Pick Which Four:
Quota Exhaustion and the Price of Saving the Best Bowler for the 19th Over in the IPL

VISHAL MISRA, Columbia University, USA

Captains in T20 cricket follow a well-known convention: when defending a target, save the team's best death-over bowler for the 19th over rather than the 20th. We ask two questions. Is this convention visible in the data as a real, identifiable departure from the natural scoring-rate curve of a T20 innings? And is it actually worth anything once you account for the match state that drives it? Using 281,256 deliveries from 19 IPL seasons (2008–2026), we document three results.

First, the convention is visible in the descriptive data only in the second innings. When linearly interpolating economy rate between the 18th and 20th overs, the 19th over in first innings lands on the interpolation line (0.07 runs per over below); in second innings it sits 0.22 runs per over below. The mechanism is also visible in bowler identity: in the second innings, 41% of 19th overs are bowled by the team's best-ranked death bowler (by era-adjusted prior-career death economy), versus 38% of 18ths and 32% of 20ths. First innings shows no such preference at the 19th.

Second, we exploit the 4-over quota cap in a quasi-experimental design. In some matches the captain's designated best death bowler has his quota consumed before the 19th over begins and cannot be deployed there. In live chases (runs needed 8–35, wickets lost 2–7 at the start of the 19th), forcing the captain off the convention in this way is associated with an additional 1.46 runs in the 19th over (SE 0.63, $p = 0.021$), controlling for match state and era. A mechanical bowler-identity swap measure gives approximately 1.1 runs per over in the full sample and 0.7 in the live-chase subsample—both conservative lower bounds on the regression estimate, for reasons we explain in Section 5. A sensitivity sweep across 32 alternative live-chase thresholds finds the effect positive in every specification, with a median of +1.5 and a range of +1.0 to +2.0.

Third, the mechanism of quota exhaustion is unexpectedly clean. In 100% of exhausted matches the designated bowler's last over before the 19th was the 17th or the 18th. Captains are not burning their best bowlers early under match-state pressure; they are trying to cover the death phase and hitting the quota wall adjacent to the 19th. The usual match-state confound that would complicate identification largely does not operate.

Together these results reframe the convention. "Save your best bowler for the 19th" is in practice a choice about which *pair* of non-consecutive death overs the ace covers (since bowlers cannot bowl consecutive overs in cricket). The dominant pattern is 17+19: the ace bowls over 17, a partner bowls 18, and the ace returns for 19. The forced-deviation group typically follows an allocation that consumes all four overs before the 19th (e.g. overs 1, 3, 14, 18), leaving no quota for the 19th. Captains who deploy their ace at 17+19 and sacrifice the 20th outperform captains whose ace's quota is consumed before the 19th (typically with the last over at 17 or 18) by approximately 1.5 runs per live chase. A natural secondary hypothesis —that batters have adapted to exploit the pre-designated soft 20th—fails in the data: a within-innings paired strike-rate test finds an acceleration pattern but no chase-specific component.

Additional Key Words and Phrases: cricket, death bowling, quasi-experimental design, T20, IPL, captain strategy

1 Introduction

In limited-overs cricket a well-known convention governs death-over bowling: when defending a target, the captain should save the team's best death-over bowler for the 19th over rather than the 20th. The reasoning, as it is usually articulated in commentary and coaching discussion, is that the 19th is often treated as higher-leverage than the 20th: a tight 19th leaves the chasing side needing more than the last over can plausibly produce, whereas a loose 19th makes the 20th an afterthought. Whether this holds as a general statement about leverage is state-dependent—there

Author's Contact Information: Vishal Misra, Columbia University, New York, NY, USA, vishal.misra@columbia.edu.

are clearly matches in which the 20th carries more win-probability weight—but the convention is widely shared and acted upon. It is a rare example of a cricket convention with a crisp, falsifiable decision rule: we can look at the data and ask whether the 19th really receives the best bowlers and whether the convention is worth anything.

This paper is a companion to earlier work establishing which IPL bowlers have genuine, persistent, era-adjusted death-over skill after empirical Bayes shrinkage [4]. That paper answered the question of who the elite death bowlers are. The present paper asks whether those bowlers are deployed optimally when they are on the field. We make three contributions:

(1) We document the descriptive fingerprint of the convention and show that it is visible only in second innings. Using linear interpolation between the 18th and 20th overs, the 19th over in chases sits 0.22 runs per over below what the local trend predicts; in first innings, the 19th is on-trend. The mechanism is confirmed by bowler-identity data: in the second innings, 41% of 19th overs are bowled by the team's best-ranked death bowler, compared with 38% of 18ths and 32% of 20ths. No such preference exists in the first innings.
(2) We exploit the 4-over per-bowler quota as a natural experiment. In a subset of matches the captain's designated best death bowler has his quota consumed before the 19th over begins and is structurally unable to deploy him there. Comparing these matches to those where the best bowler remained available and was used, in a live-chase subsample (runs needed 8–35, wickets 2–7) and conditional on match-state controls, we find that being forced off the convention is associated with an additional 1.46 runs in the 19th over ($p = 0.021$). A mechanical bowler-quality -swap measure independently gives approximately 1.1 runs per over, and a sensitivity sweep across 32 alternative threshold choices keeps the coefficient in $[+1.0, +2.0]$ with no sign flips.
(3) We document that the usual match-state confound largely does not operate in this setting. In every exhausted match, the designated bowler's last over before the 19th was the 17th or the 18th: exhaustion is not driven by desperate early deployment but by the mechanical interaction of the 4-over cap with captains' preferred coverage of the death phase. A balance table on the live-chase sample shows only one statistically significant imbalance between the two groups (runs needed, which the regression controls directly absorb), and the designated bowler's own quality is balanced across groups. This cleans up identification substantially and reframes the substantive interpretation of the convention.

