Are CS2 Maps Balanced? A Deep Dive Into CT/T-Side Bias & Win Rates

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1. Introduction

Recently in the Counter-Strike community, there has been considerable discussion about the in-game economy, the state of the map pool, and the overall health and balance of CS2 itself. Articles such as the one from bo3.gg [7] have raised concerns about CS2 map types, staleness, issues, and other in-game frustrations related to the economy. Meanwhile, various clips from players, analysts, and content creators—such as this TikTok [6]—have echoed these sentiments, highlighting negative feelings and dissatisfaction with the current balance of CS2.

As a dedicated Counter-Strike player, I have my own opinions on these topics, but the map pool stands out most. Many of the maps in rotation feel frustrating to play, and I often find myself banning certain maps in Premier Mode. This made me wonder: Why do some maps feel worse than others? Is it merely a matter of player preference, or do certain maps genuinely present balance issues between CT and T sides?

To answer these questions, I decided to conduct a data-driven analysis of CT- and T-side win rates across the most played competitive maps in CS2. By examining win percentages, side dominance, and statistical trends, my goal is to determine whether the current CS2 maps are truly balanced—or whether certain maps heavily favor one side.

In this paper, I will break down:

- How win rates vary across maps and whether they favor CT or T side.
- Which maps are the most balanced and which are the most one sided.
- How team performance is affected by side dominance.
- Whether CT- or T-round wins are more influential in overall match success.

Through this analysis, I hope to provide insight into the competitive integrity of CS2 maps and contribute to the ongoing discussion about the game's balance.

2. Data Collection & Feature Engineering

To describe the current state of teams and maps, I collected the following features. Specifically, I started by gathering all team names that had competed in S-B tier matches in 2024. For each team, I identified the most current roster based on their latest roster change and compiled all matches played by that exact lineup. Any roster that had accumulated at least 150 total rounds played was retained for this analysis. This dataset now includes key performance metrics for teams across different maps, highlighting their win rates, round performance on Terrorist (T) and Counter-Terrorist (CT) sides, and overall game outcomes. These statistics help analyze map balance, team strengths, and potential biases in competitive play.

```
# Load dataset
data_df = pd.read_csv("team_data_per_map.csv")

# Define HLTV top 20 teams
team_names = ["spirit", "vitality", "natus-vincere", "eternal-fire",
              "g2", "the-mongolz", "faze", "mousesports", "falcons-esports",
              "virtus-pro", "astralis", "liquid", "pain-gaming", "gamerlegion",
              "3dmax", "furia", "mibr", "heroic", "saw", "big", "betboom-team",
              "wildcard-gaming", "tyloo-cs-go", "m80-cs-go", "flyquest", "complexity"]

# Keep only current map pool
map_pool = ['de_dust2', 'de_inferno', 'de_anubis', 'de_ancient', 'de_mirage', 'de_nuke', 'de_train']
data_df = data_df[data_df["map_name"].isin(map_pool)]

# Remove undefined teams
data_df = data_df[data_df['team_name'] != "undefined"]
data_df = data_df.dropna()

#Averages per map
data_df["win_percent"] = data_df["games_won_count"] / data_df["games_count"]
data_df["total_rounds"] = data_df["t_rounds_count"] + data_df["ct_rounds_count"]
data_df["ct_win_percent"] = data_df["ct_round_wins_count"] / data_df["ct_rounds_count"]
data_df["t_win_percent"] = data_df["t_round_wins_count"] / data_df["t_rounds_count"]
```

Figure 1: *Python code used to load and calculate specific features*

2.1 Dataset Structure and Feature Descriptions

Column Name	Data	Description
team_name	string	The name of the team.
map_name	string	The name of the map played during the match (e.g., de_dust2, de_mirage).
t_round_count	int	The total number of rounds played by the team on the Terrorist (T) side.
t_round_wins_count	int	The number of rounds won by the team while playing as Terrorists.
ct_round_count	int	The total number of rounds played by the team on the Counter-Terrorist (CT) side.
ct_round_wins_count	int	The number of rounds won by the team while playing as Counter-Terrorists.
games_count	int	The total number of games played by the team on a specific map.
games_won_count	int	The number of games won by the team on a specific map.
win_percent	float	The overall win percentage of the team on the map
ct_win_percent	float	The percentage of rounds won by the team while playing as CT
t_win_percent	float	The percentage of rounds won by the team while playing as T
relative_ct_t_percent	float	The difference between CT and T win percentages, indicating map bias (positive means CT-sided, negative means T-sided).

