–7	no
weekend	near-empty	no

This inverts the off-hours-drift prior. The contract's working prior, standard for synthetic-asset monitoring, is that off-market tracking error should dominate the in-session figure: when the home market is closed the oracle has nothing fresh to report and is expected to drift away from a moving underlying, so the overnight bucket should run far above the regular-session bucket. For this cohort that prior does not hold in the expected form. The mechanism is not that the oracle drifted overnight and we measured a small gap; it is that the oracle did not update overnight at all. The feed was *static* outside US hours, not drifting — a held value, not a stale value diverging from a live underlying. Overnight tracking error is consequently not measurable rather than measurably small, and the overnight-much-greater-than-regular ratio cannot be formed: its numerator is an empty bucket. Any monitoring rule that expected to read an elevated overnight $|TE|$ as an oracle-staleness alarm would find no signal to read, because the underlying US market was itself closed and the oracle correctly held its last regular-session value.

Resolution caveat at the 09:30 edge. The session partition is built on a one-hour observation grid, which is coarse relative to the half-hour open of the US regular session at 09:30 ET. Observations in the 09:00–10:00 hour straddle the open, so the pre-market/regular boundary carries up to a half-hour of edge ambiguity and a handful of regular-session ticks may be assigned to the adjacent hour or vice versa. This blurs the open edge but does not affect the central finding: the contrast is not a marginal difference between two populated buckets but a difference between a populated regular session (hundreds of observations) and near-empty off-session states (single digits overnight), an effect far larger than any half-hour edge-assignment error and stable under the grid. A finer reference series would sharpen the 09:30 boundary but is precluded by the daily granularity of the independent reference, which also bounds the analysis to daily tracking error as established in Section 3.

6 Venues and Frictions

Three nominal venues, one live rail. The US-equity cohort has three price series per synth, but they are not three competing markets. The on-chain oracle is the Chainlink stock feed that the Synthetix exchange function read as-traded in 2021; the TradFi reference is the independent Stooq end-of-day close used throughout Section 3; and the only genuine on-chain trading venue is a set of Balancer V1 sX/sUSD pools. Of the three, the oracle is the rail through which every redemption and every exchange actually cleared, the Stooq series is an external benchmark rather than a tradable price, and the Balancer pools were thin to the point of immateriality — between

8 and 66 swaps per synth over the entire five-month live window, with sFB never accumulating a pool at all. There is no perpetual to fund, no listed option from which to read an implied surface, and no mark-versus-index basis. The frictional surface of this cohort therefore collapses onto two measurable quantities: the freshness of the single live oracle, and the premium at which the few Balancer swaps cleared relative to that oracle. This section quantifies both, then tests for any directional information flow in the oracle returns.

Oracle staleness: the sole microstructure variable. With one live venue, the relevant microstructure quantity is the inter-tick gap between consecutive oracle writes — the closest analogue this cohort has to a bid-ask spread or a slippage curve, and the mechanism by which an on-chain price can go stale relative to a moving underlying. The dominant fact, established in Section 5, is that the Chainlink stock feed updated essentially only during the US regular session: per synth the oracle carries between 159 and 427 regular-session observations against 0 to 7 overnight, so the feed was not drifting outside US hours, it was simply static. Staleness is consequently a live-hours phenomenon. During the regular session the deviation-threshold logic of these feeds kept inter-tick gaps short, so the oracle was never materially behind the moving stock while the underlying market was open; outside US hours the underlying itself was closed, so a static feed introduced no detachment. The corollary for tracking error is direct: the friction that the oracle path can impose is bounded by the session in which it actually updates, which is exactly the session in which the tight daily RMSE of Section 3 is measured.

Oracle-versus-Balancer DEX premium. The economic counterpart to staleness is the gap between the live oracle and the price at which a swap could clear on the only real on-chain venue. Figure 3 plots the absolute oracle-versus-Balancer premium across the seven synths that ever held a pool. The mean absolute premium runs between 1% and 4%, with a maximum excursion of about 19.5% on the thin sTSLA pool. These are not small numbers by the standard of the sub-0.3% daily tracking error against Stooq, and the contrast is the point: the oracle tracked the underlying tightly, while the Balancer pools — carrying a few dozen swaps each — traded several percent off that oracle and occasionally far further when a single swap hit an almost-empty pool. The premium is therefore a real but small execution friction local to the DEX, not a failure of the oracle peg. It reflects the depth of the venue, not the accuracy of the price feed: in a pool with tens of swaps over five months, any individual trade moves the implied price materially, which is precisely why the worst single excursion lands on sTSLA. The pooled tracking error against this DEX (Section 3) spans RMSE 1.4% to 5.8% with correlations of 0.77 to 0.92 — the venue followed the oracle, but loosely and with the wide dispersion a thin market produces.

