

HG Pre-Expiry (DTE) Analysis 2008–2024

Futures Curve Pipeline (Stages 0–2)

January 20, 2026

What this report contains (analytics only)

This document summarizes the **analytic outcomes** of a DTE-anchored (business-day) pre-expiry study for HG calendar spreads, based on daily US-session VWAP series derived from the Stage 2 spread panel. Reproducibility commands and technical implementation details live in `README.md`.

Key findings (headline)

- The strongest in-sample family (2008–2024) in a constrained DTE window search is typically **short S1** with an **entry-day S2 regime filter** (“ $S2 \geq 0$ at entry”).
- A representative fixed rule selected on 2008–2024 is: **Short S1, enter at DTE=20, exit at DTE=0, only if $S2(\text{entry}) \geq 0$** , with round-trip costs included (1 tick/leg/side).
- The fixed-rule robustness check shows that this rule is **sensitive to execution timing**: using **shift=1** (next-business-day execution) flips performance negative in the pooled sample.

Definitions and conventions (minimal)

Spreads. $S1 = F2 - F1$, $S2 = F3 - F2$.

DTE. The x-axis is **business days to expiry** (DTE), aligned to the near leg of the spread.

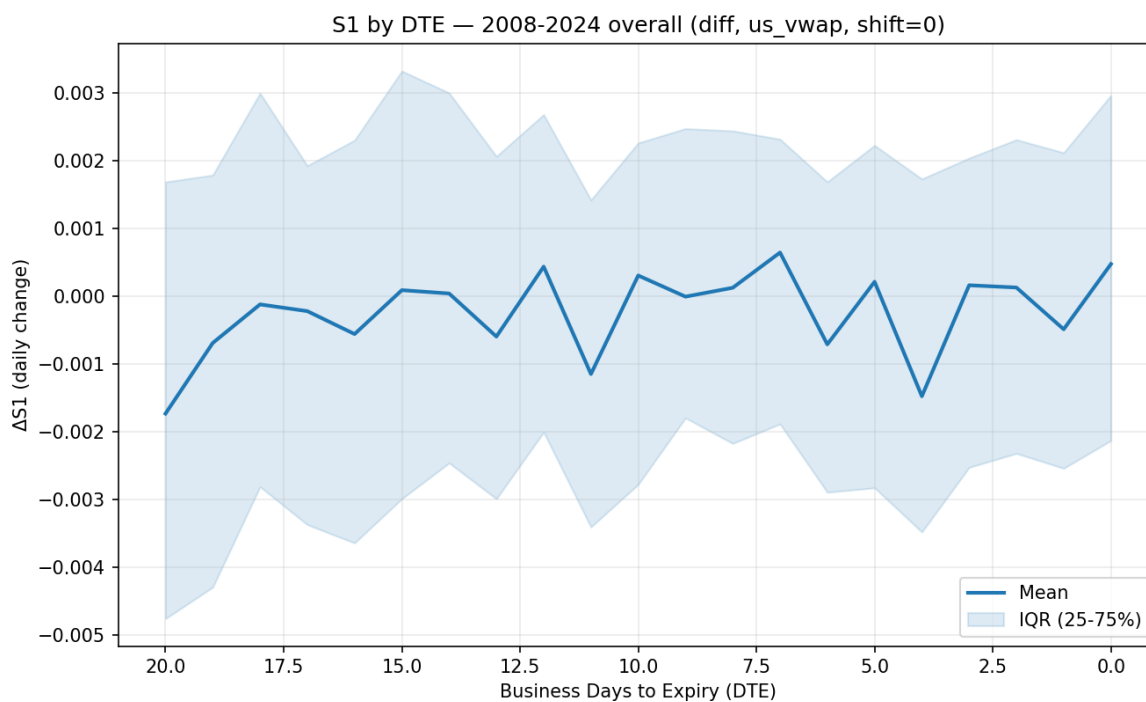
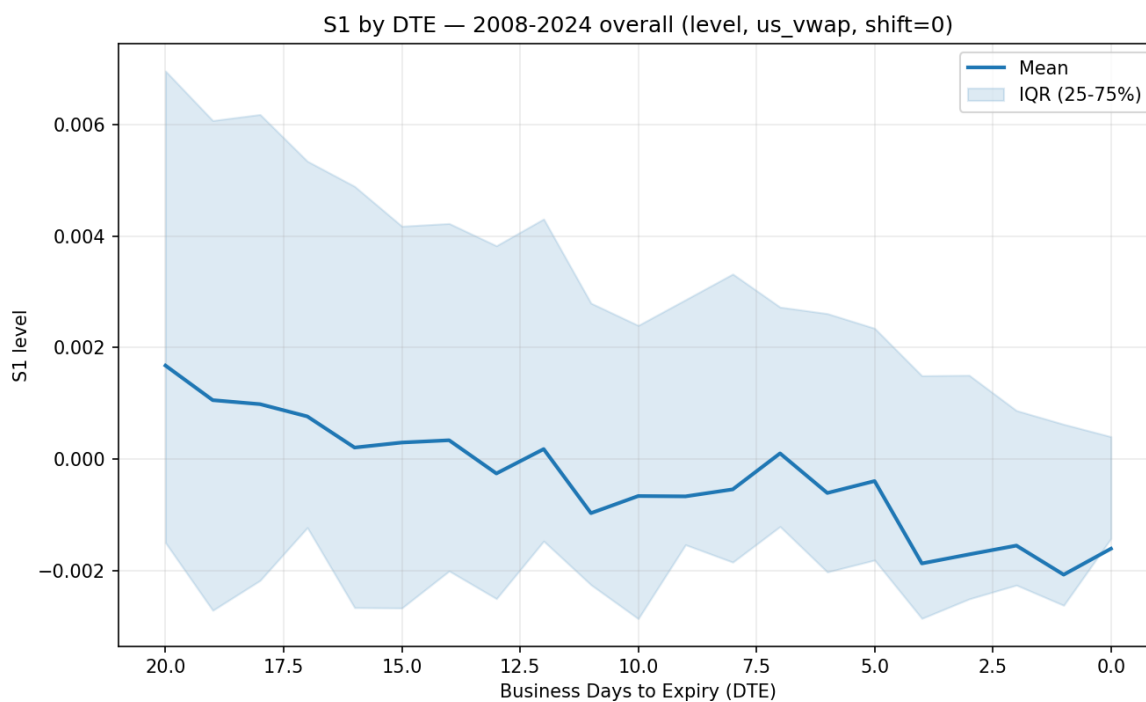
Daily series. Baseline price proxy is **US-session VWAP** (buckets 1–7) with **shift=0** (same-day execution convention).