Table 1: *Overview of key performance metrics for teams across different maps, including side-specific (CT and T) round wins, overall games played and won, and calculated win percentages.*

3. Data Visualizations & Explanations

3.1 Bar Graph Comparison (CT vs. T)

The bar graph in Figure 2 represents the comparison between CT (blue) and T (orange) side win percentages for each map. This calculation is different from the common calculation of CT/T Wins per map. See this example from HLTV - Distribution of T / CT wins on maps [4]. The graph in figure 1 shows the calculation of each side individually not as a whole, so each T and CT bar for each map is calculated by one of these equations :

$$T\ Win\ \% = \frac{T\ Side\ Rounds\ Won}{T\ Side\ Round\ Total} \qquad CT\ Win\ \% = \frac{CT\ Side\ Rounds\ Won}{CT\ Side\ Round\ Total}$$

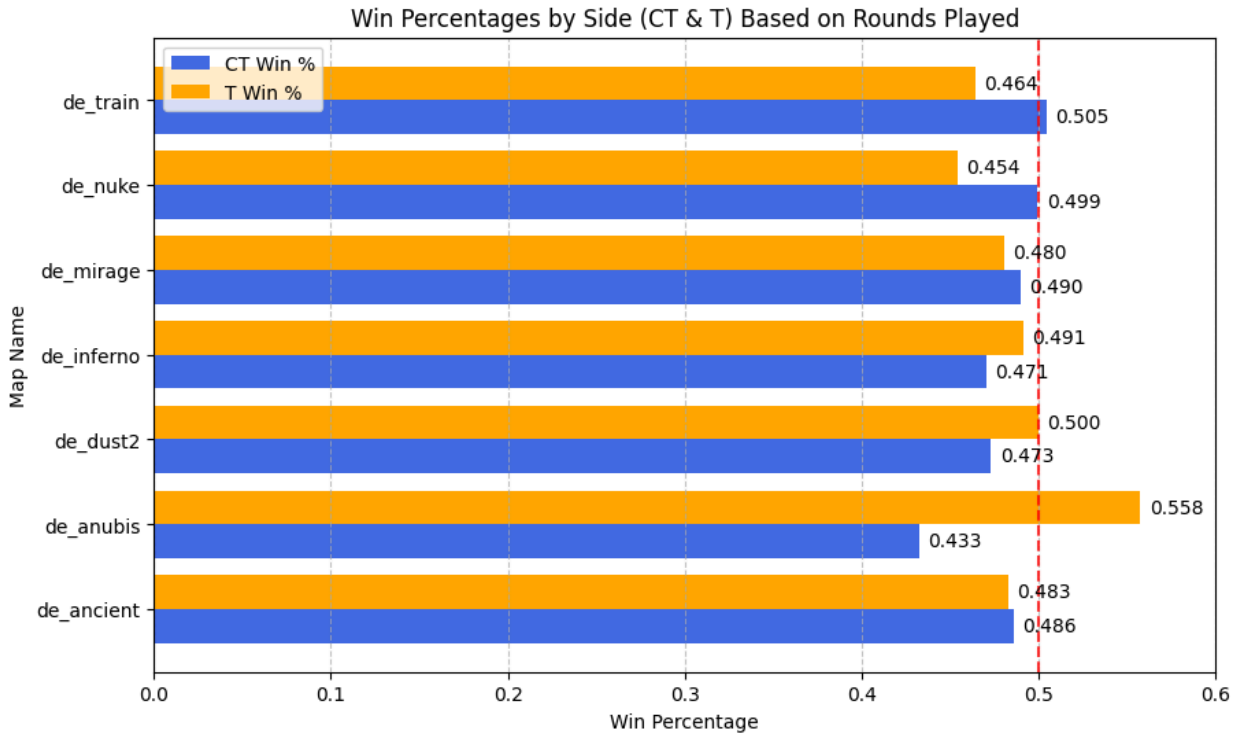

Figure 2: *Bar graph illustrating Comparison of CT and T Side Win Percentages by Map*

Based on these results, the maps considered “even” for both sides are Mirage, Dust 2, Nuke, Inferno, and Ancient, as they all boast a percentage differential of less than 5%. This difference translates to around a 1–2 round swing per half, although some players still *perceive* these maps to be more one-sided. For example, most players consider Nuke slightly CT-sided, but the data in pro play does not strongly support this.