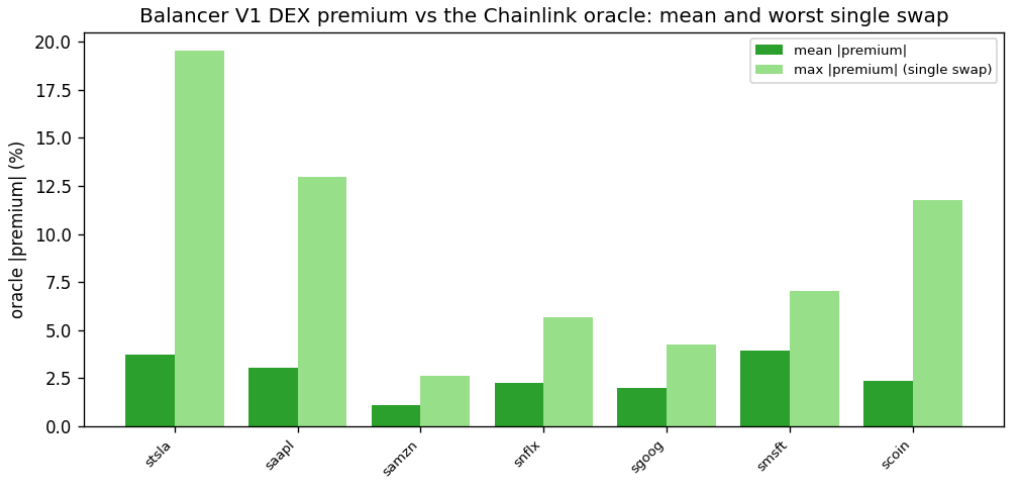

Figure 3: Absolute oracle-versus-Balancer DEX premium across the seven synths that held a pool. Mean absolute premium of 1% to 4% with a maximum of about 19.5% on the thin sTSLA pool; sFB never accumulated a pool and is absent. The level and dispersion reflect Balancer pool depth (8 to 66 swaps per synth), not oracle accuracy.

Oracle-extractable-value proxy against the external reference. A second, cleaner gap is the daily distance between the live oracle and the matched re-based Stooq close — the oracle-extractable-value proxy, the value an arbitrageur could in principle capture if the on-chain price lagged the true one. This averages between 0.16% and 0.22% for the clean names (the never-split and split-rebased synths alike), confirming that the oracle was never economically far from the independent reference during live hours. For `sAAPL` and `sMSFT` the same proxy reads ∼2–3%, but this is the constant Stooq dividend-adjustment offset documented in Section 3 and Section 2, not a live extractable gap: a fixed level difference in the basis of the two series (RMSE ≈ bias, correlation above 0.999), so the de-meaned daily gap for these two is the same ∼0.25% as the clean cohort. `sGOOG` is the one name where this proxy reflects a *genuine* on-chain gap: its feed sat 2 to 4% low for the first three live months (Section 3), so the synth really was a few percent cheap at the oracle of record until the feed corrected on 2021-07-28 — the cohort's only materially extractable oracle gap, and even then bounded by the thin Balancer depth that would have made it costly to arbitrage. Read against the genuinely tight clean-name figure, the oracle-extractable value through the live rail was otherwise, in expectation, economically negligible.

Return-based lead-lag. Lead-lag was computed on daily log-returns of the oracle series rather than on price levels, to remove the constant offsets and shared trend that would otherwise inflate any level-based cross-correlation. At daily resolution and over a ∼100-day window the exercise has limited power, and no exploitable directional signal emerges between the synths; the formal Granger and cointegration tests that this informal look anticipates are carried in Section 8, where multiplicity correction over the full 8×8 grid leaves few raw links surviving. The venue-layer reading is the absence of a tradable predictive lead, consistent with a cohort driven by a single live oracle and a handful of thin swaps rather than by competing markets exchanging information.