Costs. All net metrics include a round-trip cost model of **1 tick per leg per side** (2 legs, entry+exit).

DTE-anchored seasonality (S1)

The seasonality view aligns each contract cycle by DTE and summarizes the cross-cycle distribution (mean + IQR).

Overall average (2008–2024)



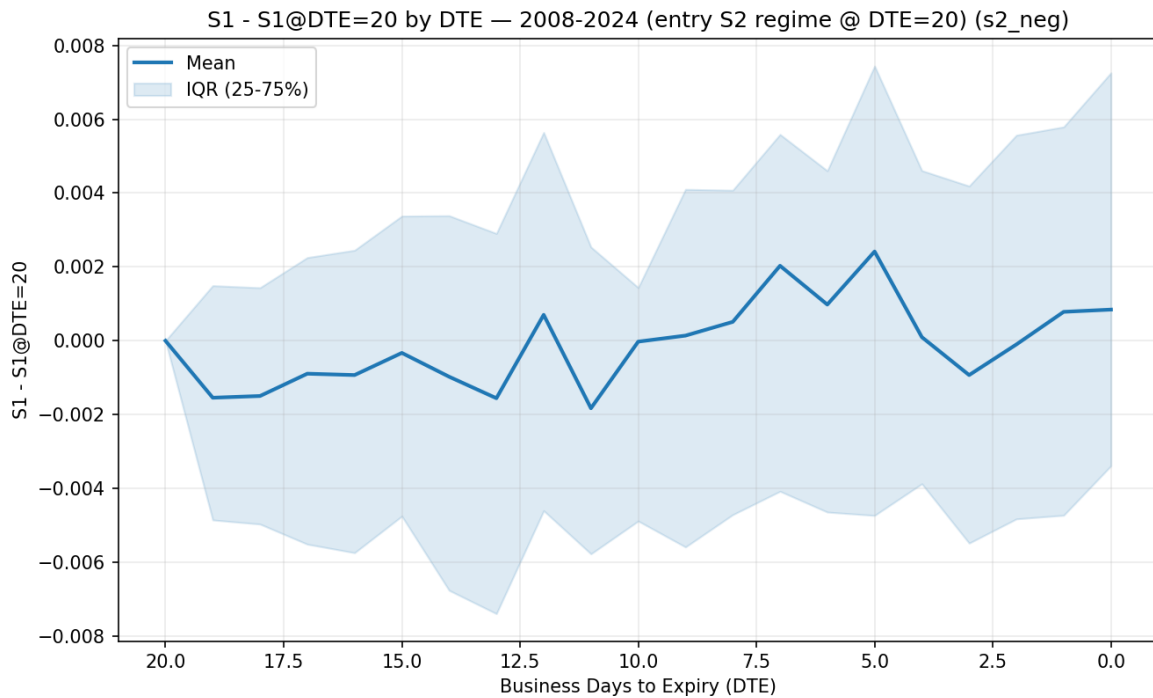
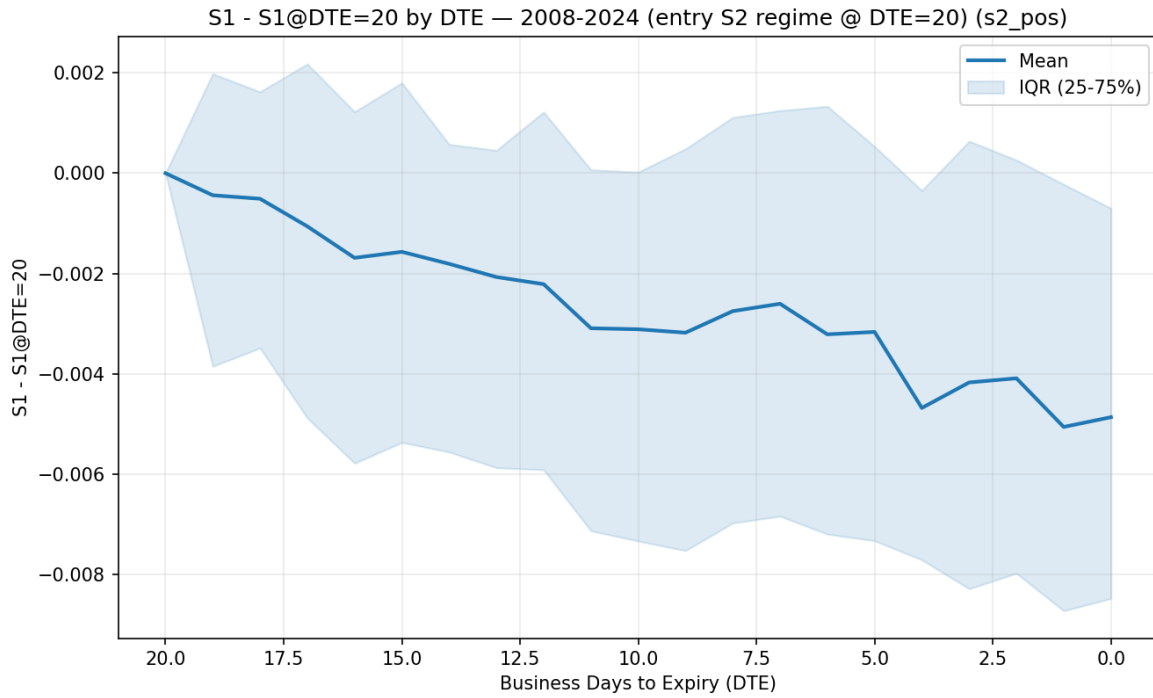
Why this matters for strategy search

The overall DTE-anchored curves guide which DTE subwindows might plausibly contain a consistent drift and help motivate a constrained grid search over entry/exit windows.

