ICC MEN'S T20 WORLD CUP 2024 POWERPLAY ANALYSIS

A dive into T20 World Cup 2024 Opening Overs

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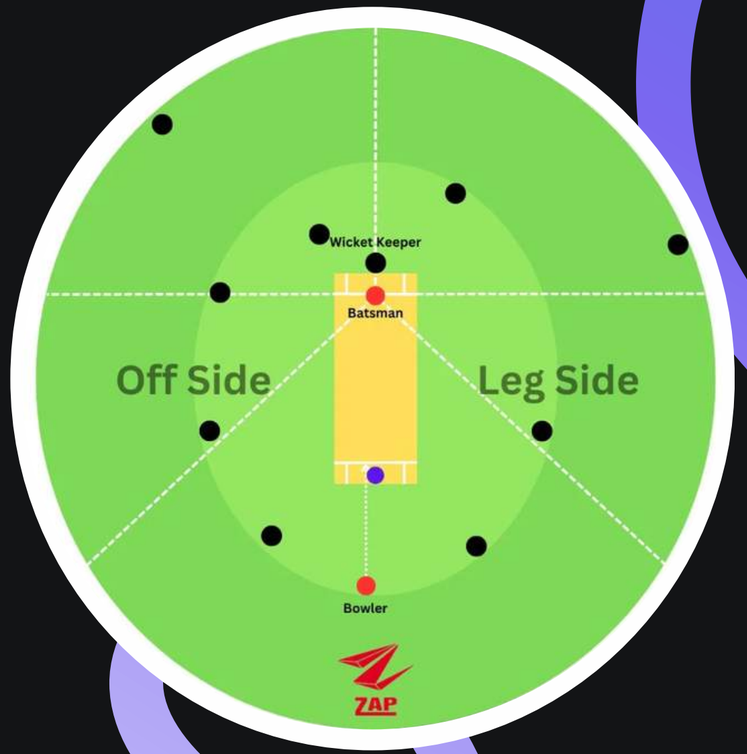
Powerplay(PP)

- 1 over = 6 deliveries
- Powerplay = 6 overs = 36 deliveries
- Total match overs = 20 overs = 120 deliveries

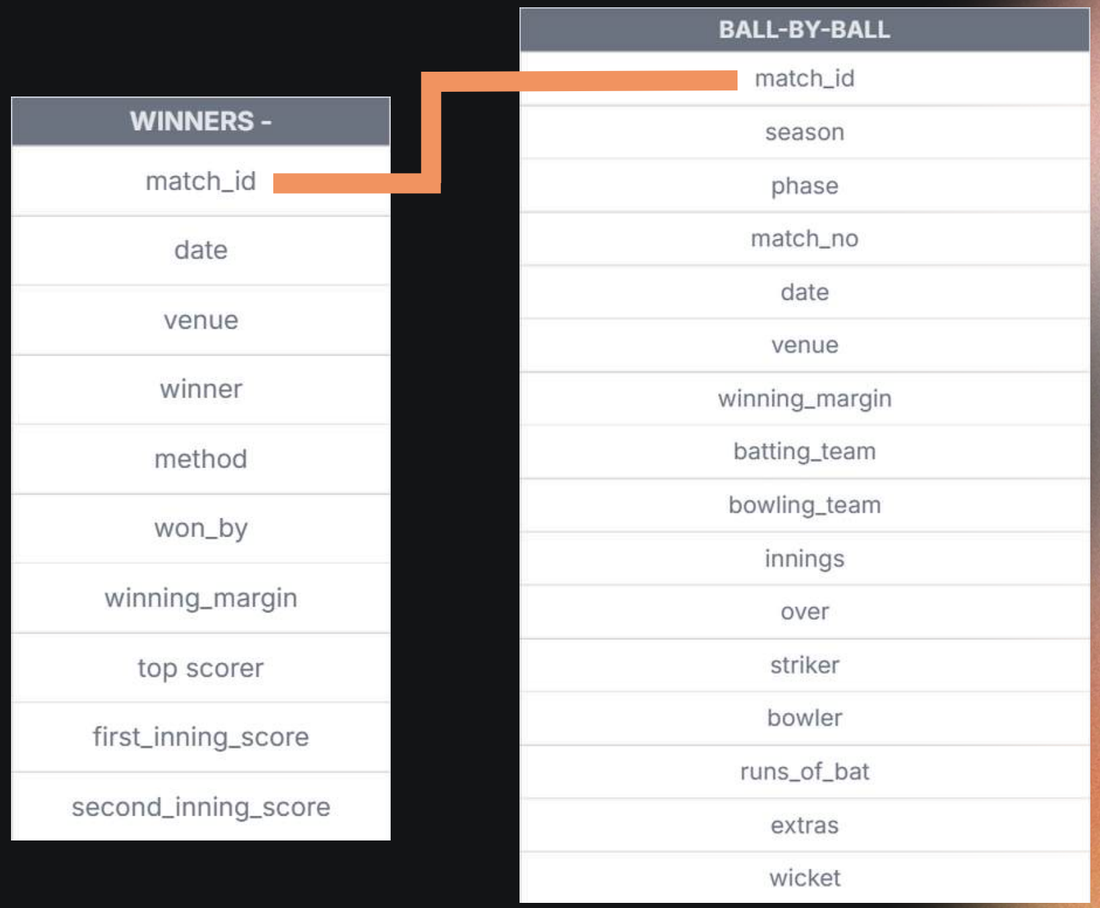
Why powerplay analysis?