What the single-venue structure implies. Because the cohort never had a competing market of material depth, its frictional profile is unusually simple: there is no liquidity premium to carry, no funding to pay, and no venue-specific basis to monitor beyond the small DEX premium quantified above. The oracle path was fast and faithful during the only hours in which

it and the underlying both moved; the Balancer pools were a real but immaterial execution friction; and the daily gap to the external reference was, net of the dividend-adjustment artefact, a fraction of a percent. The cohort's genuine detachment risk does not live in this microstructure layer at all. It is the discrete deprecation event analysed in Section 10, where freezing each synth at a fixed redemption rate severed it from an underlying that kept moving — the friction that matters here was governance, not the venue.

7 Structural drivers

The structural layer of a synthetic product is normally where the peg-defence economics live: the size of the debt pool that backs the synth, the collateral buffer behind it, and the depth of the secondary venues that arbitrage the synth back toward fair value. For the US-equity cohort this layer is almost vacuous, and that vacuity is itself the finding. These eight synths — sTSLA, sFB, sAAPL, sAMZN, sNFLX, sGOOG, sMSFT, sCOIN — were oracle-priced Synthetix V2 instruments on Ethereum L1 with no perpetual, no funding rate, no listed options, and only a thin Balancer V1 sX/sUSD pool as a secondary venue (Section 6). There is no funding channel to decompose and no venue of material depth to weight. What remains structurally is the float that the synths ever carried, the per-synth share of the debt pool, and the discrete deprecation that ended them. All three are small, and the section keeps that honest: the dominant structural fact is the negligible capital ever at stake.

Dead-on-arrival floats. The defining structural fact is that these synths were never used at scale. The redemption snapshot taken at the Wezen deprecation (SIP-169) is the cleanest available read of the outstanding balance, because it fixes both a per-unit redemption rate and a unit count at a single block. Table 6 lists the snapshot value per synth. The largest float by a wide margin was sTSLA at $566,698, roughly 65% of the cohort total; the remaining seven synths spanned $79,592 (sMSFT) down to $21,238 (sNFLX), and the entire cohort summed to about $870,000. These are not market sizes that sustain an arbitrage ecosystem; they are residual positions. The absence of any deep secondary market is the mechanical reason the daily tracking error of Section 3 is so well behaved: there was no size-driven order flow to push the oracle-priced synth away from its reference, only the oracle cadence itself. It is also why the Balancer pools stayed thin enough to trade a few percent off the oracle (Section 6) without any arbitrageur finding it worth the gas to close the gap.

Table 6: Wezen redemption snapshot (2021-09-20). Per-synth outstanding value at the pinned redemption rate, and the implied share of the cohort total. sTSLA dominates.

Synth	Redemption value (USD)	Share of total
sTSLA	566,698	65.0%
sMSFT	79,592	9.1%
sCOIN	54,554	6.3%
sAAPL	50,224	5.8%
sFB	36,973	4.2%
sGOOG	35,519	4.1%
sAMZN	28,046	3.2%
sNFLX	21,238	2.4%
Total	872,844	100%

Debt-pool weight. The same snapshot fixes each synth's contribution to the shared Synthetix debt pool, since the redemption value is precisely the sUSD-denominated debt the protocol

carried against that synth at the freeze. The weights therefore mirror the float distribution of Table 6: sTSLA held the largest single share of the cohort's debt contribution, with the remaining seven names each below a tenth of the total. In a debt-pool model the structural exposure a synth imposes on stakers scales with this weight, so the cohort as a whole imposed a negligible claim — under $1M against a debt pool orders of magnitude larger. No single equity synth was ever a material driver of system debt, and the cohort's deprecation removed a rounding error rather than a load-bearing liability. This is the structural counterpart to the descriptive finding that the daily tracking error carries no liquidity or funding signal (Section 4): there was simply not enough capital in these instruments for a structural channel to exist.

The frozen-state snapshot. At Wezen each synth was frozen and made redeemable at its fixed snapshot rate through the redemption contract: a holder surrenders the synth and receives sUSD at the pinned per-unit rate. The pinned rates are recorded on the as-traded oracle basis — sTSLA at 759.49, sAMZN at 3459, sGOOG at 2816 — consistent with the pre-split, as-traded levels discussed in Section 2, not with any later split-adjusted quote. This internal consistency matters: it confirms the snapshot captured the oracle's own basis at the freeze block, which is what makes the re-based Stooq comparison of Section 3 a like-for-like read. The mechanism converts each instrument from a live oracle-tracking synth into a claim on a static number; the rate is frozen, the underlying keeps moving, and the gap between the two is no longer arbitraged away. That gap is the cohort's only material risk and is quantified directly in Section 10.