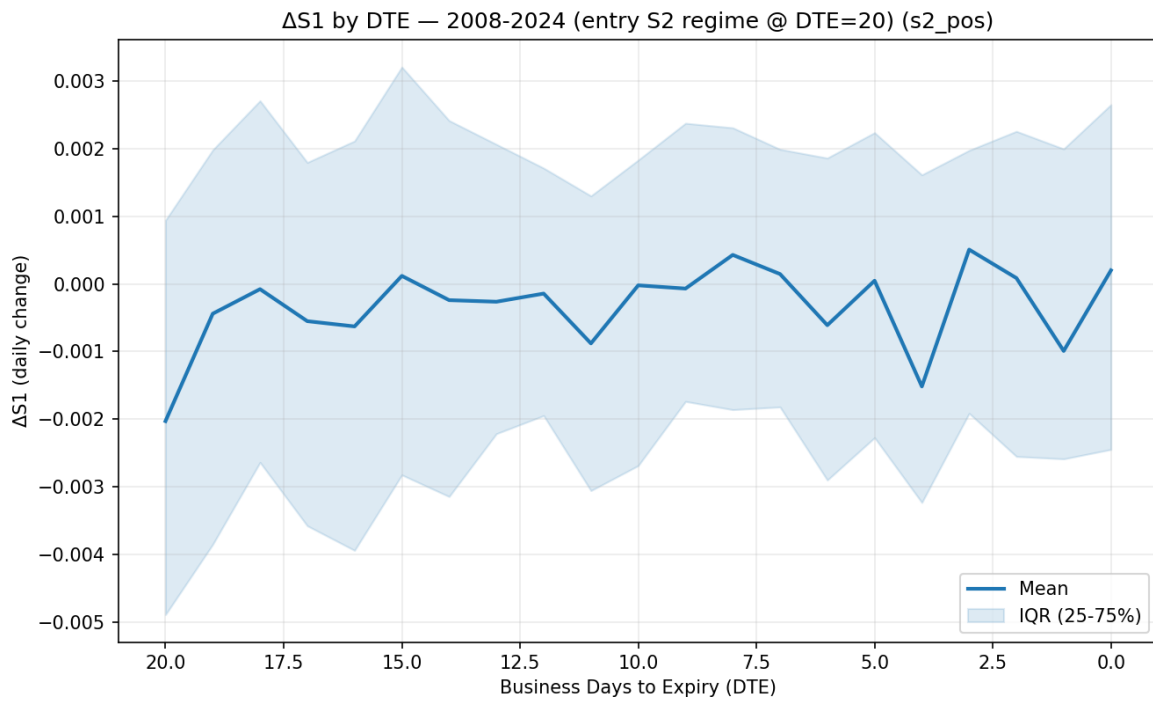
Regime-stratified event study (entry-day S2 regime)

We split contract cycles into regimes using the **entry-day** S2 sign at a chosen entry DTE (here, DTE=20). The plots show the mean path and dispersion conditional on that entry regime.