A natural secondary hypothesis—that batters have adapted to the pre-designated weaker 20th-over bowler by attacking the 20th harder than the 19th—appears in cross-sectional data but fails a within-innings paired test. The within-innings paired 20th-minus-19th strike rate delta is +12.4 points ($p = 0.0003$) but is not chase-specific: it is the same size in first innings (+11.6) as in second innings (+14.1). The pattern is better explained as a generic last-over effect (conservation value of wickets drops to zero in the final over) than as strategic exploitation of the convention. We include this as a reported null because it corrects a natural reading of the descriptive data.

The core framing of the paper is that the 19th-over convention is best understood as *a coverage decision, not a privileging decision.* In 74% of matches, the ace bowls just one death over; in 26%, two. The captain's decision is which death over(s) the ace covers with whatever quota remains after the earlier phases. When the ace bowls one death over, the convention says it should be the 19th. When the ace bowls two, the dominant pairing is 17+19 (46% of two-over cases), followed by 18+20 (41%) and 17+20 (13%). A captain whose ace covers the 19th is following the convention; a captain whose ace has consumed his quota by the 18th and cannot reach the 19th is in the "forced deviation" group. The data says the first choice is better by roughly 1.5 runs per live chase.

2 Data

2.1 Ball-level extract

We extract every delivery bowled in overs 1–20 of IPL matches from the ESPN Cricinfo ball-by-ball database, covering all 19 IPL seasons from 2007/08 through 2025/26. The dataset comprises 281,256 deliveries across 1,158 completed matches. For each delivery we record bowler and batsman identity, over and ball number, runs conceded, wides and no-balls, cumulative runs and wickets at the start of the ball, dismissal type, innings number, venue, season, and the identities of the two teams and the team batting first.

2.2 Bowler career baselines

For each bowler, we compute an era-adjusted prior-career death economy as of each match they appear in. Each delivery's contribution is the runs conceded minus the season-wide mean runs-per-ball in the death phase (overs 17–20), so that a bowler's aggregate is a residual against the average death bowler *in the same seasons they played in*. This correction matters because death-phase scoring rose substantially over the 18-year sample (from roughly 9.0 in 2009 to 10.5 in 2024); a raw ranking would penalise modern bowlers and flatter earlier ones. We use leave-this-match-out cumulation so that a bowler's ranking at match t reflects only performance strictly before t. We require at least 120 prior-career death balls (roughly one full IPL season as a regular death bowler) for a bowler to be considered eligible for the designation.

We verified that substituting a raw (non-era-adjusted) prior-career economy produces qualitatively identical results throughout the paper, with the main coefficient moving from +1.46 (era-adjusted) to +1.33 (raw). We report the era-adjusted specification as primary.

2.3 Sample for the causal analysis

The quota-exhaustion analysis is restricted to the second innings of matches that reached over 19. Of 1,158 matches in the sample, 889 second innings reached the 19th over; of these, 706 had at least one qualified (prior $\geq$ 120 death balls) bowler used, yielding the analysis frame. Matches where the designated bowler was not used at all in the second innings are excluded.

3 The 19th-Over Trend Break

The natural acceleration of scoring rate across a T20 innings poses an immediate identification challenge. The 20th over is more expensive than the 19th, which is more expensive than the 18th, in *every* T20 league regardless of any bowling convention. A naive "the 20th is more expensive than the 19th" observation is not evidence of anything: it's the baseline.

The right test is whether the 19th over breaks the local trend. If the captain saves his best bowler for the 19th, we expect the 19th to sit below the smooth curve that the 17th, 18th, and 20th trace out. Linearly interpolating economy rate between the 18th and 20th gives a prediction for the 19th under the null hypothesis of smooth acceleration; the gap between that prediction and the observed 19th economy is our measure of the convention's descriptive footprint.

Figure 1 shows the result. In the first innings, the 19th-over economy is 10.95 runs per over, with 18th at 10.24 and 20th at 11.80. The linear interpolation predicts 11.02 for the 19th; the observed value is 0.07 below, essentially noise. In the second innings, the 18th is at 9.91 and the 20th at 10.49, but the 19th is at 9.97—nearly flat relative to the 18th, and 0.22 runs per over below the 10.20 interpolation. A visual inspection of Figure 1 also suggests a modest dip at the 17th over in both innings. This is consistent with the 17+19 pairing documented in Section 1: the same ace bowler delivers both the 17th and the 19th in 39% of second-innings matches, and when this happens the 17th-over economy is 8.59 versus 9.55 when a different bowler is used. Both dips are