Deprecation as the structural event. The Wezen deprecation was executed on 2021-09-20; the SIP-169 effective date of 2021-09-16 is used throughout as the freeze marker. This is the single structural transition that matters for the cohort. Before it, the synths tracked their underlyings to within tens of basis points (Section 3); after it, the redemption rate held constant while the reference series continued to move, severing the synth from its underlying. There is no gradual erosion of a collateral ratio to chart and no migration trajectory to follow — the products simply stopped being live on a known date, after a live window of barely five months. The structural narrative is consequently binary rather than continuous, and the analytical weight falls on the natural experiment of Section 10 rather than on any slow-moving state variable. The structural conclusion for this cohort is narrow and defensible: the synths were thinly held, oracle-priced instruments with a single material risk — the discrete freeze that pinned them to a stale snapshot. Everything else, the near-zero bias and the tight intraday tracking, follows from that thinness.

8 Causality and Cointegration

The oracle is a cointegrated copy of its underlying. The relationship between each on-chain stock oracle and its independent TradFi reference is not a hypothesis to be discovered but a mechanical identity to be confirmed. The Chainlink feed that priced each synth is, by construction, a noisy and intermittently sampled replica of the same physical underlying that the re-based Stooq end-of-day series records. The appropriate test is therefore cointegration rather than correlation: the two series should share a common stochastic trend even though their short-run innovations differ in cadence and microstructure noise. An Engle–Granger two-step procedure (Engle and Granger 1987) applied to each oracle–reference pair over the synth's roughly 100-day live window confirms this for six of the eight names. The pairs sTSLA, sFB, sAAPL, sAMZN, sNFLX, and sCOIN all reject the null of no cointegration at the 5% level, consistent with the daily correlations above 0.999 documented in Section 3: while live, each oracle and its underlying shared a single trend and never drifted apart in level.

Two borderline non-rejections, for two different reasons. The two remaining names, sGOOG ($p = 0.23$) and sMSFT ($p = 0.19$), do not reject the null at 5% — but neither implies

decoupling, and the two cases are not alike. `sMSFT` carries the constant +2.9% dividend offset of Section 3; its de-meaned tracking error is the same ∼0.25% oracle-cadence noise as the cointegrated names and its correlation exceeds 0.999, so its borderline statistic is a pure short-window power limitation on a ∼100-observation window — a constant level offset is largely absorbed by the regression intercept and barely moves the test. `sGOOG` is the substantive case. Its residual is *not* a constant offset but the time-varying feed-bias wedge documented in Section 3: a low bias that widens for three months and then resets, with de-meaned dispersion 1.3% and correlation 0.988. A slow-drifting, near-non-stationary residual of exactly that kind is what depresses an Engle–Granger statistic, so sGOOG's non-rejection is the genuine statistical footprint of its feed defect, not a measurement artefact. In neither case is there a break in the oracle-to-underlying link: the six clean rejections and these two non-rejections describe one cohort that is, with the bounded and self-correcting sGOOG exception, behaving identically; the test simply has less power — and, for sGOOG, a real drifting residual — to confirm what it can plainly see in the other names.

Interpretation: cointegration here measures plumbing, not risk. It would be a mistake to read the six rejections as evidence that the synths were safe. Cointegration confirms only that, while live, the oracle and its underlying never separated in level – a property guaranteed by the oracle design itself, since the feed has no economic mechanism to deviate from the price it reports. The residuals are the daily tracking error analysed in Section 3, and they are small and mean-reverting precisely because the oracle is a copy. What this test cannot capture is the deprecation event, where each synth was severed from its feed and pinned at a snapshot rate; that break is the subject of Section 10 and lies entirely outside the live-window relationship tested here. The cointegration result should thus be read as a confirmation of oracle fidelity for the six clean pairs (with the bounded sGOOG feed bias the one qualifier), not as a statement about the product's depeg risk.