Cumulative drift: $S1 - S1@DTE = 20$



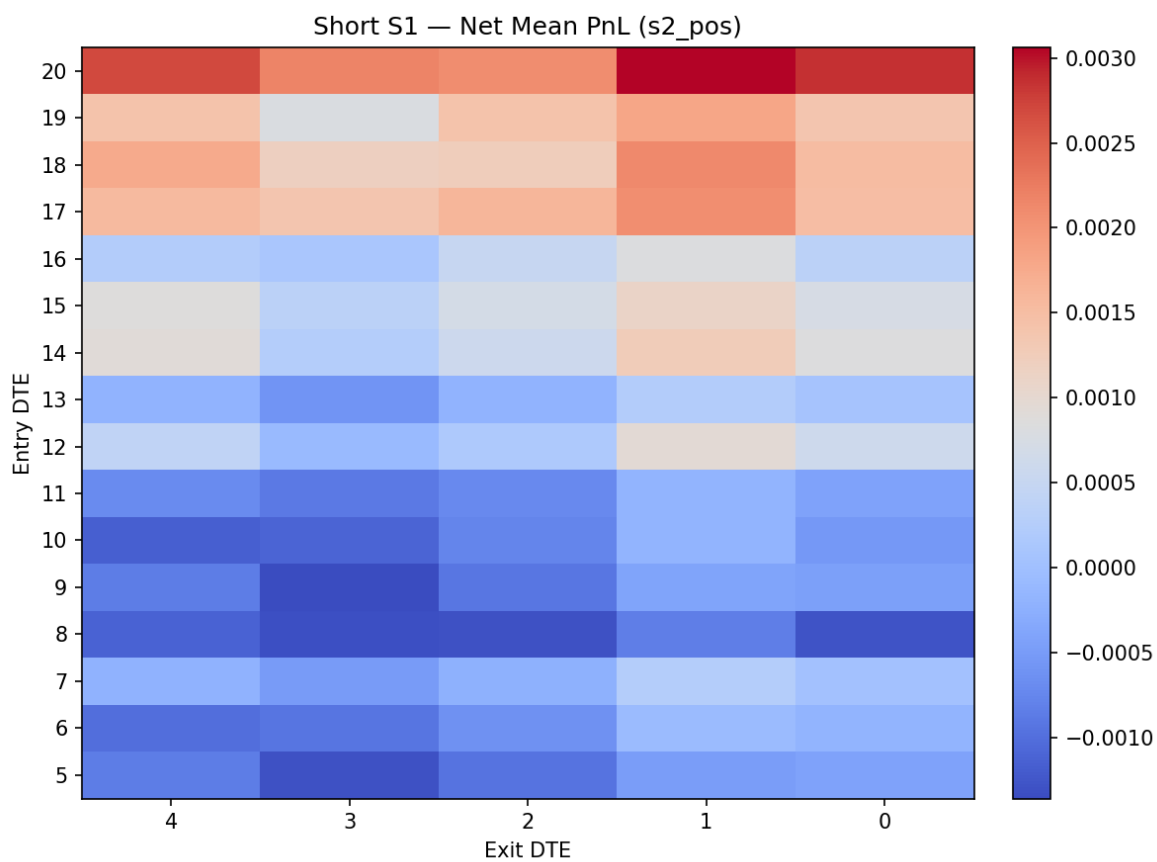
Daily drift: $\Delta S1$ by DTE

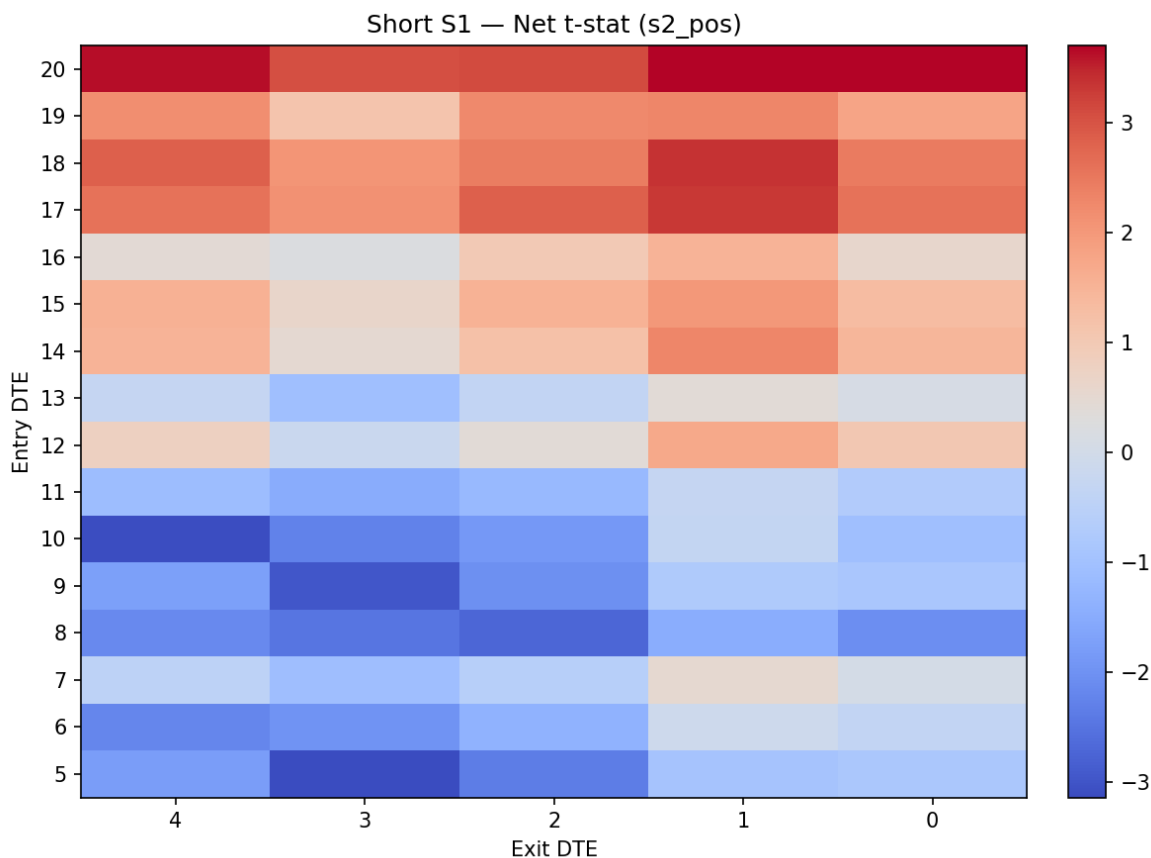


Window scan (costed; constrained search)

We scan DTE windows with entry DTE in $[20..5]$ and exit DTE in $[4..0]$, for both long and short S1. Metrics are computed per contract cycle; net P&L subtracts the round-trip spread cost.