- Field restriction: only 2 fielders can be outside of the inner circle
- More chances of scoring for batting side
- Higher chance of restricting runs for bowling side



Dataset

- Indexed **scores** data to include only 6 overs
- Removed invalid matches to include only matches with innings < 1 or innings >2
- Removed duplicate deliveries

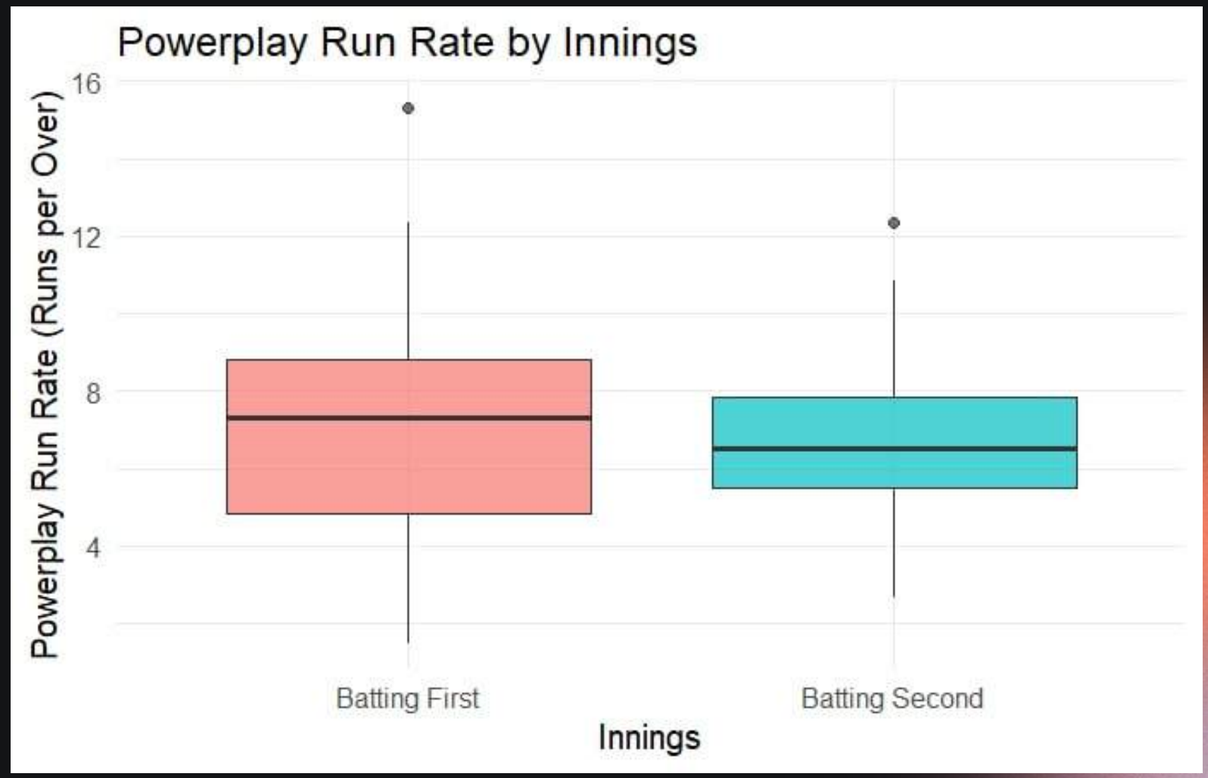


Powerplay Runrate By Innings

Powerplay Run Rate is calculated as

$$\text{Run Rate} = \frac{\text{Total Runs Scored}}{\text{Overs Faced}}$$

For powerplay, overs = 6



Does batting 1st or 2nd effect PPRR?