Two notable outliers to this balanced trend are Anubis and Train. Since Train is new to the map pool (added on Jan 8, 2025 after Vertigo was removed) [4] , many teams are still developing a consistent playstyle. Typically, when a map is first introduced, it starts out favoring the CT side due to underdeveloped T-side tactics. Over time, as teams refine their Terrorist strategies—defaults, executes, mid-round calls—the side gap often narrows. Train, on the other hand, has been in the map pool since CS:GO [5] and still shows the largest side differential at 12%.:

- Extremely contestable mid area with few safe positions for CTs unless they use heavy utility.
- Quick rotates from sites through canals for T-side.
- Less effective CT utility, as Anubis lacks natural choke points to slow down T advances, unlike Nuke or Inferno.

3.2. CT/T Win Rate Trends Across Maps

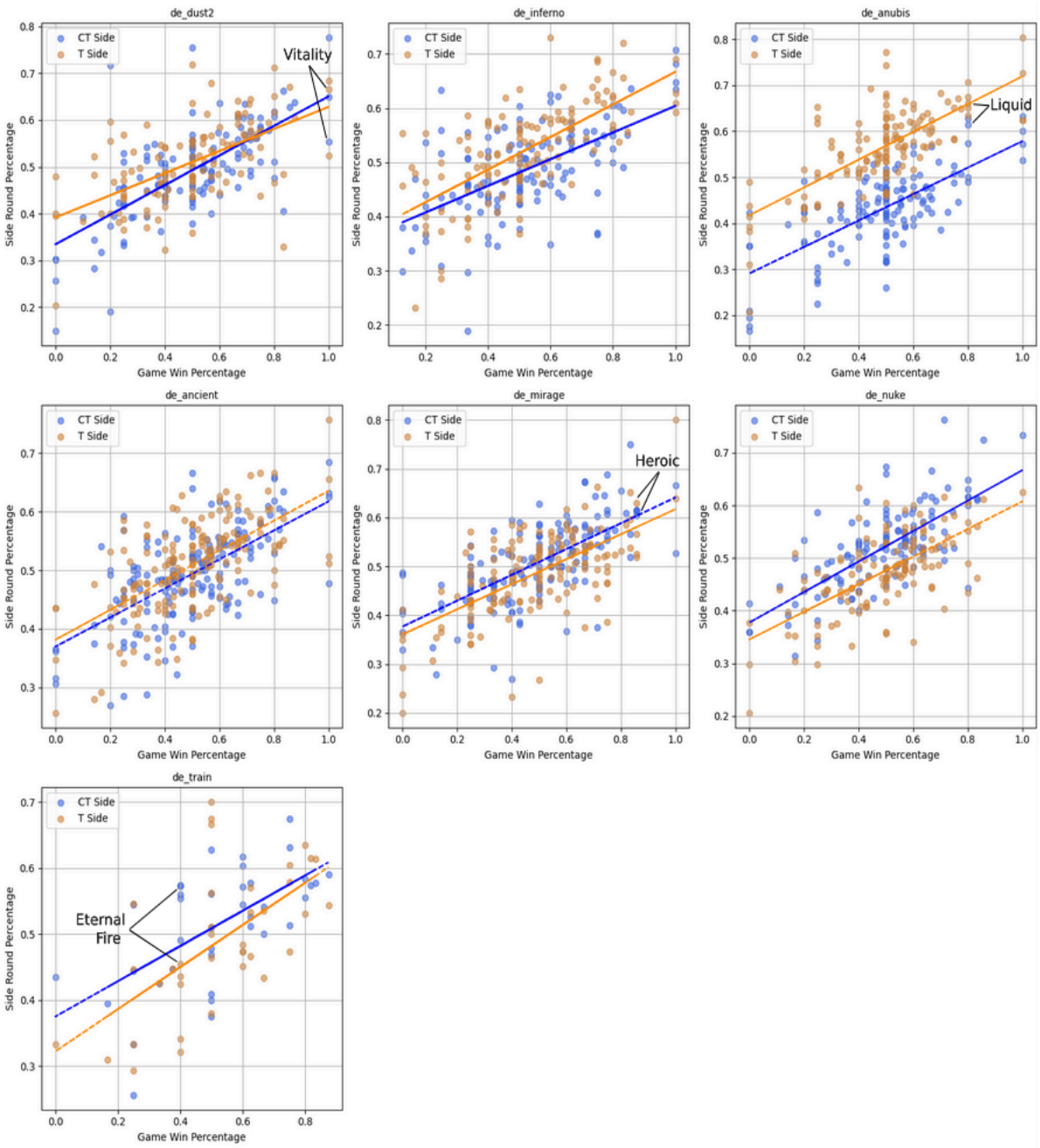

***Figure 3**. Scatter plots illustrating CT-side and T-side round win percentage in relation to overall game win percentage across various maps, each with its own trendline.*