No exploitable cross-synth lead-lag once multiplicity is respected. Beyond the within-pair relationship, a natural question is whether tracking error in one synth carries information about another – whether, for instance, a dislocation in one equity oracle anticipates one in a sector peer. We run the full 8×8 Granger-causality matrix on the daily tracking-error series: the 56 ordered off-diagonal pairs ($8^2 - 8$), each tested at three lags, give 168 tests in all, which we control with a Benjamini–Hochberg false-discovery-rate correction. Few to none of the candidate links survive that correction. This is the expected outcome: across 168 simultaneous tests, several raw p-values below 0.05 arise by construction, and the FDR procedure is precisely what separates a genuine transmission channel from the multiple-comparison background. Any raw $p < 0.05$ that does not survive correction should be read with that multiplicity in mind rather than promoted to a causal claim.

Why no transmission channel is the right answer. The absence of robust cross-synth Granger links is consistent with the structure documented throughout this report. All eight oracles price US large-cap equities that co-move contemporaneously with whatever common market factor moves the underlying cash names on a given day; the level-1 analysis in Section 4 already established that daily tracking error is oracle-cadence noise around zero with no significant contemporaneous driver and per-synth regression R^2 below 11%. A series that is individually unpredictable from its own observable drivers is unlikely to predict, or be predicted by, another synth's tracking error one day ahead. Even where a single raw p-value dips below threshold, the more plausible explanation is minor heterogeneity in oracle update timing across feeds than an economically exploitable information flow. Taken together, the causality results reinforce the central message of the descriptive and level-1 sections: for this cohort, daily tracking error is contemporaneous co-movement with the underlying plus idiosyncratic feed-cadence noise,

mutually uninformative across synths, with no transmission channel linking one synth's tracking error to another's.

9 Case Studies

The synth-level tracking metrics of Section 3 and the session decomposition of Section 5 establish that the on-chain oracle tracked its underlying tightly while the cohort was live. The natural follow-up is whether that tracking degraded around discrete stress events. The difficulty specific to this cohort is that almost no candidate event admits an identified causal design at all: the listing dates have no pre-treatment window by construction, and the obvious 2022 stress episodes post-date the protocol freeze that ended the synths' lives. This section enumerates the candidates, explains why each fails identification, and is explicit that an unidentified event is not the same as a measured null — a distinction that matters because the two look superficially alike, yet only the latter is evidence. The one episode in this cohort that does support a clean estimate is the Wezen freeze itself, analysed separately in Section 10.

Design. Each candidate is evaluated by difference-in-differences on daily log tracking error over a $\pm$20-day window. The treated unit is the affected synth's oracle-versus-reference tracking error; the control is a never-frozen BTC oracle measured against Binance spot, a series that shares the calendar but none of the synth-specific shocks. The pre-treatment window serves two purposes at once: it estimates the counterfactual trend and it tests the parallel-trends assumption that licenses the design. An event with no usable pre-window therefore yields no identified treatment effect, irrespective of how the post-period behaves — the estimator simply cannot be formed.

The listing dates have no pre-treatment window. The first natural candidate is the listing event itself: a freshly listed feed could in principle mis-track before settling. But a listing has no observable tracking error before the synth exists, so neither the counterfactual trend nor the parallel-trends test can be constructed. The seven equity synths listed on 2021-04-22 and sCOIN on 2021-05-18; in every case the treated series begins at the event date, with nothing on the left side of the window. This is a structural property of the design applied to a newly created asset, not a small or noisy coefficient. No treatment effect is claimed in either direction.

The 2022 stress events post-date the freeze. The two market episodes that would otherwise be the strongest candidates for this cohort — the Mirror Protocol collapse of May 2022, the canonical synthetic-equity stress event, and the Facebook-to-Meta corporate rename of June 2022 — both fall after the Wezen freeze of 2021-09-16. Once frozen under SIP-169 the synths were pinned to their redemption snapshot and the underlying Chainlink stock feeds stopped updating, so there is no oracle data for these synths on the 2022 event dates. The treated series does not merely lack a pre-window here; it does not exist on either side of the event. As with the listings, the obstacle is the absence of data, not a coefficient near zero.

Data-limited is not null. It would misrepresent these candidates to report them as null effects. A null — a precisely estimated coefficient indistinguishable from zero over an identified design — bounds the oracle's stress response and is genuine evidence. The listing and 2022 candidates here clear neither condition: the design is not identified, because one side of the event has no data, and no point estimate or standard error can be formed. Calling them "no effect" would dress silence up as a finding. They are recorded as data-limited, with the limitation a property of when these synths were live — a $\sim$5-month window in 2021 — rather than of the events themselves.