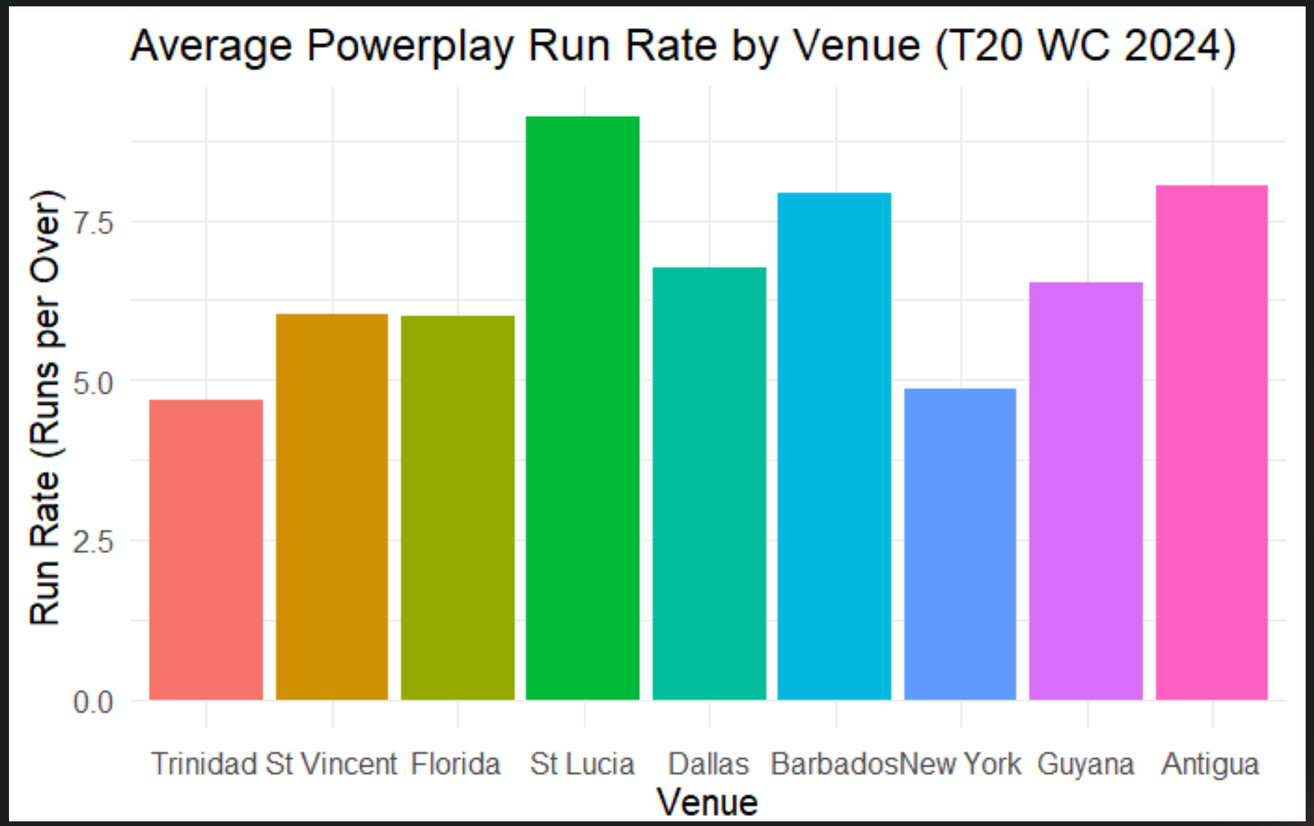
Result

- p-value > 0.05
- We fail to reject the null hypothesis

```
        Welch Two Sample t-test

data:  pp_runrate by innings_label
t = 0.48215, df = 88.258, p-value = 0.6309
alternative hypothesis: true difference in means between group Batting First and group Batting Second is not
equal to 0
95 percent confidence interval:
 -0.7326012  1.2019889
sample estimates:
 mean in group Batting First mean in group Batting Second
                    6.901361                     6.666667
```

PPRR: Does Location Matter?



Does Venue Significantly Impact PPRR?

A highly significant
p-value 0.0000704

We reject the null hypothesis

One-way ANOVA

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
city	8	181.9	22.742	4.685	7.04e-05	***
Residuals	98	475.7	4.854			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Post-hoc test

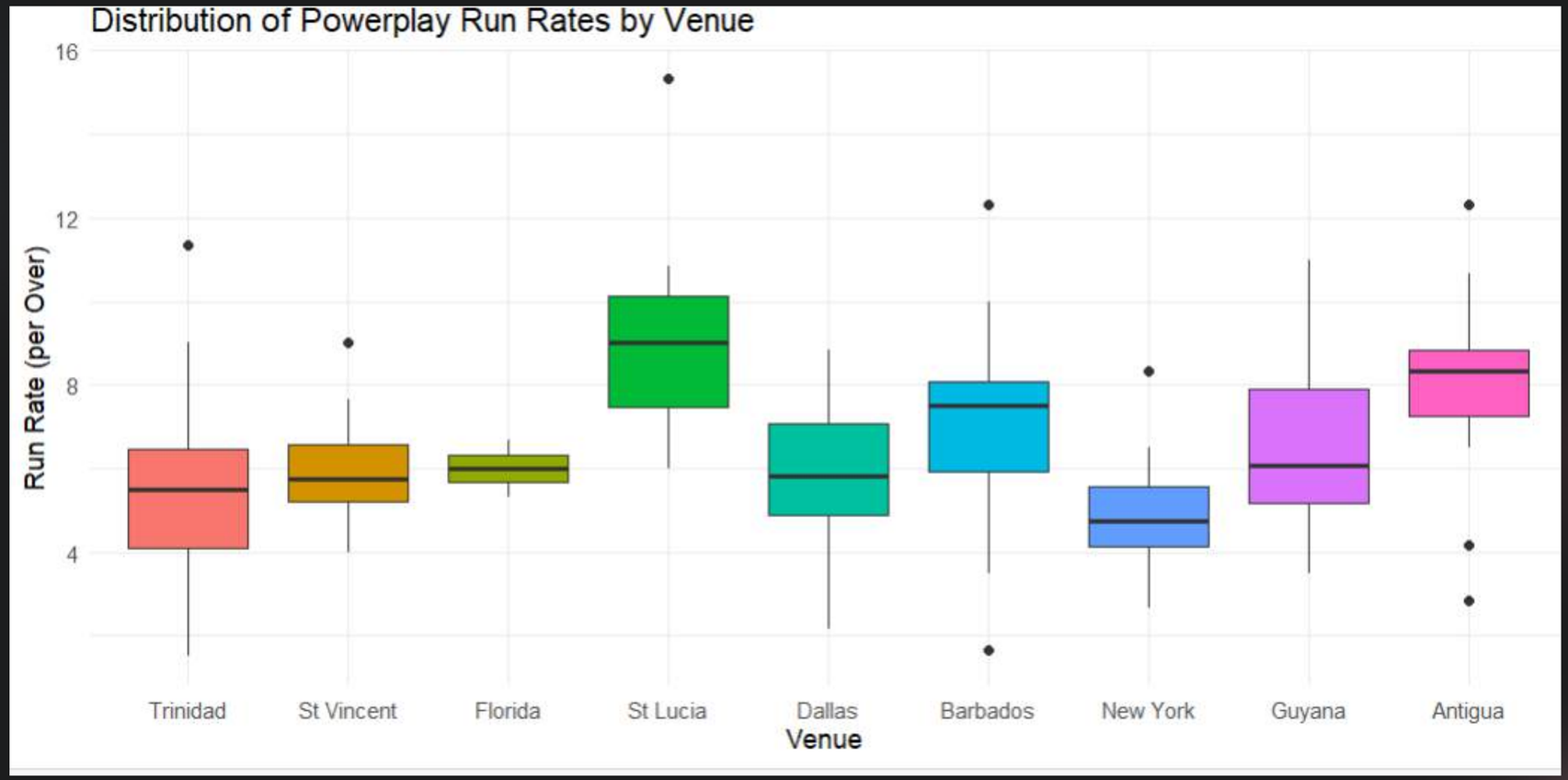
St. Lucia is a significantly higher scoring powerplay venue than Trinidad
p-adj= 0.012