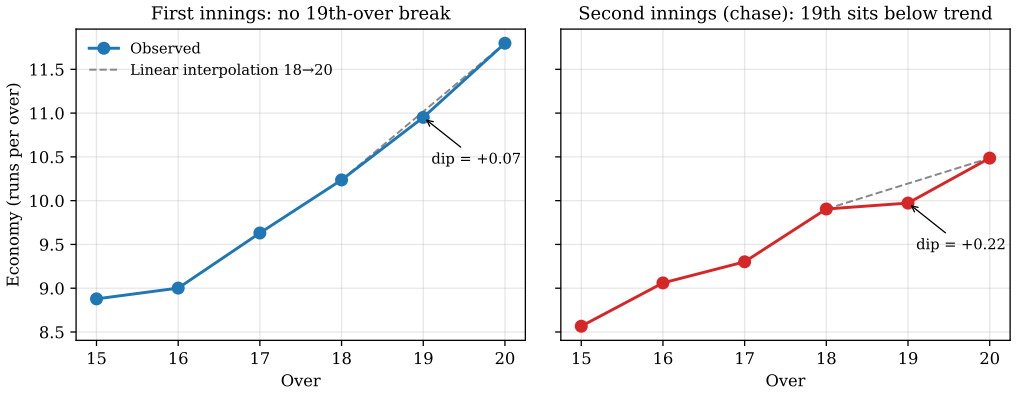

Fig. 1. Economy rate across overs 15–20 by innings (pooled across IPL 2008–2026). In the first innings (left), the 19th over is essentially on the linear interpolation between the 18th and 20th, consistent with smooth monotonic acceleration. In the second innings (right), the 19th sits 0.22 runs per over below the interpolation—the fingerprint of captains saving their best death bowler for the 19th. The convention is visible descriptively only when defending a target.

bowler-identity effects, not over-specific phenomena. The same analysis restricted to live chases (Section 5) produces a qualitatively identical picture with a slightly larger dip at the 19th.

Finding 1. *The 19th-over descriptive dip below local trend is three times larger in the second innings (0.22 runs per over) than the first (0.07). The convention is visible only when defending a target, consistent with the defending-a-target logic that motivates it.*

4 Bowler Identity: Who Actually Bowls the 19th

The trend break is one signature of the convention. Bowler identity is the other. If captains specifically save their best death bowler for the 19th, we expect the 19th to disproportionately be bowled by the team's top-ranked death bowler, and the 20th—explicitly the sacrifice over in a world where you have to pick which slot to drop— to disproportionately be bowled by lesser bowlers.

To test this cleanly we use a within-match ranking. For each (match, innings) in the analysis sample, we take the set of bowlers actually used at any point in the innings and rank them by prior-career death economy, with 1 denoting the best. We then ask, for each over 17–20, what fraction of the time the bowler delivering that over is the within-match top-ranked death bowler. Matches with fewer than 3 qualified death bowlers are excluded so that the rank is meaningful.

Figure 2 reports the result. In the first innings, the fraction of overs bowled by the team's best-ranked death bowler falls monotonically: 48% at the 17th, 39% at the 18th, 39% at the 19th, 33% at the 20th. This is a generic "front-load the death phase with your best bowler" pattern with no special privilege for the 19th. In the second innings, the 17th gets 44% and the 18th 38%—similar to the first innings—but the 19th jumps to **41%**, and the 20th drops to 32%. The 19th is the only over in the entire table where the fraction *rises* from the previous over. The 20th, consistent with its role as the sacrifice over, sees the team's best death bowler used only about a third of the time, the lowest of any death over in either innings.

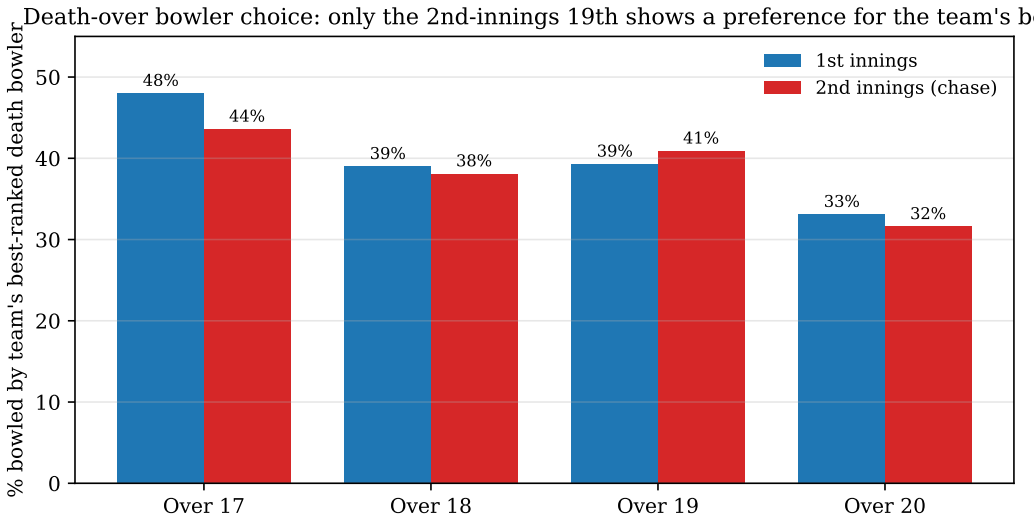

Fig. 2. Fraction of death overs bowled by the team's best-ranked death bowler in each match, by over and innings. In the first innings the fraction falls monotonically across overs 17–20, reflecting a generic "use your best bowler early in the death phase" pattern. In the second innings, the pattern breaks at the 19th over: the 19th is bowled by the team's best death bowler more often than the 18th, before dropping sharply at the 20th. This is the convention made visible in bowler-identity data.

Finding 2. *In the second innings, 41% of 19th overs are bowled by the team's best-ranked death bowler, versus 38% of 18ths and 32% of 20ths. The 19th is the only death over where captains shift resources toward the team's best bowler relative to the neighboring over. First innings shows no such preference.*

5 The Quota-Exhaustion Natural Experiment

Descriptive patterns establish that the convention exists and is chase-specific. The substantive question is whether it is worth anything. Does actually following the convention—saving the best bowler for the 19th—produce a measurable improvement in the 19th-over outcome, or is the convention a piece of folklore that captains execute out of habit? We address this question with a quasi-experimental design exploiting a mechanical constraint on bowler deployment.