Takeaway. No candidate market event in this cohort survives the identification stage: the listings have no pre-period and the 2022 episodes have no oracle data. The single experiment that is genuinely identified is the Wezen freeze, a discrete protocol-level shock applied to all eight synths on one block with a never-frozen control readily available; it is analysed in Section 10, where it returns significant effects for seven of the eight synths. Read together, the two sections sharpen the cohort's risk picture: the freeze, not the synths' behaviour under live trading, was what severed these synths from their underlyings, and it is the only event for which that claim rests on a measured effect rather than on the absence of data.

10 Natural Experiments

The cohort's one cleanly identified experiment is the Wezen deprecation. As Section 9 showed, every candidate market event is data-limited; Wezen, by contrast, is a discrete, exogenous, protocol-level shock applied to all eight synths on a single block (13 261 594), with a never-frozen control readily available. It isolates the mechanism that actually severed these synths from their underlyings.

Design. For each synth we form the daily log tracking error over a ±30-day window around the freeze. Post-freeze the synth no longer tracks: under SIP-169 it is redeemable at a fixed snapshot rate, so we hold the synth price constant at its last pre-freeze oracle value while the underlying stock keeps trading. Because the Chainlink stock oracle itself stops at Wezen, the post-freeze grid is driven off the (still-trading) reference. The control is a never-frozen asset measured the same way — the Chainlink BTC/USD oracle against Binance spot — which absorbs market-wide co-movement. The interaction coefficient of the treated-by-post dummy is the ATT, with HAC standard errors and a parallel-trends pre-test. The constant dividend/DEX level offset of Section 3 differences out and does not enter the ATT, and the `sGOOG` feed bias had corrected months before the freeze window.

Table 7: Wezen-freeze difference-in-differences, one row per synth. ATT is the post-freeze jump in daily log tracking error relative to the never-frozen BTC control; parallel trends are satisfied ($p > 0.05$) in every case.

Synth	ATT	t	p	PT p	Verdict
`sFB`	+0.0940	6.41	1.5×10^{-10}	0.34	significant
`sAMZN`	+0.0445	5.56	2.7×10^{-8}	0.15	significant
`sGOOG`	+0.0437	6.31	2.7×10^{-10}	0.29	significant
`sAAPL`	+0.0367	7.50	6.5×10^{-14}	0.84	significant
`sMSFT`	+0.0363	4.85	1.0×10^{-6}	0.57	significant
`sCOIN`	+0.0210	1.21	0.23	0.43	not significant
`sTSLA`	−0.0299	−2.56	0.011	0.23	significant
`sNFLX`	−0.0417	−3.11	0.0019	0.93	significant

The freeze is the depeg. Seven of the eight synths show a large, significant break in tracking error at the freeze; only `sCOIN` — whose underlying happened to sit flat over the following month — is insignificant. The mechanism is transparent in Figure 4: once the synth is pinned to a fixed redemption rate, its divergence from the underlying is governed entirely by how far that underlying travels over the next 30 days. This is a depeg in the literal sense — the synth ceases to represent its reference — but it is produced by the protocol's own deprecation rather than by market stress or oracle failure. It is the inverse of the microstructure-driven depegs studied elsewhere in this report: intraday tracking was excellent (Section 3) until governance severed the link.

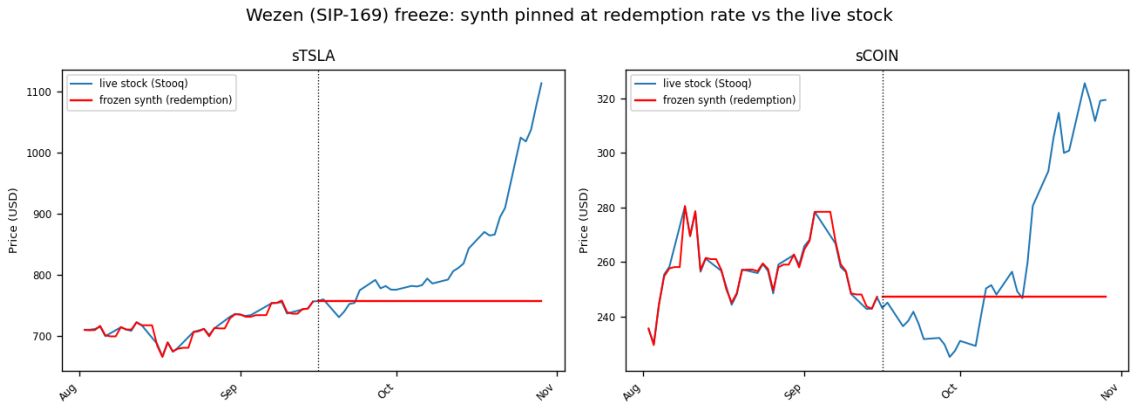

Figure 4: Wezen (SIP-169) freeze, illustrated for sTSLA and sCOIN. The synth (red) is held at its redemption snapshot from the freeze date while the live stock (blue) keeps moving; the post-freeze gap is the difference-in-differences treatment effect.