New York shows significantly lower PPRR compared to St. Lucia p-adj = 0.00006

$city

	diff	lwr	upr	p adj
St Vincent-Trinidad	0.31666667	-2.8088054	3.4421387	0.9999964
Florida-Trinidad	0.30000000	-5.1134764	5.7134764	1.0000000
St Lucia-Trinidad	3.43888889	0.4464772	6.4313005	0.0122687
Dallas-Trinidad	0.08333333	-3.0421387	3.2088054	1.0000000
Barbados-Trinidad	1.44912281	-1.2812555	4.1795011	0.7549208
New York-Trinidad	-0.83541667	-3.6526791	1.9818458	0.9899507
Guyana-Trinidad	0.81388889	-2.1785228	3.8063005	0.9943515
Antigua-Trinidad	2.33125000	-0.4860124	5.1485124	0.1899382
Florida-St Vincent	-0.01666667	-5.4301430	5.3968097	1.0000000
St Lucia-St Vincent	3.12222222	0.1298106	6.1146339	0.0339658
Dallas-St Vincent	-0.23333333	-3.3588054	2.8921387	0.9999997
Barbados-St Vincent	1.13245614	-1.5979221	3.8628344	0.9243232
New York-St Vincent	-1.15208333	-3.9693458	1.6651791	0.9298953
Guyana-St Vincent	0.49722222	-2.4951894	3.4896339	0.9998376
Antigua-St Vincent	2.01458333	-0.8026791	4.8318458	0.3713414
St Lucia-Florida	3.13888889	-2.1988708	8.4766486	0.6387090
Dallas-Florida	-0.21666667	-5.6301430	5.1968097	1.0000000
Barbados-Florida	1.14912281	-4.0462710	6.3445166	0.9986666
New York-Florida	-1.13541667	-6.3769926	4.1061593	0.9988521
Guyana-Florida	0.51388889	-4.8238708	5.8516486	0.9999976
Antigua-Florida	2.03125000	-3.2103260	7.2728260	0.9479961
Dallas-St Lucia	-3.35555556	-6.3479672	-0.3631439	0.0161969
Barbados-St Lucia	-1.98976608	-4.5667639	0.5872317	0.2699471
New York-St Lucia	-4.27430556	-6.9431854	-1.6054257	0.0000616
Guyana-St Lucia	-2.62500000	-5.4781526	0.2281526	0.0968468
Antigua-St Lucia	-1.10763889	-3.7765187	1.5612410	0.9240693
Barbados-Dallas	1.36578947	-1.3645888	4.0961677	0.8096495
New York-Dallas	-0.91875000	-3.7360124	1.8985124	0.9814913
Guyana-Dallas	0.73055556	-2.2618561	3.7229672	0.9973157
Antigua-Dallas	2.24791667	-0.5693458	5.0651791	0.2303329
New York-Barbados	-2.28453947	-4.6559014	0.0868225	0.0682595
Guyana-Barbados	-0.63523392	-3.2122317	1.9417639	0.9971286
Antigua-Barbados	0.88212719	-1.4892348	3.2534892	0.9588926
Guyana-New York	1.64930556	-1.0195743	4.3181854	0.5742505
Antigua-New York	3.16666667	0.6957641	5.6375693	0.0030044
Antigua-Guyana	1.51736111	-1.1515187	4.1862410	0.6797481

Comparison of Venues



Analysis of PPRR & PPWT

Hypothesis

How do both a team's Powerplay Run Rate (PPRR) conceded and powerplay wickets taken (PPWT) together influence their chance of winning of the bowling team?

H_0 No association between the two

H_1 There is an association between the two

Analysis of PPRR & PPWT

Preprocessing

- Calculated final team score (FTS) per innings (after 20 overs)
- Count number of wickets taken in powerplay (PPWT)
- Dividing PPRR into 3 categories:

Low	PPRR < 7
Medium	7 ⩽ PPRR ⩽ 9
High	9 < PPRR

	match_id	innings	PPRR	bowling_team	phase.x	winner	winner_flag	stage_type	phase.y	PPRR_cat	PPWL	FTS
1	202401	1	8.333333	USA	Group A	USA	1	Group Stage	Group A	7-9 PPRR	1	194
2	202401	2	6.833333	CAN	Group A	USA	0	Group Stage	Group A	<7 PPRR	1	197
3	202402	1	5.666667	WI	Group C	WI	1	Group Stage	Group C	<7 PPRR	3	136
4	202402	2	8.666667	PNG	Group C	WI	0	Group Stage	Group C	7-9 PPRR	1	137

Analysis of PPRR & PPWT

- **PPRR with Win/Loss**

	Win(1)	Loss(0)
PPRR < 7	10	23
7 ⩽ PPRR ⩽ 9	18	14
PPRR < 9	21	12

- **Statistical Test**

  Chi Square for PPRR category vs win/loss, tells us:
  Whether the chance of winning depends on the PPRR category.