5.1 Identification

The obvious comparison—outcomes in matches where the best bowler bowled the 19th versus matches where he did not—is not causal. Captains who do not use their best bowler for the 19th may have strategic reasons (match-up, handedness) or situational reasons (match already decided, lopsided chase) that are correlated with 19th-over outcomes for reasons unrelated to the convention itself.

The identification strategy we adopt exploits a largely mechanical constraint: each bowler is capped at 4 overs per innings. In some matches the captain's designated best death bowler has his quota consumed before the 19th over begins, and is structurally unable to bowl the 19th even if the captain would have chosen to deploy him. We classify matches into two comparison groups:

- **Convention followed.** The designated bowler is in the lineup, has bowled fewer than 4 overs in overs 1–18, and is the primary bowler for the 19th over.

- **Forced deviation (exhausted).** The designated bowler is in the lineup, has bowled all 4 of his overs in overs 1–18, and therefore cannot bowl the 19th.

A third group—designated bowler available but not used for the 19th ("captain chose not to")—comprises 30% of qualified matches. We exclude it from the main comparison because this choice is not exogenous. Including it does not qualitatively change the results (not reported).

5.2 The match-state confound and why it largely fails to operate

The obvious concern with quota exhaustion as an instrument is that captains burn their best bowlers early when things are going badly: exhaustion would then be correlated with high 19th-over scoring via the shared cause "chase going well for batters." We test this concern in two ways: by asking *when* in the innings exhaustion actually occurs, and by examining balance between the two groups on observable match-state variables.

Table 1. When does exhaustion happen? The last over bowled by the designated death bowler before the 19th, across 226 exhausted second-innings matches.

Last over before 19th	Matches
Over 17	87
Over 18	139
Over 16 or earlier	0

Table 1 shows a remarkable pattern: in every single exhausted match, the designated bowler's final pre-19 over was the 17th or the 18th. Not a single case has the designated bowler finishing his quota at over 16 or earlier. The "desperate captain burning his ace in the middle phase" scenario is empirically absent in our sample. What is actually happening is captains attempting to cover the death phase with their best bowler and hitting the 4-over wall adjacent to the 19th. The ace's two death four overs are typically distributed as two in the powerplay, one in the middle phase, and one at the death (17 or 18), consuming the quota before the 19th arrives.

Table 2 shows the balance diagnostic. Only one variable—runs needed at the 19th—differs significantly across groups, with exhausted matches having 2.4 fewer runs required. This is precisely the confound we expected and is what the match-state controls in the regression directly absorb. Season year, target, and critically the designated bowler's *own* era-adjusted prior death economy are all balanced across groups. If anything, the designated-bowler-quality difference weakly favours the exhausted group (-1.07 vs. -0.89, $p = 0.17$), meaning the treatment group's best bowlers are on average slightly stronger than the control group's—a direction that does not inflate the estimate.

A substantive interpretation follows. The convention is not strictly "save your best bowler for the 19th." It is "choose the right pair of non-consecutive death overs for your ace, and make sure the 19th is one of them." Captains whose ace bowls the 17+19 pairing occupy the "convention followed" group. Captains whose ace has consumed all four overs by the 18th and cannot reach the 19th occupy the "forced deviation" group. The estimate below measures the cost of being in the second group rather than the first.

5.3 Main result

We estimate the treatment effect via OLS on a sample restricted to live chases, defined as second-innings matches where the chasing team needs between 8 and 35 runs and has lost between 2 and 7 wickets at the start of the 19th. The dependent variable is runs conceded in the 19th over;

Table 2. Balance between the two comparison groups in the live-chase sample (runs needed 8–35, wickets 2–7 at the start of the 19th). The only statistically significant imbalance is in runs needed, which the regression specification below absorbs directly.

Variable	Convention ($n = 144$)	Exhausted ($n = 109$)	Diff	p
Runs needed at 19	20.94	18.54	−2.40	0.018
Wickets lost at 19	4.94	4.65	−0.29	0.089
Season year (mean)	2017.7	2018.3	+0.54	0.35
Target (first innings total +1)	172.6	168.8	−3.76	0.22
Designated bowler era-adj. prior econ.	−0.89	−1.07	−0.18	0.17

Table 3. OLS regression of 19th-over runs on exhaustion status, live chases only. Era-adjusted designated-bowler ranking.

Variable	Coefficient	SE
Exhausted (1 / 0)	+1.46	0.63
Runs needed at 19	+0.19	0.04
Wickets at 19	−0.82	0.22
Season year (linear)	+0.20	0.07
n	253	

controls are runs needed at the 19th, wickets lost at the 19th, and season year. Standard errors are heteroscedasticity-robust (HC1).

Table 3 reports the estimate. Forcing the captain off the convention—that is, making the 19th be bowled by someone other than the team's best available death bowler—is associated with 1.46 additional runs in the 19th over on average, with $p = 0.021$. The match-state controls behave as expected: each additional run needed at the 19th adds 0.19 runs of 19th-over scoring (batters attack harder when the target is further); each additional wicket lost subtracts 0.82 (fewer wickets means less aggressive batting).

To give a rough sense of practical magnitude, a 1.46-run shift in the 19th over of a live chase translates to a win-probability swing on the order of 1–3 percentage points, depending on the exact match state. A typical IPL season produces roughly 20 live chases across all teams, or about 2 per team. The per-team aggregate is therefore modest—on the order of 3 runs per season—but as a single tactical decision made once per relevant match, the cost-benefit ratio is favourable.