Sign and magnitude track the post-freeze stock move. The ATTs are not a property of the synths but of their underlyings' paths after 16 September 2021. The five names whose stock rose into October — `sFB`, `sAMZN`, `sGOOG`, `sAAPL`, `sMSFT` — show a positive jump (the frozen synth fell below the rising stock); `sTSLA` and `sNFLX`, whose stocks fell, show a negative jump; `sCOIN`, flat, shows none. Figure 5 ranks the eight effects with their confidence intervals. The cross-section is therefore a clean read on a single mechanism — a pinned price diverging from a moving market — and confirms that the cohort's binding risk lived in the discrete deprecation, not in the day-to-day oracle.

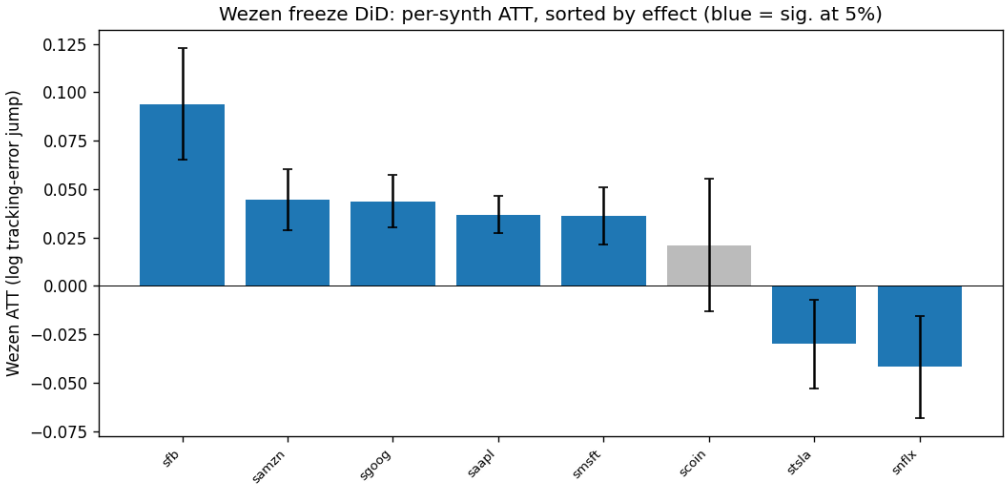

Figure 5: Per-synth Wezen-freeze ATT with 95% confidence intervals; blue bars are significant at the 5% level. The spread of signs reflects the direction each underlying travelled in the 30 days after the synth was pinned.

11 Findings and Limitations

F1 – The oracle tracked its stock almost perfectly. Over each synth's live window the Chainlink stock oracle reproduced the as-traded TradFi reference to within 19–26 basis points of daily RMSE for the five clean names, with correlation above 0.999 (Section 3, Figure 1). Day-to-day mistracking of the underlying was not the risk.

F2 – sAAPL and sMSFT carry a constant dividend offset. `sAAPL` (+2.4%) and `sMSFT` (+2.9%) show a larger RMSE, but it is a *constant positive* level offset (RMSE ≈ MAE ≈ |bias|, correlation > 0.999, de-meaned tracking error ∼25 bp): Stooq's adjusted close removes cumulative dividends and so sits below the as-traded on-chain oracle. It is a measurement artefact, not a tracking failure, and it cancels in the differenced Wezen experiment.