- **PPWT with Win/Loss**

	Win(1)	Loss(0)
PPWT : 0	9	4
PPWT: 1-2	32	26
PPWT: 3+	8	19

- **Statistical Test**

  Chi Square for PPWTcategory vs win/loss, tells us:
  Whether number of wickets taken is related to win/loss.

Analysis of PPRR & PPWT

PPRR and Win/Loss

- p-value is smaller than 0.05
- Statistically significant

```
Using Pearson's Chi-squared Test.

        Pearson's Chi-squared test

data:  contingency_table_main_filtered
X-squared = 8.0758, df = 2, p-value = 0.01763
```

PPWT and Win/Loss

- p-value is smaller than 0.05
- Statistically significant

```
        Pearson's Chi-squared test

data:  table_ppwl
X-squared = 7.0252, df = 2, p-value = 0.02982
```

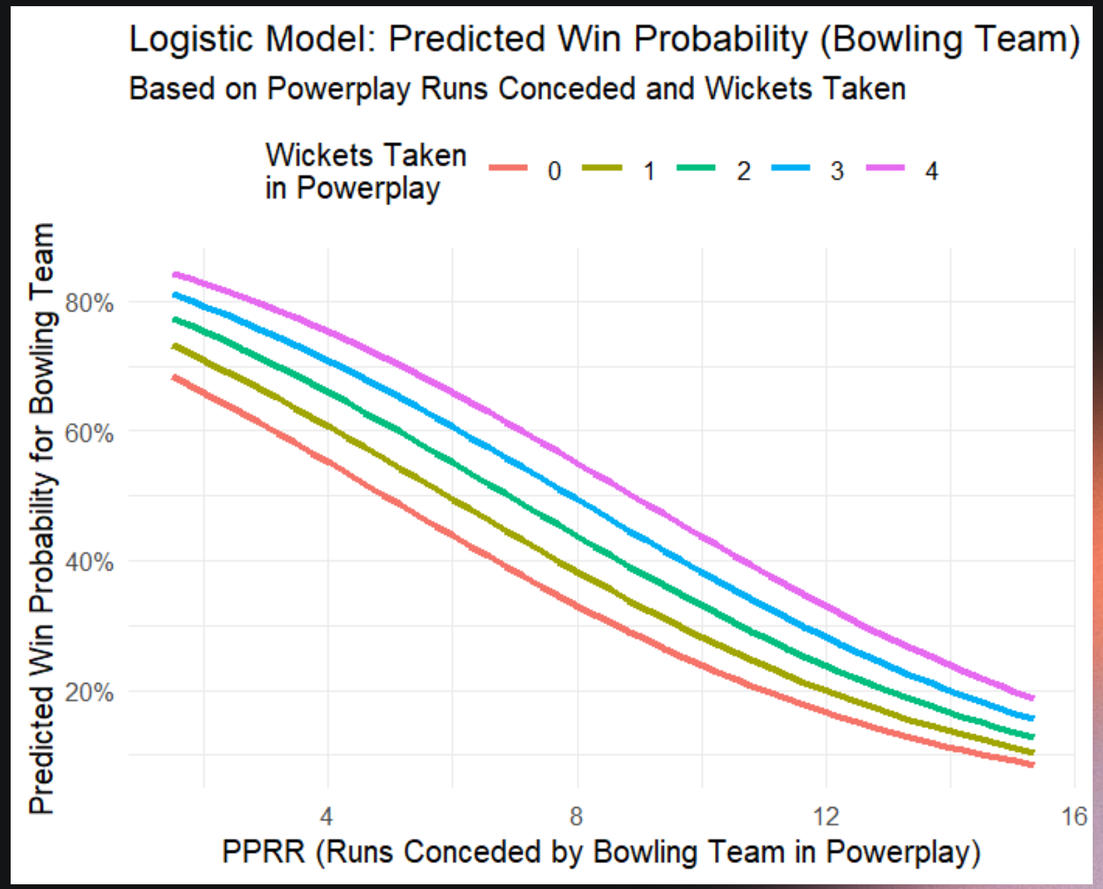
Analysis of PPRR & PPWT

Result

- Reject Null hypothesis
- There is an association between Powerplay Run Rate AND Power play Wicket loss with winning or losing

Interpretation

- Bowling team that concedes fewer runs and takes more wickets in power play are more likely to win the match

