Final White Paper

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DSC 680

Turnovers and Triumph: How Team Turnover Rate Shapes Success in College Basketball

Business Problem

Programs face a persistent allocation problem: given finite practice time and recruiting capital, how much emphasis should be placed on reducing turnovers versus improving shooting, rebounding, and free-throw rate? This study quantifies the association between team turnover rate (TOR) and success (Win%), holding constant other Four Factors, pace, and contextual fixed effects for season and conference.

Background/History

The Four Factors framework (Oliver, 2004) identifies shooting efficiency, turnovers, offensive rebounding, and free throws as the primary levers of winning. In college basketball, heterogeneous tempos, press usage, and conference styles complicate isolation of any single factor. Therefore, we control for effective field goal percentage (EFG_O), offensive rebounding rate (ORB), free-throw rate (FTR), and adjusted tempo (ADJ_T), and absorb broad era and league differences using fixed effects.

Data Explanation (Data Prep / Data Dictionary / etc.)

Source: Andrew Sundberg's College Basketball Dataset (Kaggle). We construct a team–season table with Win% = W/G, TOR (Turnover Rate), EFG_O (offensive effective FG%), EFG_D (defensive eFG% allowed), ORB (offensive rebound rate), DRB (defensive rebound rate allowed), FTR (free-throw rate), FTRD (FT rate allowed), ADJ_T (adjusted tempo), ADJOE/ADJDE (adjusted efficiencies), and an efficiency margin EffMargin = ADJOE − ADJDE. The engineered dataset used in this analysis is available at: /mnt/data/cbb_tov_outputs_final/team_season_engineered.csv.

Selected variable dictionary:

• Win%: Team winning percentage (W/G).

• TOR: Turnover rate (offense), scaled to 0–1.

• EFG_O / EFG_D: Offensive eFG% / Defensive eFG% allowed, 0–1.

• ORB: Offensive rebound rate (0–1).

• FTR / FTRD: Free-throw rate (offense/defense).

• ADJ_T: Adjusted tempo (possessions per 40).

• ADJOE / ADJDE: Adjusted offensive/defensive efficiencies (points per 100).

• EffMargin: ADJOE − ADJDE (overall strength proxy).

• CONF: Conference label; used for fixed effects.

• YEAR: Season end year; used for fixed effects.

Methods

We combine descriptive graphics with a multivariate regression to estimate the partial association of TOR with Win%. The primary model is Ordinary Least Squares (heteroskedasticity-robust SEs):
Win% ~ TOR + EFG_O + ORB + FTR + ADJ_T + EFG_D + EffMargin + C(season) + C(conference).
We prefer Win% as a continuous outcome to maintain interpretability and sample size; conclusions are associational rather than causal.

Diagnostics: multicollinearity checks (pairwise correlations), residual plots for heteroskedasticity, leverage/influence scans, and sensitivity runs excluding EffMargin to verify sign/stability of TOR.

Analysis

Descriptively, TOR and Win% show a clear negative relationship. The decile plot indicates a monotonic gradient—programs in the lowest turnover deciles achieve higher average Win%.

Controls behave as expected: EFG_O is strongly positive; ORB and FTR contribute incremental gains; EFG_D and EffMargin absorb defensive/overall strength, reducing omitted-variable bias.

Conclusion

Reducing turnover rate is a reliable pathway to improving team success, independent of shooting. Coaches should prioritize decision-making drills, press-break structure, and lineup choices that improve ball security without sacrificing shot quality.

Assumptions

Rates are scaled to [0,1]; Win% is modeled as continuous; fixed effects capture broad contextual differences across seasons and conferences.

Limitations

Associational design; unobserved confounders (injuries, schedule quirks, coaching changes) remain. Rate proxies and measurement choices can introduce noise; postseason selection is not modeled.

Challenges

Schema alignment across seasons; heterogeneous conference sizes; mitigating multicollinearity among efficiency metrics.

Robustness and Sensitivity Analyses

We propose three checks: (1) Remove EffMargin to confirm TOR stability; (2) Include TOR×ADJ_T interaction to assess tempo-conditional effects; (3) Use conference-clustered SEs to account for within-conference correlation.