Heatmaps ($S2 \geq 0$ regime; short S1)





Validation (walk-forward, out-of-sample)

We run an expanding-window walk-forward procedure by expiry year (train on cycles with expiry year $< Y$, test on cycles with expiry year $= Y$). Selection is constrained with minimum trade counts and a positive net mean requirement, and evaluated out-of-sample per year.

Robustness (fixed rule; execution/cost stress)

We take a single baseline rule (selected in-sample) and re-evaluate it under alternative execution assumptions (shift=1, bucket1 proxy, doubled cost). This isolates sensitivity to execution timing and cost assumptions without re-optimizing parameters.

Top ranked windows (in-sample; costed)

Regime	Dir	Entry	Exit	N	Net mean (USD/ct)	Net t
s2_pos	short	20	0	128	71.70	3.70
s2_pos	short	20	1	129	76.57	3.69
s2_pos	short	20	4	129	67.09	3.64
s2_pos	short	20	2	128	52.30	3.10
s2_pos	short	18	1	157	52.88	3.37
s2_pos	short	20	3	129	54.37	3.05
s2_pos	short	17	1	157	51.79	3.33
s2_pos	short	17	2	155	39.88	2.84
s2_pos	short	18	4	157	44.15	2.84
s2_pos	short	17	0	156	37.65	2.60

Walk-forward out-of-sample summary

Year	Regime	Dir	Entry	Exit	N	Net mean (USD/ct)	Net t	Win
2013	all	short	12	1	12	49.23	2.02	0.67
2014	s2_pos	short	18	1	6	15.22	0.12	0.50
2015	s2_pos	short	17	1	8	100.57	0.62	0.50
2016	s2_pos	short	17	1	12	-12.77	-0.56	0.50
2017	s2_pos	short	17	1	12	54.90	2.56	0.67
2018	s2_pos	short	17	1	12	56.54	1.44	0.75
2019	s2_pos	short	17	1	9	38.95	1.07	0.56
2020	s2_pos	short	17	1	10	-66.73	-1.88	0.20
2021	s2_pos	short	17	1	6	-56.61	-0.82	0.33
2022	s2_pos	short	17	1	7	7.27	0.11	0.43
2023	s2_pos	short	20	0	8	183.16	2.50	0.88
2024	s2_pos	short	20	0	10	208.26	1.52	0.70
pooled	nan	nan			112	50.12	2.36	0.57

Fixed-rule robustness (pooled)

Scenario	N	Net mean (USD/ct)	Net t	Win
baseline_us_vwap_shift0_cost1	128	71.70	3.70	0.69
shift1_us_vwap_cost1	129	-65.35	-3.25	0.35
bucket1_shift0_cost1	57	141.89	2.70	0.70
baseline_us_vwap_shift0_cost2	128	21.70	1.12	0.55

Baseline fixed-rule performance by expiry year

Expiry yr	N	Net mean (USD/ct)	Net t	Win
2008	4	-268.69	-1.55	0.25
2009	8	8.23	0.16	0.50
2010	10	84.02	2.92	1.00
2011	10	169.10	4.49	0.90
2012	7	-63.09	-1.25	0.43
2013	9	153.71	2.70	0.78
2014	4	115.66	1.82	0.75
2015	6	-71.77	-0.40	0.33
2016	10	23.38	0.75	0.60
2017	8	94.90	3.47	0.88
2018	8	149.41	2.37	0.88
2019	7	63.22	2.10	0.86
2020	8	33.75	0.54	0.50
2021	5	-38.13	-1.20	0.20
2022	6	70.67	1.39	0.67
2023	8	183.16	2.50	0.88
2024	10	208.26	1.52	0.70
pooled	128	71.70	3.70	0.69