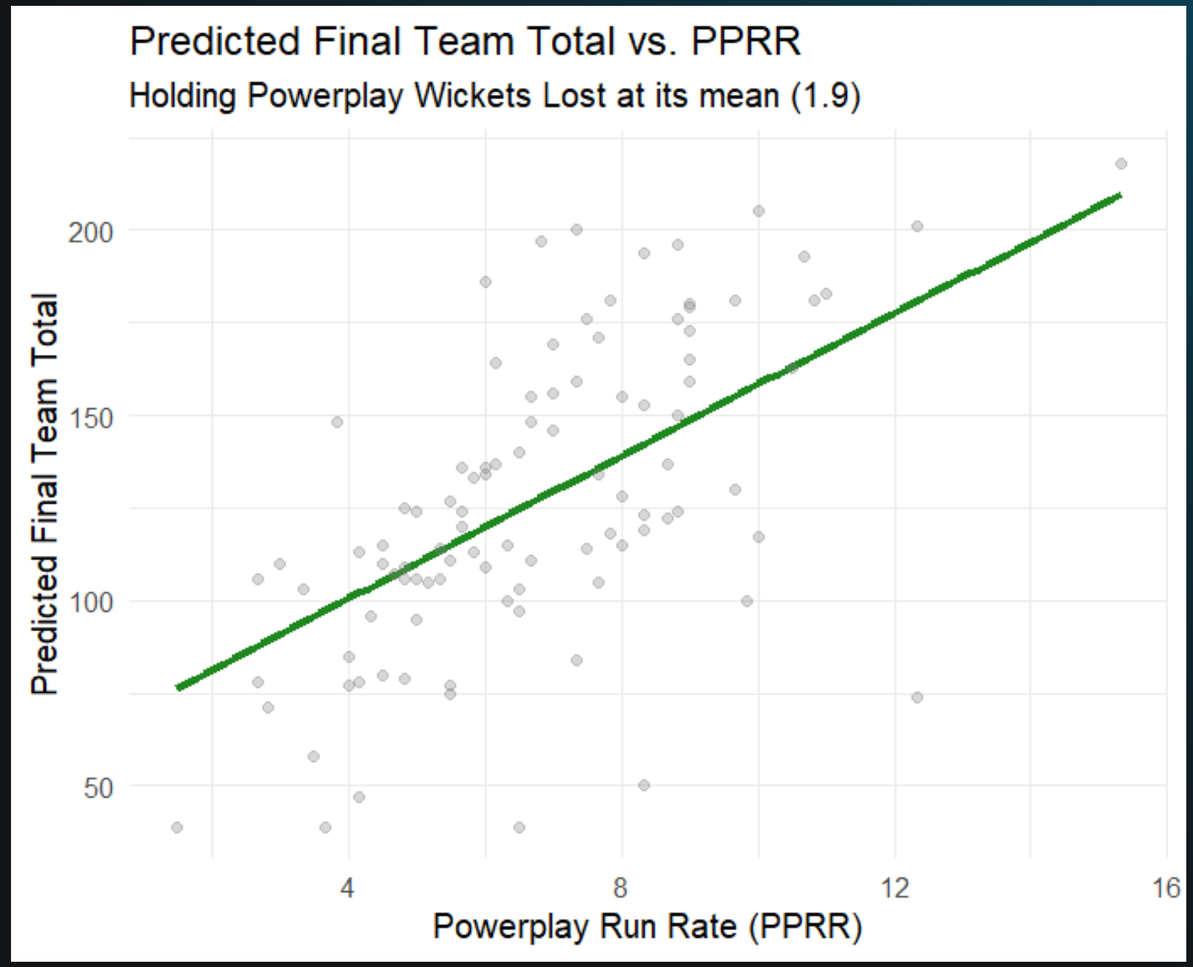


Analysis of PPRR & PPWT

If we isolate one variable (PPRR) while controlling the other....

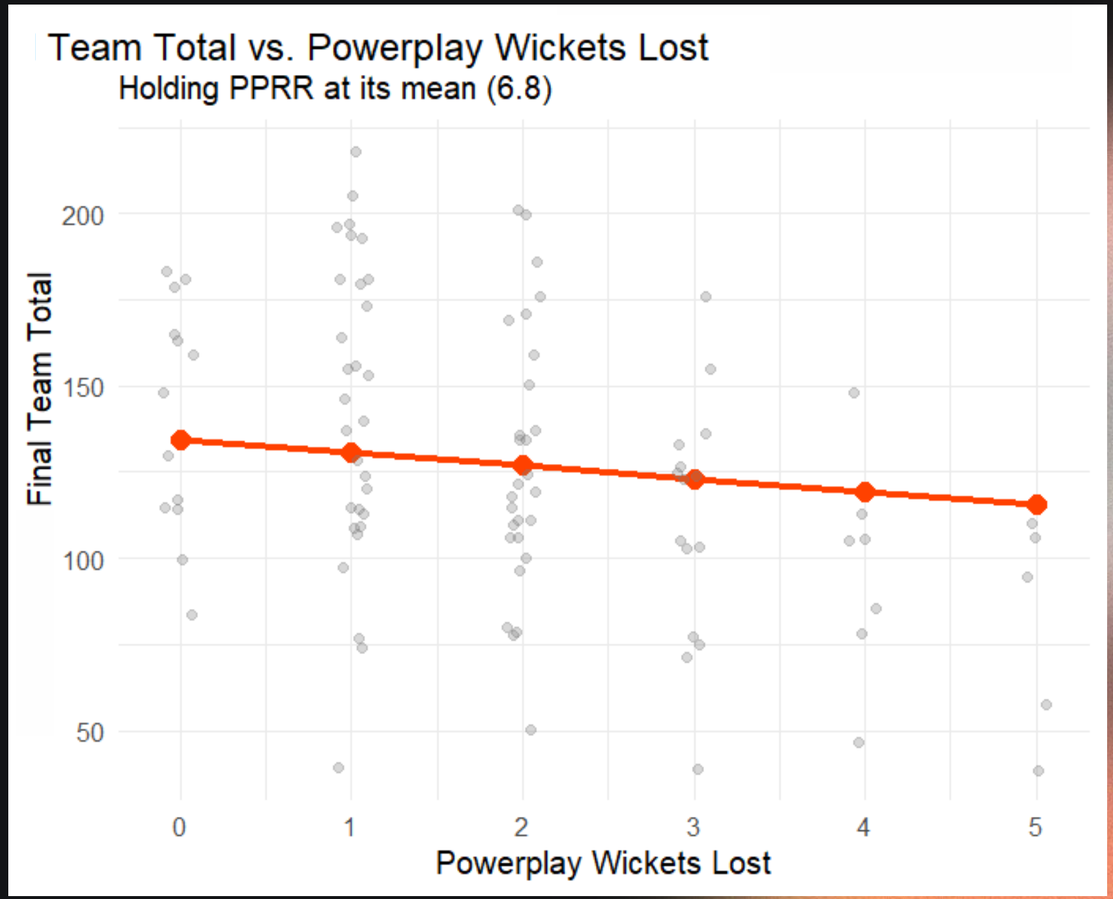
How much significant is the powerplay run rate against a team's final score?