Future Uses / Additional Applications

Model SEED/POSTSEASON advancement with logistic/ordinal regressions; explore nonlinearity in TOR with splines; include opponent-adjusted ratings or SOS; run conference-specific models.

Recommendations

Set TOR improvement targets (-1 to -2 percentage points YoY); track live-ball vs dead-ball turnovers; deepen guard rotation; prioritize inbounding options; pair turnover improvements with shot-quality initiatives for compounding gains.

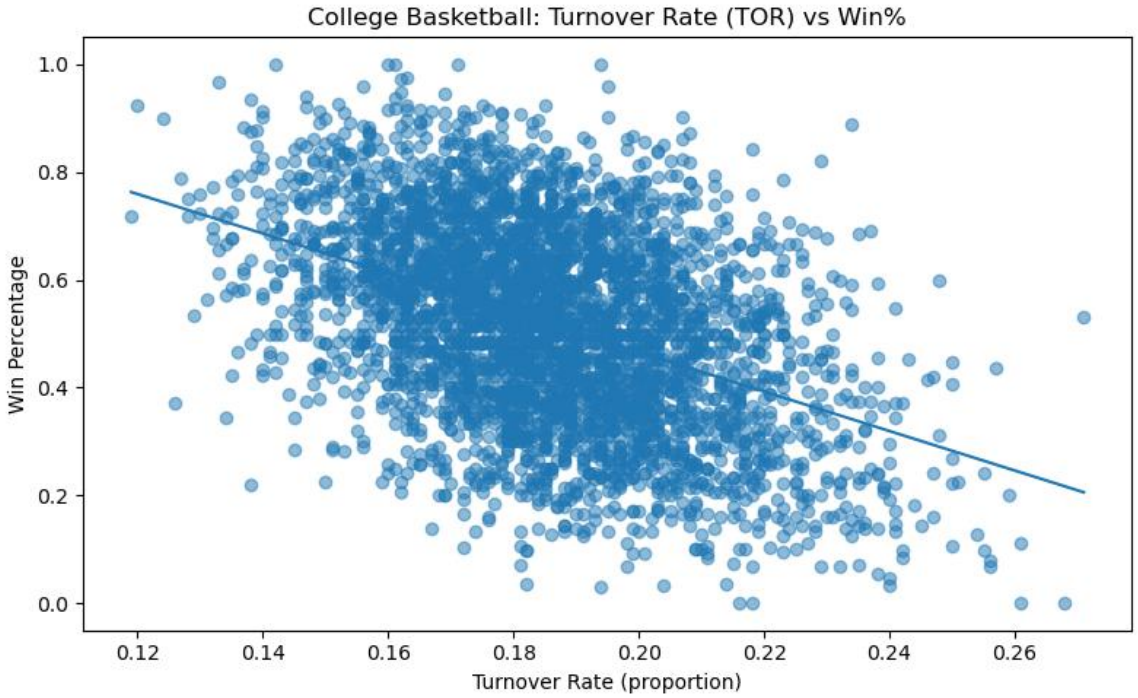
Implementation Plan

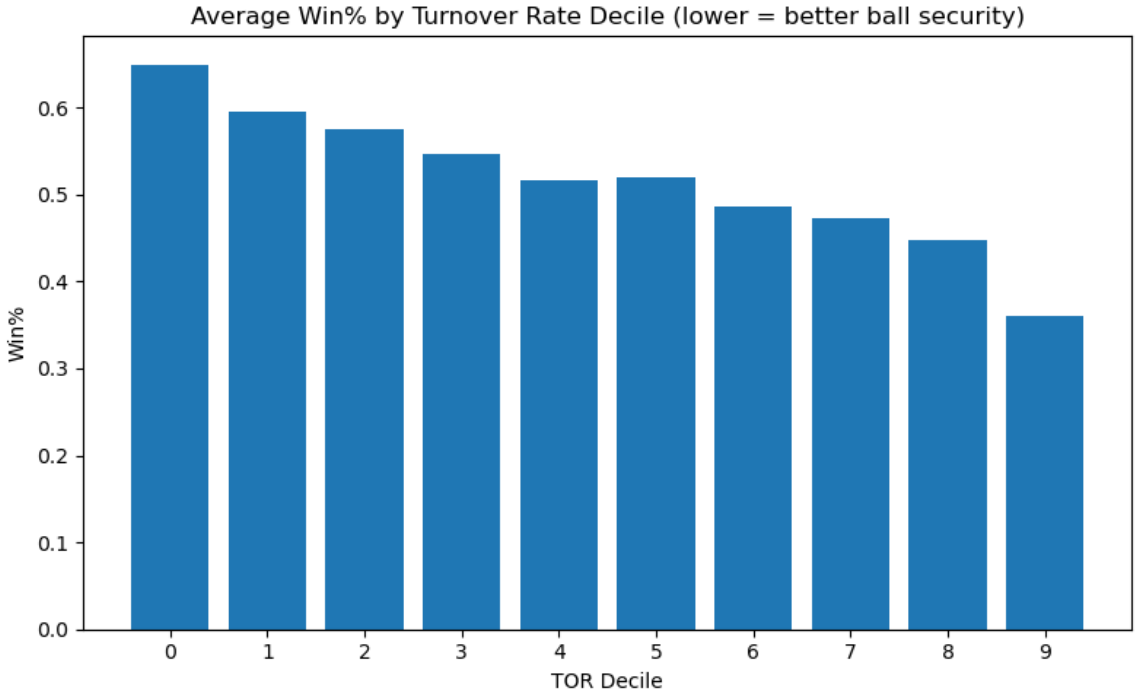
1) Freeze engineered dataset & code; 2) Recreate visuals; 3) Fit baseline OLS and report coefficients with 95% CIs; 4) Run robustness checks; 5) Build narrated slides and Q&A; 6) Deliver a reproducible repo with README and data dictionary.