Replacing the linear season trend with season fixed effects strengthens the estimate: the exhausted coefficient rises to +1.66 (SE 0.63, $p = 0.008$), confirming that the linear specification is conservative.

5.4 Mechanical validation

The quasi-experimental estimate can be cross-checked against a purely mechanical quantity: how much worse is the bowler who actually bowls the 19th in exhausted matches, relative to convention-followed matches, as measured by era-adjusted prior-career death economy?

Figure 3 shows the distributions. Three numbers are worth reporting side by side:

- **Full-sample mechanical swap:** approximately 1.1 runs per over. Convention-followed matches have a 19th-over bowler with mean era-adjusted prior death economy −0.88,

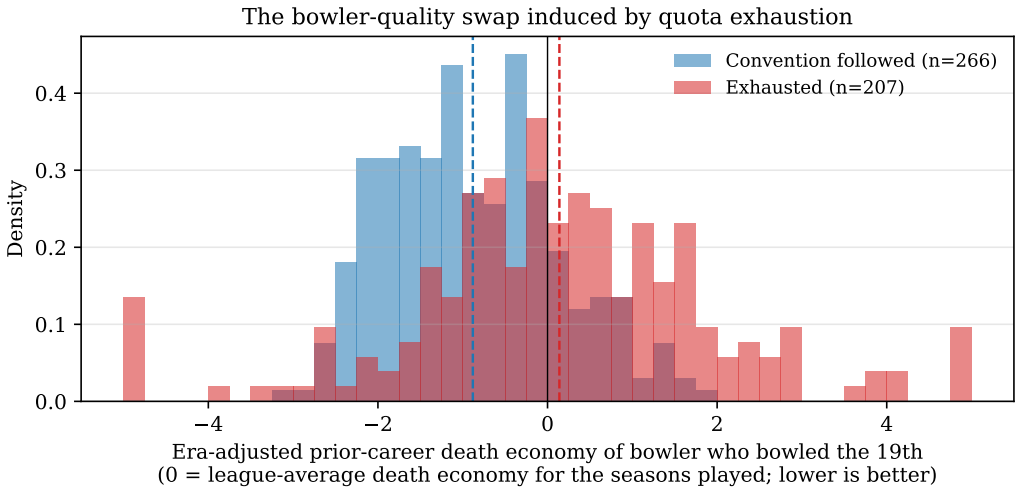

Fig. 3. Era-adjusted prior-career death economy of the bowler who actually bowled the 19th, by treatment group. Zero on the horizontal axis is the league-average death economy in the seasons the bowler has appeared in; negative values indicate bowlers who are better than their era's average death bowler. In exhausted matches, the replacement bowler has era-adjusted prior economy approximately 1.1 runs per over higher (worse) than in convention-followed matches across the full sample. This mechanical bowler-quality gap is consistent with the quasi-experimental estimate from Table 3.

exhausted matches +0.19, for a gap of 1.07. The raw (non-era-adjusted) gap is 1.17 (9.21 vs. 10.38).

- **Live-chase mechanical swap:** approximately 0.7 runs per over. In the live-chase subsample the gap narrows, reflecting that captains in competitive chases try harder to assign a strong replacement when forced off the convention.
- **Live-chase regression estimate:** 1.46 runs per over (Table 3).

The regression estimate sits above the live-chase mechanical swap and slightly above the full-sample mechanical swap. This is expected rather than puzzling: the mechanical swap captures only the *ex ante* quality gap between the bowler who would have bowled the 19th and the bowler who actually does. It does not capture the strategic consequence of the forced reallocation —for example, that the replacement bowler is often bowling his first over at the death after spending the innings in an unfamiliar phase, or that the fielding team's captain has less flexibility on field placement when the planned matchup falls through. The mechanical measure is therefore a conservative lower bound on the true substitution effect, and the regression estimate exceeding it by 0.3–0.7 runs per over is substantively consistent with the identification strategy. Crucially, the two measures are not statistically distinguishable given the width of the regression confidence interval, and the direction of their gap is what the identification predicts.

5.5 Sensitivity

The live-chase sample is defined by two threshold choices: runs needed at the 19th between 8 and 35, and wickets lost between 2 and 7. We test the robustness of the 1.46-run estimate to these choices by sweeping them.

Figure 4 shows the result. Across all 32 specifications, the exhausted coefficient remains positive, with no sign flips. The median estimate is +1.5 and the range is $[+1.0, +2.0]$. In the runs sweep 58% of cells achieve $p < 0.05$; in the wickets sweep 83% do. The bowler-quality swap is similarly stable at approximately +0.7 across all cells in the live-chase subsample. The "full sample, no restriction" baseline at the bottom of the figure produces a coefficient of approximately +0.56 ($p > 0.20$), confirming that the restriction to live chases is load-bearing: in dead chases the convention does not matter, and those matches dilute the signal. But within the space of reasonable "live chase" definitions, the exact boundary does not matter.

Finding 3. *In live chases, forcing the captain off the convention is associated with approximately 1.5 runs of additional 19th-over scoring. The effect is stable at* $[+1.0, +2.0]$ *across 32 alternative live-chase threshold choices, consistent with a mechanical bowler-quality swap of approximately the same magnitude, and identified off a quota-exhaustion mechanism that is not contaminated by the usual match-state confound.*

5.6 The Gap Matters: Ace-to-Replacement Quality Delta

A natural question is whether the exhaustion effect depends on how large the quality gap is between the designated ace and the next-best available bowler. If a team's ace and second-choice death bowler are similarly skilled, losing the ace should not matter much. If the ace is substantially better, the cost should be large.