It tells:
Regardless of PPWL, if teams have higher PPRR, they will score higher



Analysis of PPRR & PPWT

How much does a team score is effected by powerplay wickets lost?



PPRR in High Stake Games

Hypothesis

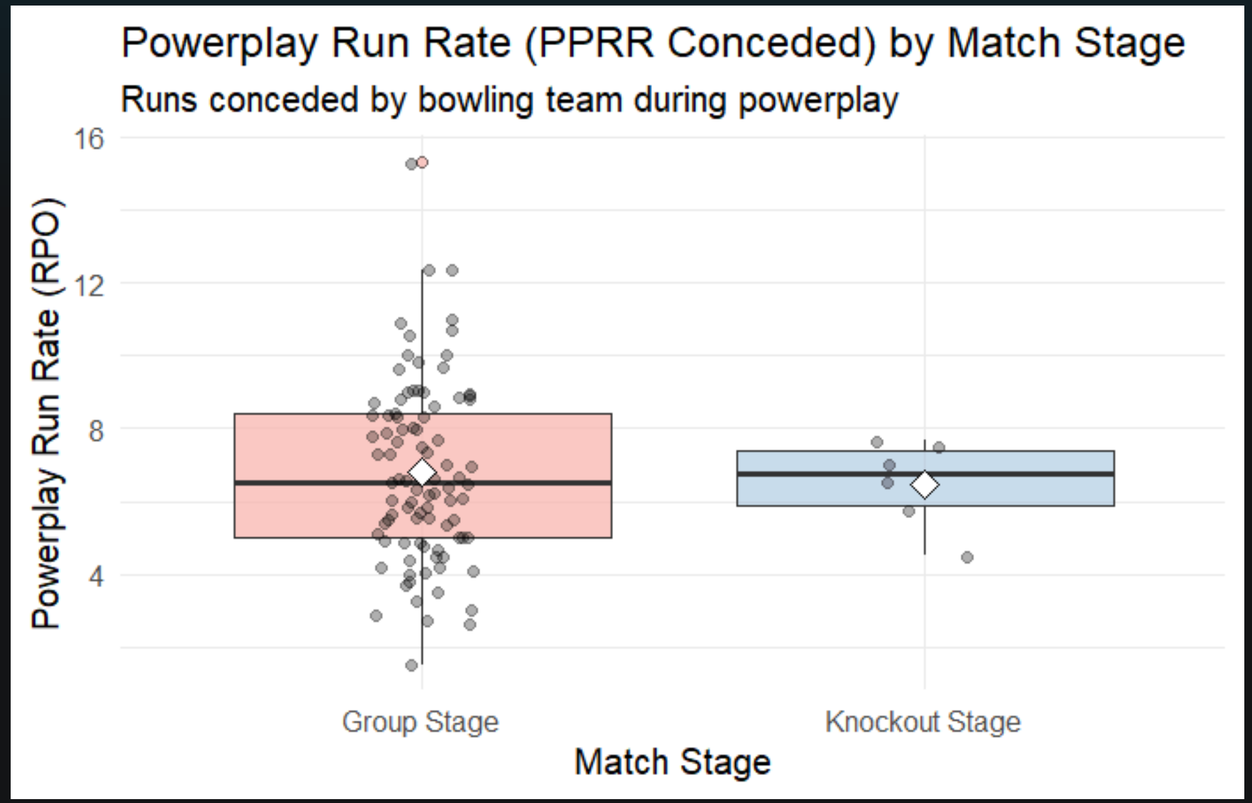
Does the PPRR change for group stages versus semifinal/grand final?