Building on our knowledge of total CT vs. T-side win percentage, we next examine Game Win Percentages per map. Using CT & T side win percentage for each team and overall Game Win Percent for each map, we can generate the scatter plots in Figure 3, each equipped with a trendline for CT and T side.

- **Anubis, Inferno, Ancient:** Show a clear relationship between T-side win percentage and game wins.
- **Nuke and Mirage:** Indicate that a higher game win percentage correlates more closely with higher CT-side win rates.
- **Dust 2:** Displays an interesting case where the T-side trendline is generally higher than the CT-side trendline, suggesting teams with stronger T rounds tend to win more games. However, at the very top end of game win percentages, the CT-line briefly converges or surpasses T.
- **Train:** Acts as the opposite of Dust 2, with a higher CT-round win rate typically leading to more match wins, except at the very highest levels of game win percentage. However, Train remains a special case given its relatively recent return to the map pool.

Game and Side Win Percentages for Selected Teams

Team Name	Map Name	Game Win %	T Round W%	CT Round W%
Liquid (#11)	Anubis	80%	65.12%	62.75%
Vitality (#2)	Dust 2	100%	66.67%	55.35%
Heroic (#17)	Mirage	85.74%	63.04%	61.54%
Eternal Fire (#4)	Train	40%	45.45%	57.33%

*T**able 2**: Selected team performance on different maps, comparing overall game win percentage and side-specific (T and CT) win rates.*

Diving deeper into some of these plots and looking at specific data points, we select 4 teams (all of which are currently ranked in HLTVs top 25 [3]) to help point out specific win rates and percentages.

1. **Liquid (#11) on Anubis**
   - Dominates with an 80% game win rate.
   - T-round win rate (65.12%) is slightly higher than CT-round (62.75%).
   - Positioned in the upper right quadrant at the higher end of the Game Win % for Anubis
2. **Vitality (#2) on Dust 2:**
   - Perfect 100% game win rate over 5 games.
   - T Side win rate (66.67%) is higher than CT side (55.35%), indicating effective attacking strategy.
   - Appears in the upper right region of the Dust 2 scatter plot, reinforcing their strong T-Side performance.
3. **Heroic (#17) on Mirage:**
   - Strong win rate at 85.75%
   - T-side win rate (63.04%) is slightly above CT-side (61.54%), showing balanced performance on both sides.
   - Plotted among the higher win percentage teams on Mirage, emphasizing their effectiveness.
4. **Eternal Fire (#4) on Train:**
   - Moderate game win rate (40%), indicating struggles on this map.
   - CT-side win rate (57.33%) significantly outperforms T-side (45.45%), showing a reliance on defense.
   - Plotted lower on the Train scatter plot, reflecting inconsistencies in securing wins.

3.3. CT/T Performance of the Top 25 Teams

Because the collected dataset includes data from S, A, and B-tier competitions, I wanted to narrow in on the most elite, top 25 teams so far.

Rank	Team Name	Rank	Team Name
1	Spirit	13	GamerLegion
2	Vitality	14	3DMAX
3	Natus Vincere	15	Furia
4	Eternal Fire	16	MIBR
5	G2	17	Heroic
6	The MongolZ	18	SAW
7	FaZe	19	BIG
7	Mousesports	20	BetBoom
8	Falcons	21	Wildcard
9	Virtus Pro	22	Tyloo
10	Astralis	23	M8
11	Liquid	24	FlyQuest
12	Pain Gaming	25	Complexity

Table 3: *Ranking of the top 25 teams from HLTV. [3]*

By focusing on these elite teams, I can better understand the current meta of competitive Counter-Strike, identify which sides they excel on, and see how round win percentages influence overall performance. This deeper analysis helps differentiate true top-tier consistency from teams that only excel in specific matchups or map pools.