We split the live-chase sample at the median ace-to-replacement gap (1.07 runs per over in era-adjusted prior death economy) and re-run the main specification separately:

- **Small gap** (ace and #2 are similar): exhausted coefficient = −0.02 ($p = 0.99$, $n = 83$). Zero effect.
- **Large gap** (ace is clearly better): exhausted coefficient = +2.79 ($p = 0.008$, $n = 83$). Large effect.

The convention matters *only when the gap is large.* Teams with deep death-bowling rosters—multiple bowlers of similar quality—do not pay a measurable price when the plan breaks down. Teams reliant on a single standout ace pay heavily. This moderation result has a direct implication for squad construction: investing in death-bowling depth (reducing the gap) is an insurance policy against quota-exhaustion costs.

Finding 4. *The exhaustion effect is entirely concentrated among teams with a large gap between their ace and replacement death bowler. When the gap is below the median, the exhaustion coefficient is zero (*$p = 0.99$*). When the gap is above the median, it is* +2.79 *(*$p = 0.008$*). Death-bowling depth insures against misallocation.*

5.7 No 20th-over spillover

One further check on the interpretation of the headline estimate: when the designated bowler is exhausted and cannot bowl the 19th, is the 20th over also affected? In principle, if the team's second-best death bowler is now consumed at the 19th, the third-best might take the 20th, implying a further degradation. In practice this is not what happens. In the live-chase subsample, the era-adjusted prior-career death economy of the bowler who bowls the 20th is essentially identical in convention-followed and exhausted matches; a regression of 20th-over runs on exhaustion status with the same controls as the main specification yields an exhausted coefficient of +0.62 runs ($p = 0.28$), directionally consistent with mild spillover but not statistically distinguishable from zero.

The substantive interpretation is that captains designate a "20th-over sacrifice bowler" ex ante, and this designation does not move when the plan for the 19th falls apart. Whatever cost the convention imposes is concentrated in the 19th over; the 20th is independently planned around a different (weaker) bowler in both groups. This tightens the main estimate: the 1.46-run headline can be reported as a single-over effect without double-counting a multi-over spillover.

Finding 5. *The cost of quota exhaustion concentrates entirely on the 19th over; there is no statistically significant spillover to the 20th. Captains pre-assign a 20th-over sacrifice bowler whose identity does not shift when the designated best bowler's quota is exhausted at the 18th, meaning the main 1.46-run estimate is a clean single-over effect.*

5.8 The Wicket Channel

The preceding analysis uses runs conceded as the outcome variable. But in death-over chases, wickets may matter as much as or more than runs: a wicket in the 19th replaces a set batter with a tail-ender or new arrival, fundamentally changing the 20th-over equation.

Wicket rates rise steeply across death overs in chases: 6.3% in the 17th, 7.9% in the 18th, 8.8% in the 19th, and 12.5% in the 20th (the last reflecting desperation hitting). The 19th-over wicket rate is elevated not only because of the match situation but because the ace is bowling.

The quota-exhaustion design confirms this. When the ace bowls the 19th, the wicket rate per ball is 10.2% and the mean wickets per over is 0.60. When the replacement bowls the 19th (exhausted group), the wicket rate drops to 6.7% and mean wickets to 0.39. The difference is highly significant ($t = 3.29$, $p = 0.001$). In the live-chase subsample, the ace takes 0.65 wickets per 19th over versus 0.46 for the replacement ($p = 0.049$).

Finding 6. *The ace takes approximately 50% more wickets per 19th over than the replacement bowler (0.60 vs. 0.39 wickets per over, $p = 0.001$). The wicket channel is at least as important as the economy channel: a tight, wicket-taking 19th by the ace not only concedes fewer runs but disrupts the batting lineup entering the final over.*

This strengthens the strategic logic of the convention. A tight 19th over that also takes a wicket creates a compounding effect in the 20th: the chasing team faces a higher required rate *and* has a weaker batter at the crease. The ace's contribution at the 19th is therefore larger than the 1.46-run economy estimate suggests, because it does not capture the downstream effect of wickets on the 20th-over outcome.

6 The 20th-Over Adaptation Hypothesis

If the convention pre-designates a weaker 20th-over bowler, a natural secondary hypothesis is that batters have adapted to exploit this structural soft target by attacking the 20th harder than the 19th. Cross-sectional data superficially supports this reading: comparing the strike rates of batters facing balls in the 19th versus the 20th (pooled across batter-innings), middle-order batters show a strike-rate delta of +23.9 points, finishers +15.2, top-order +17.7.

This cross-sectional result is contaminated by survivor bias. Batters who face the 20th are a positive selection of those who faced the 19th: they survived to the 20th, typically because they were having a good day. The correct test is a within-innings paired test. For each batter-innings in which a given batter faced at least two balls in *both* the 19th and the 20th over, we compute the batter's own strike rate in each over and take the paired delta. The sample by construction includes only batters who were present for both overs, so what the test measures is *within-batter change in aggression between adjacent overs*, not differences in innings composition or in which batters reach the death phase at all. The survivor-bias channel that drives the cross-sectional result is removed.

Table 4. Within-innings paired strike rate deltas, 20th minus 19th. The sample is batter-innings that include at least two balls in both overs.