Null Hypothesis:

PPRR is same across different groups

Alternate Hypothesis:

PPRR is different across different groups



PPRR in High Stake Games

Wilcoxon Text
(Mann Whitney U Test)

- For PPRR between Group stage and Knockout Stage
- Use - Good for continuous variable, here it is PPRR

Result

- p-value is greater than 0.05
- strong evidence that PPRR is same for both groups
- fail to reject the Null Hypothesis

```
[1] "mann Whitney test for PPRR by Stage Type:"
> print(mann_whitney_pprr_stage)

        Wilcoxon rank sum test with continuity correction

data:  PPRR by stage_type
W = 291, p-value = 0.8298
alternative hypothesis: true location shift is not equal to 0
```

PPRR in High Stake Games

Two categorical variables here for each stage separately:

- PPRR_cat (3 levels: <7 PPRR, 7-9 PPRR, >9 PPRR)
- winner_flag (2 levels: bowling team won = 1, lost = 0)

Fisher's Exact Test

- Divided the groups into Low, Medium, High PPRR
- Use - Ideal for relationship of categorical variables

Result

- significant association b/w PPRR & bowling team win rate for each group

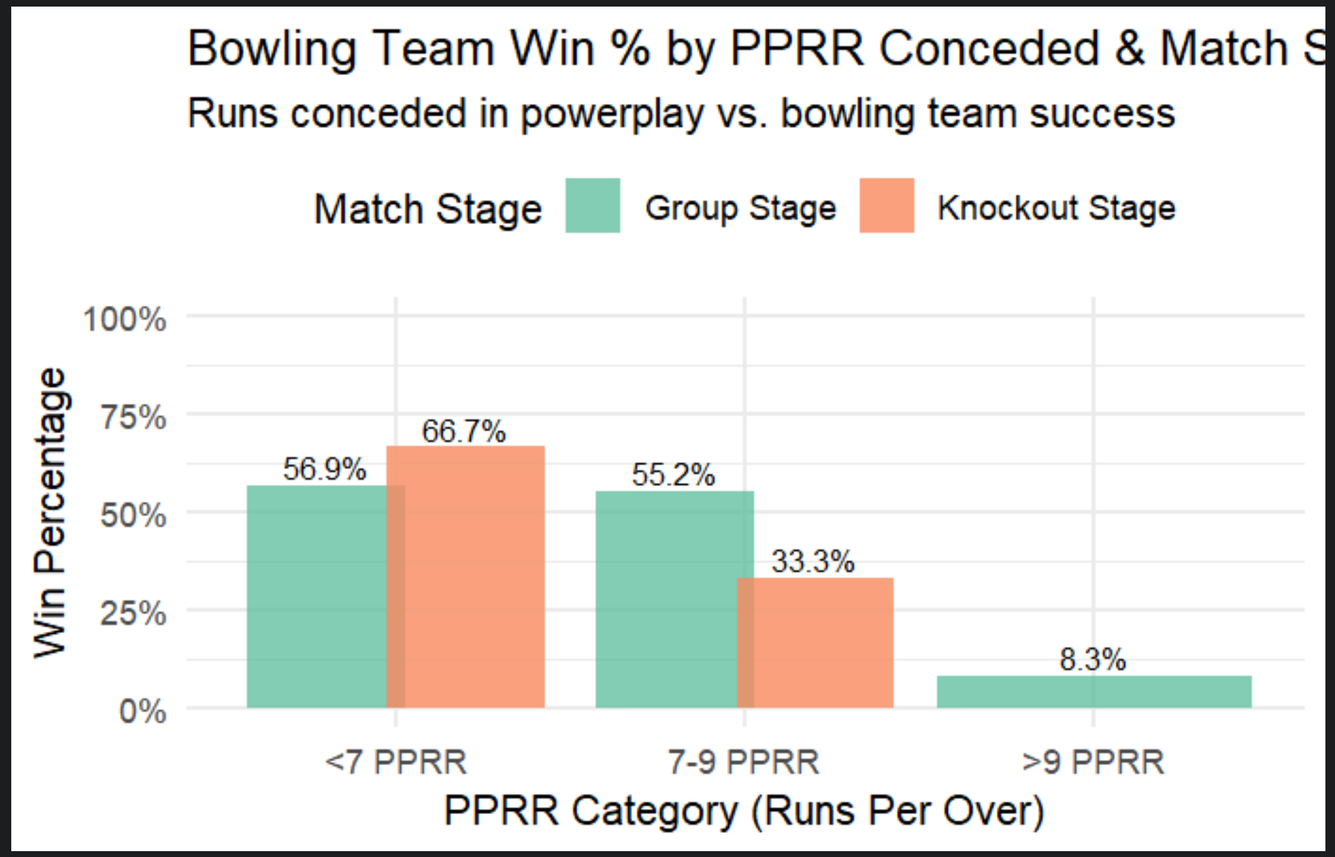
```
Win summary by stage and PPRR category:
> print(win_summary)
# A tibble: 5 × 5
  stage_type     PPRR_cat matches  wins win_percentage
  <fct>          <fct>      <int> <dbl>          <dbl>
1 Group Stage    <7 PPRR       51    29          0.569
2 Group Stage    7-9 PPRR      29    16          0.552
3 Group Stage    >9 PPRR       12     1          0.0833
4 Knockout Stage <7 PPRR        3     2          0.667
5 Knockout Stage 7-9 PPRR       3     1          0.333
```

```
--- Fisher's Exact Test for: Group Stage ---
Contingency table:
          Won_by_Bowling_Team
PPRR_Cat    0  1
  <7 PPRR  22 29
  7-9 PPRR 13 16
  >9 PPRR  11  1

        Fisher's Exact Test for Count Data with simulated p-value
        (based on 10000 replicates)

data:  tbl
p-value = 0.005999
```

PPRR in High Stake Games



Conclusion

- PPRR is not impacted by innings order
- Venue does effect PPRR
- PPRR is crucial for predicting Win/Loss
- PPRR does matter in group stage and knockout stage

Thank You