3.4. Top 25 Teams - Side Dominance Analysis

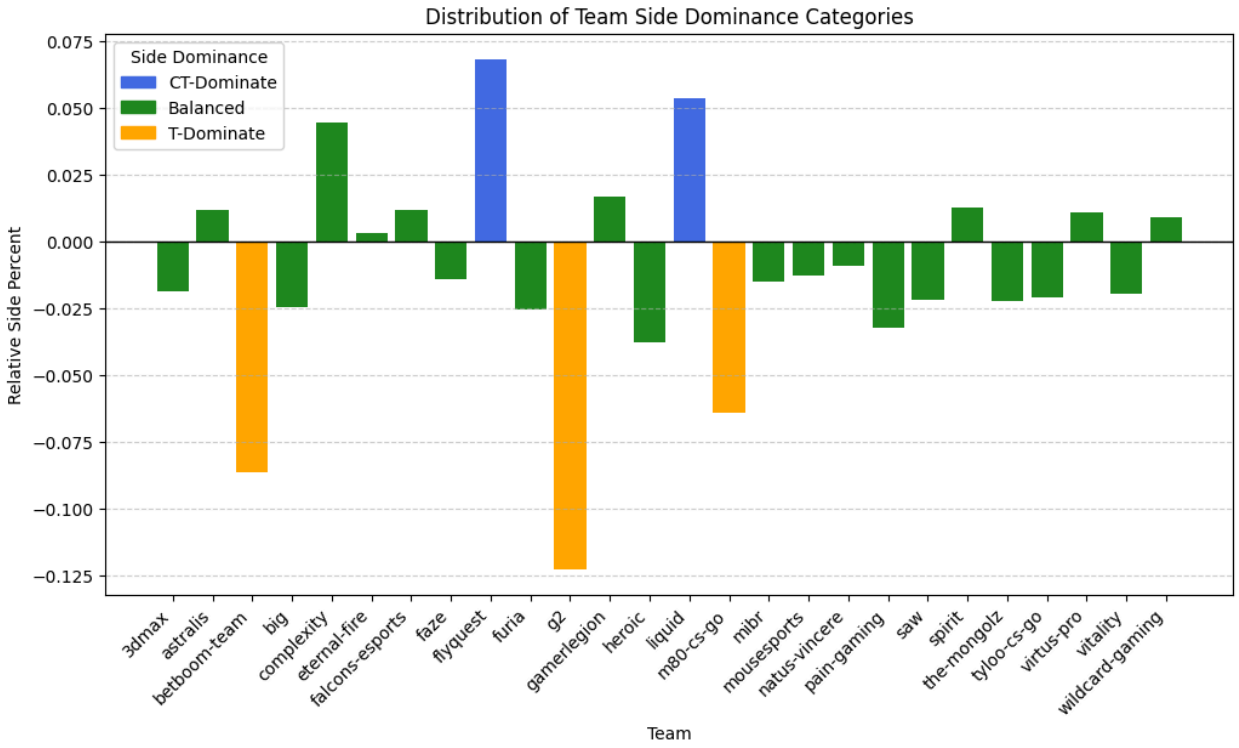

Figure 4: *Chart illustrating side dominance (CT vs. T performance) for the top 25 HLTV teams. [3]*

In Figure 4, a bar chart shows the different types of teams that make up the top 25 ranked on HLTV. Using CT and T win round percentages, we created a relative win percentage (Figure 4) to classify teams:

1. **CT-Dominant Team:** Relative percentage ≥ +0.05
2. **Balanced Team:** Relative percentage between -0.05 and +0.05 (inclusive)
3. **T-Dominant Team:** Relative percentage ≤ -0.05

For example, the world's #1 team, Spirit, is categorized as balanced with a 0.008 relative value. Meanwhile, Vitality, currently challenging for that #1 rank, holds a -0.085 relative value, labeling them T-dominant. Since conducting this research, Zywoo and his squad have won back-to-back events (ESL One Katowice 2025 and ESL Pro League), achieving two of the three events in the ESL Triple Crown. Could their T-side dominance be fueling this success?