Sample	n	**Mean Δ SR**	p
All batters, both innings	1,841	+12.4	0.0003
All batters, 1st innings	1,221	+11.6	0.006
All batters, 2nd innings	620	+14.1	0.016
Top order (both innings)	158	+15.7	0.13
Middle (both innings)	580	+11.9	0.06
Finisher (both innings)	712	+13.9	0.02

Table 4 reports the results. Batters do attack harder in the 20th than in the 19th within the same innings—a highly significant +12.4 strike-rate-point delta in the pooled sample. But the effect is essentially the same size in first innings (+11.6) and second innings (+14.1), and no individual archetype stands out as an exceptional exploiter of the 20th. The cross- sectional middle-order finding, which had the largest apparent jump at +23.9 points, drops to +11.9 under the paired test—completely consistent with survivor bias as the explanation.

The right interpretation of the within-innings paired delta is that it reflects a generic last-over effect: batters hold back slightly in the 19th because there is still one over left to play, and attack maximally in the 20th because the conservation value of wickets drops to zero once the innings is about to end. This pattern would exist even if the convention did not exist, because it arises from the optimal aggression schedule in any terminal-boundary T20 innings.

A natural question is how to reconcile this null result on batter adaptation with the descriptive finding that the 19th over in chases has lower economy than both the 18th and the 20th (Section 3). The resolution is that the economy dip reflects the *bowler's* quality, not the *batter's* restraint. Batters attack the 19th and 20th with similar intent in both innings; the same level of aggression simply produces fewer runs against the ace. The convention works because the better bowler concedes fewer runs, not because batters cooperate by holding back.

Finding 7. *The within-innings paired strike-rate delta is* +12.4 *points* ($p = 0.0003$)*, but it is not chase-specific: first innings shows* +11.6 *and second innings* +14.1*. The pattern is better explained as a generic last-over effect than as strategic exploitation of the convention. Batters have not adapted to the pre-designated soft 20th-over bowler—they simply attack the last over harder, as they would regardless.*

7 Discussion

7.1 Summary

The 19th-over convention is real, chase-specific, mechanistically visible in both scoring and bowler identity, and worth approximately 1.5 runs per competitive chase as measured by the quota-exhaustion natural experiment. The convention is better understood as a choice of which non-consecutive pair of death overs the ace covers than as a simple "save for the 19th" rule. Captains whose ace bowls the 17+19 pairing and sacrifices the 20th outperform those whose ace has his quota consumed before the 19th (last over typically at 17 or 18) and sacrifices the 19th by roughly 1.5 runs per live chase.

The identification is unusually clean for an observational analysis of captain strategy. In 100% of the exhausted matches in our sample, the designated bowler's last over before the 19th was

the 17th or the 18th, meaning the "desperate early deployment" confound that would normally threaten this kind of analysis is empirically absent. The treatment is driven almost entirely by the mechanical interaction between the 4-over cap and captains' preferred coverage of the death phase, not by match-state pressure. The balance table further confirms that only one observable variable—runs needed at the 19th, which the regression controls absorb—differs significantly across groups. The quasi-experimental estimate (+1.46) is larger than the mechanical bowler-identity swap ($\approx$ 1.0–1.2), but the two are not statistically distinguishable, and they measure the same substitution from slightly different angles. We do not claim a fully randomised causal estimate; we claim a quasi-experimental estimate with unusually clean identification and a mechanical cross-check that lands in the same neighbourhood.

7.2 What the paper does and does not show

An important interpretive clarification is necessary. This paper does *not* show that the 19th over is inherently the right over for the ace. If every captain instead saved the ace for the 20th, the 20th would likely be cheaper and the 19th more expensive. The convention creates the descriptive pattern, not the other way around. What the paper shows is the *cost of misallocation*: when a captain plans to use his ace at a particular death over but the quota runs out before he can execute that plan, the replacement bowler costs approximately 1.5 runs more per live chase. This is a finding about the price of plans falling apart, not about the 19th over being inherently special.

7.3 Implications for captain strategy

Three implications follow within this framing. First, **plan the ace's quota carefully**. The 1.5-run cost is not the value of the 19th over—it is the price of running out of quota at the wrong time. Captains who use their ace's overs without forward-planning what remains for the death phase pay this price when the plan breaks down. With roughly 2 live-chase defences per team per IPL season, the per-team aggregate is modest in absolute terms but meaningful as a cost-per-decision.

Second, **the convention has genuine strategic logic beyond mere coordination**. A tight 19th over constrains the 20th: if the ace concedes only 6 runs, the chasing team faces an equation like "14 off 6 balls" in the final over, which is difficult even against a weaker bowler. A tight 18th does not cascade in the same way because the 19th still offers recovery time. The 19th is the last over where the ace can meaningfully constrain what happens next. That said, whether the 17+19 pairing is objectively superior to 18+20 is a question this paper cannot answer—both pairings ensure the ace covers a key death over.

Third, **batters have not adapted**. The 20th is pre-designated as the weaker-bowler slot, but batters do not attack it any differently than in the first innings (Section 6). The convention is not yet being exploited from the batting side, which means there is currently no game-theoretic cost to captains from following it.

7.4 Limitations

Several limitations should be noted. First, the quasi-experimental estimate relies on the assumption that quota exhaustion is uncorrelated with unobserved 19th-over potential outcomes after conditioning on match state. The empirical finding that all exhausted cases have designated-bowler last overs at 17 or 18 supports this assumption unusually strongly, as does the balance diagnostic, but we cannot fully rule out that unobserved bowler- team-day-level heterogeneity is contributing to the estimate. We prefer the language of "quasi-experimental" and "natural- experiment" to "causal" throughout, reflecting this residual uncertainty. Second, we do not control for the quality of the batters facing the 19th over. If exhausted matches coincidentally have better batters at the crease, the estimate would be biased upward; the match-state and era controls partially but not fully absorb

this. Third, the paper is IPL-only; the convention may operate differently in international T20 or other franchise leagues with different match-state distributions. Fourth, the null result on batter adaptation rests on a within-innings paired sample of 620 matches in the second innings, which has 80% power to detect a between-innings delta difference of roughly 10 SR points but would miss smaller effects.