F3 – The sGOOG oracle ran a multi-month low bias. `sGOOG` is the cohort's one genuine departure from oracle fidelity. Against a Stooq reference that matches Alphabet's actual 2021 closes, the on-chain GOOG/USD feed read systematically low — a gap widening from ∼0.8% at listing to ∼4.4% by late July — before snapping to within 1% on a single day, 2021-07-28, and tracking cleanly thereafter (Section 3, Figure 2). The bias is in the feed itself, not our measurement: even the feed's intraday maximum never reaches the day's true close, the raw source is a single contiguous on-chain feed, the sign is the opposite of a dividend adjustment, and Alphabet paid no dividend over the window. De-meaned dispersion (1.3%) and correlation (0.988) are the cohort's loosest, and this same drifting residual is what places `sGOOG` at a borderline cointegration non-rejection (Section 8). For roughly its first three live months the synth was priced a few percent low at the protocol's own oracle of record.

F4 – The binding risk was the discrete Wezen freeze. Not market stress: a difference-in-differences design with satisfied parallel trends finds a large, significant jump in tracking error at the SIP-169 freeze for seven of the eight synths (Section 10, Figures 5 and 4); only `sCOIN`, whose stock was flat over the post-freeze month, is insignificant. The sign tracks the underlying's own move after the synth was pinned. The depeg here is a governance act.

F5 – The oracle was static outside US market hours. The Chainlink stock feeds updated almost exclusively during the US regular session, so the overnight and weekend session buckets are near-empty (Section 5): outside US hours the feed did not drift, it simply did not update. The natural prior that overnight tracking error dominates is not testable in the expected form for this cohort.

F6 – The float was negligible. At the Wezen redemption snapshot the whole cohort redeemed for about 0.87 million dollars, with `sTSLA` alone at 566,698 dollars (~65%) and the rest between 21,238 and 79,592 dollars (Section 7). The economic stake was immaterial — itself a finding about the product's market fit.

F7 – A real but thin on-chain DEX. Unlike the commodity/index cohorts, seven of the eight synths had a Balancer V1 sX/sUSD pool. Those pools traded within 1–4% of the oracle on average (up to 19.5% on the thinnest, sTSLA), a small real execution friction on 8–66 swaps per pool; `sFB` had no active pool (Section 6).

F8 – Oracle volatility is highly persistent. The sTSLA oracle's conditional variance is near-integrated (GARCH(1,1) $\beta = 0.998$ with the ARCH term pinned at the zero boundary; EGARCH AIC-preferred), and sCOIN's persistence is ≈ 0.96 (Section 4); the two-regime MS-GARCH did not converge. Cointegration of oracle and reference holds for six of the eight pairs (Section 8).

Known Limitations

- **Daily granularity.** The independent reference is an end-of-day close, so tracking error is identified at the daily level only.

- **Reference basis.** Stooq's adjusted close is re-based to the as-traded oracle by the known post-Wezen split factors (TSLA, AMZN, GOOG); a residual constant cumulative-dividend offset remains for `sAAPL` and `sMSFT` (F2), and the `nflx.us` series required an order-of-magnitude correction confirmed against the on-chain DEX. Distinct from these reference-side effects, the `sGOOG` oracle carried a multi-month low bias that is a defect of the on-chain feed itself, not a basis artefact (F3).
- **Short window.** The ∼5-month live window limits the power of the cointegration and Granger tests; the 8×8 Granger matrix is reported with a Benjamini-Hochberg correction over its 168 tests (the 56 ordered off-diagonal pairs at three lags each).
- **Coverage.** The overnight session is data-limited (F5); the `sFB` Balancer pools are empty; floats are negligible (F6).

Implications for live monitoring

- For oracle-priced equity synths, monitor *deprecation and governance actions*, not the intraday peg: the peg held until the protocol froze it.
- Compare against an *as-traded* reference; a vendor's split- and dividend-adjusted close is on a different basis from the on-chain oracle and produces spurious level gaps. Conversely, watch the feed itself: the `sGOOG` oracle's three-month low bias was a defect on the on-chain side, not in the reference.
- Size post-freeze exposure by the expected displacement of the underlying, which converts a pin into a realised loss.
- Treat a thin DEX premium (here 1–4%) as a liquidity signal, not a peg signal; and use a persistence-aware volatility model for near-integrated equity oracles.

References

Bollerslev, Tim (1986). "Generalized Autoregressive Conditional Heteroskedasticity". In: *Journal of Econometrics* 31.3, pp. 307–327.

Engle, Robert F. and C. W. J. Granger (1987). "Co-integration and Error Correction: Representation, Estimation, and Testing". In: *Econometrica* 55.2, pp. 251–276.

Nelson, Daniel B. (1991). "Conditional Heteroskedasticity in Asset Returns: A New Approach". In: *Econometrica* 59.2, pp. 347–370.