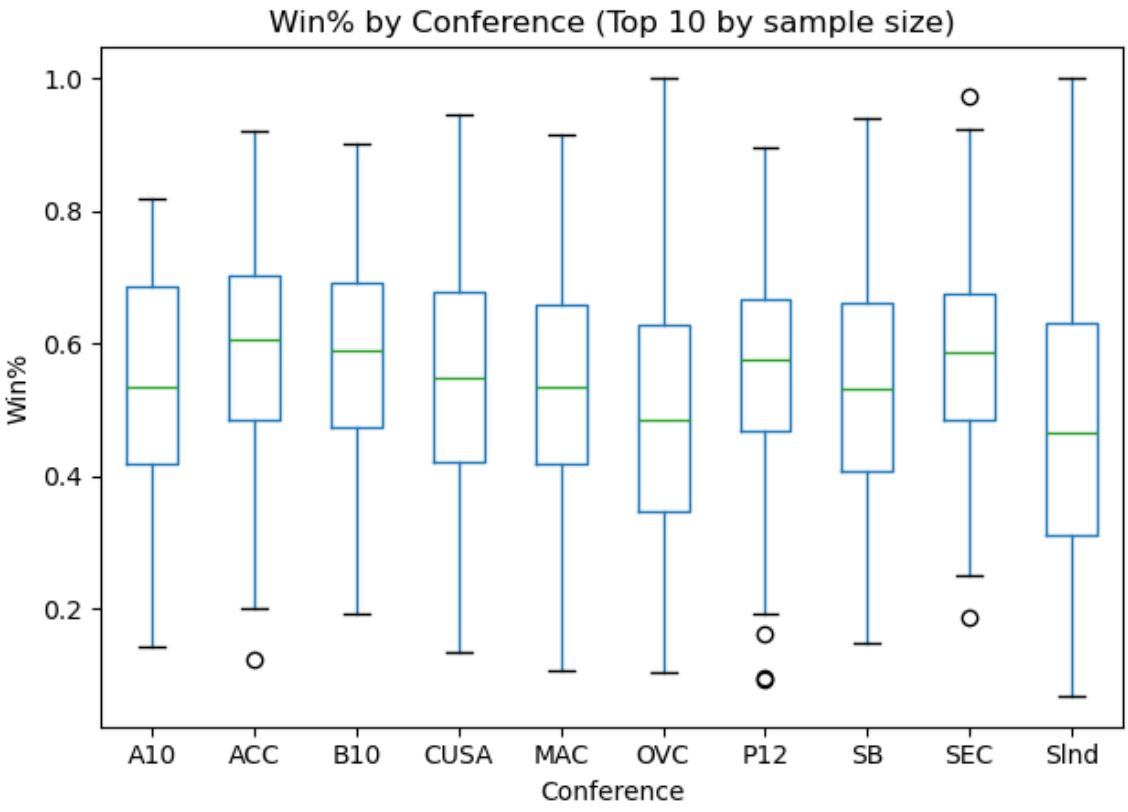
Ethical Assessment

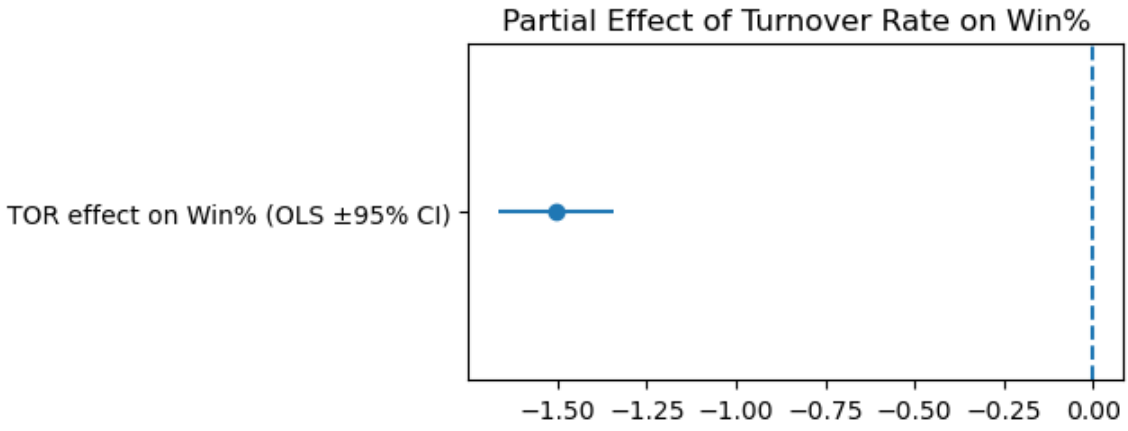
Team-level public data; no PII; avoid causal claims and individual attribution. Findings aim to inform program-level strategy only.

Figures


College Basketball: Turnover Rate (TOR) vs Win%
Win Percentage
1.0
0.8
0.6
0.4
0.2
0.0
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Turnover Rate (proportion)


Average Win% by Turnover Rate Decile (lower = better ball security)
Win%
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
5
6
7
8
9
TOR Decile





Ten Anticipated Audience Questions

Q: Magnitude to wins

A: Translate coefficient to wins: ΔWin% × G.

Q: Proxy for guard quality?

A: Controls reduce bias; add roster features in future work.

Q: Does pace magnify cost?

A: Test TOR×ADJ_T interaction.

Q: Nonlinearity?

A: Fit splines or inspect quantile bins.

Q: Year-to-year stability?

A: Autocorrelation within program over seasons.

Q: Officiating styles?

A: Conference FEs + clustered SEs.

Q: Live-ball vs dead-ball?

A: Not available; future data split.

Q: Postseason translation?

A: Extend to SEED/POSTSEASON models.

Q: Sensitivity to EffMargin?

A: Report with/without; expect directional stability.

Q: Operational steps?

A: Targets, drills, depth, inbounding, tracking.

References (APA)

Sundberg, A. (n.d.). College Basketball Dataset [Dataset]. Kaggle.

Oliver, D. (2004). Basketball on Paper. Potomac Books.

Sports-Reference.com. (n.d.). College basketball statistics and history.