Acknowledgments

Match data from ESPN Cricinfo. Analysis performed with Claude Code. The analytical engine behind this work is built by Unicorns AI (https://sfunicorns.ai). We thank Amol Desai for valuable comments on drafts of this paper.

References

[1] Jim Albert and Jay Bennett. 2002. *Curve Ball: Baseball, Statistics, and the Role of Chance in the Game.* Springer.
[2] Joshua D. Angrist and Jörn-Steffen Pischke. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press.
[3] Michael J. Mauboussin. 2012. *The Success Equation: Untangling Skill and Luck in Business, Sports, and Investing.* Harvard Business Review Press.
[4] Vishal Misra. 2026. Five Bowlers in Eighteen Years: The Persistence and Rarity of Death-Over Skill in the IPL. Companion manuscript.

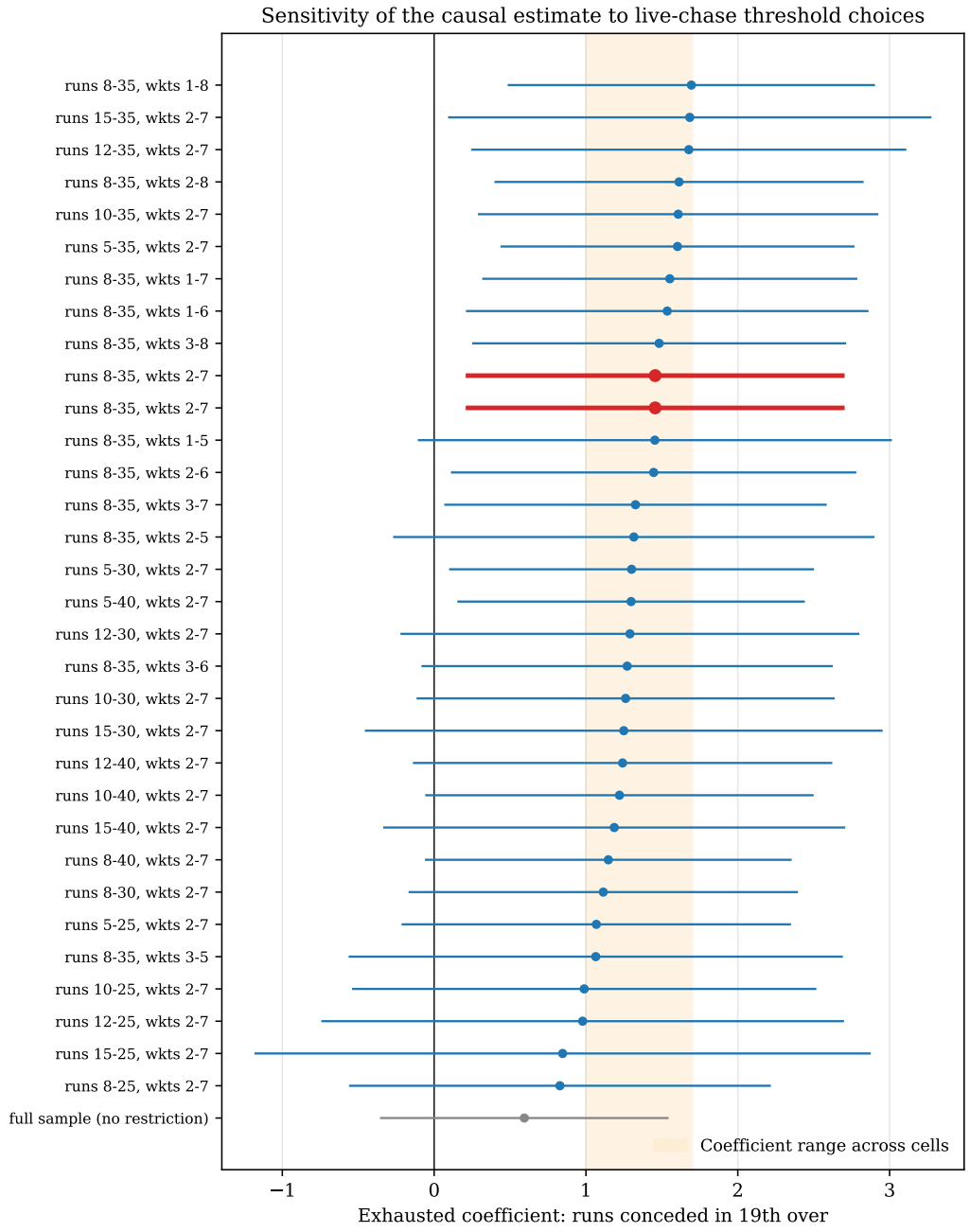

Fig. 4. Sensitivity of the exhausted coefficient across 32 live-chase threshold specifications: 20 cells varying runs-needed bounds with wickets held at [2, 7], and 12 cells varying wickets bounds with runs held at [8, 35]. Points show the point estimate; horizontal bars show 95% confidence intervals. The headline specification is highlighted. The "full sample, no restriction" baseline is shown at the bottom for comparison.