3.5. Top 25 Teams - Side Win Percent Comparison

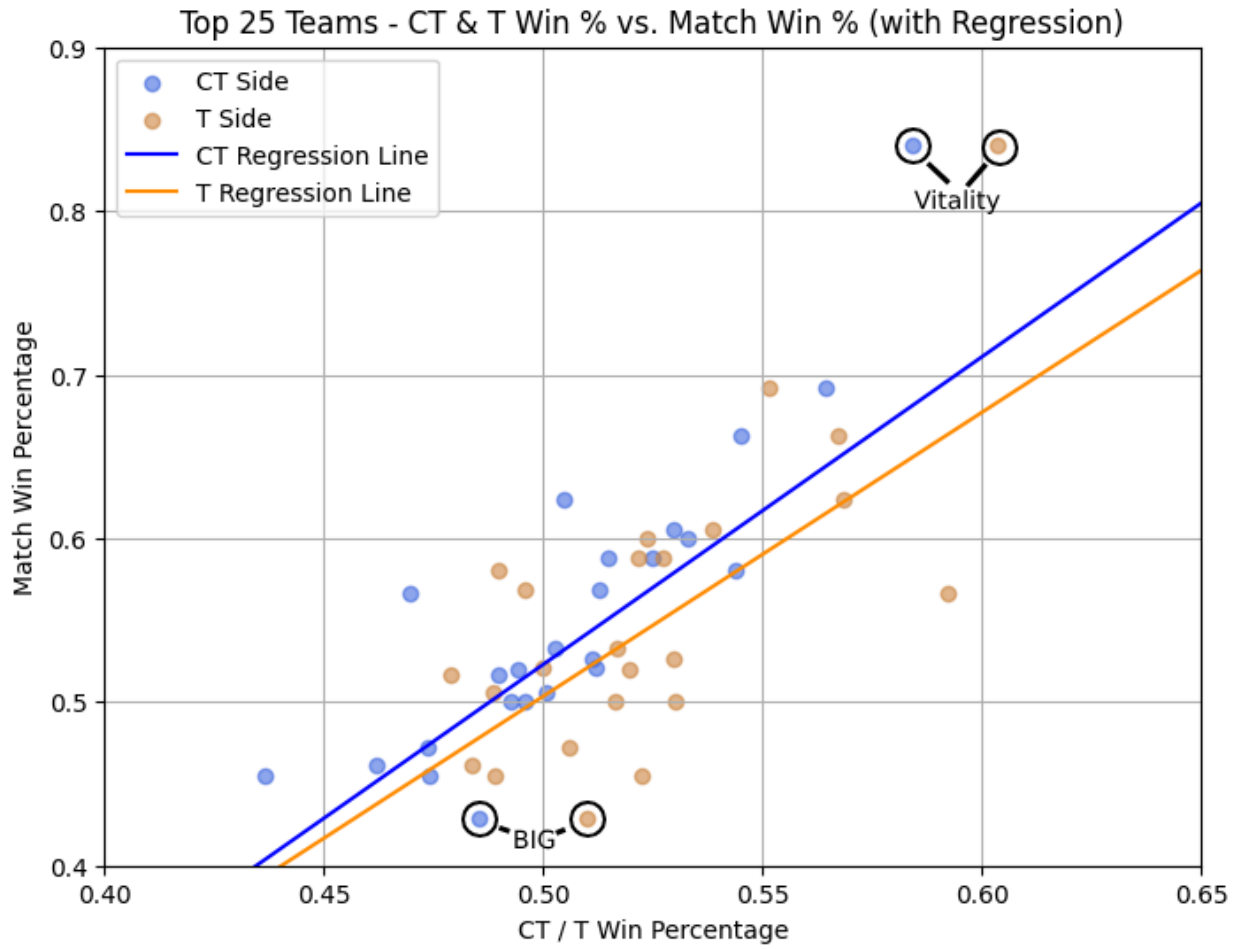

Figure 5: *Scatter plot comparing the top 25 teams' average CT- and T-side win percentages across all played maps (x-axis) to their overall game win percentage (y-axis). Vitality and BIG are highlighted to illustrate contrasting performance trends.*

In Figure 5, the scatter plot visualizes each team's average CT and T win percentages across all maps played, excluding maps they have not competed on. The x-axis represents the side win percentage (CT/T rounds won), while the y-axis shows the overall game win percentage.

Two notable examples:

- Vitality (#2): Positioned in the top-right quadrant, Vitality boasts a 0.84 game win percentage with balanced CT/T round win rates (58.81% CT vs. 60.36% T). Their equilibrium—paired with strong firepower—has made them one of the most dominant teams in recent tournaments.
- BIG (#19): In contrast, BIG has the lowest overall win rate (42.86%) among the top 25 teams. Their CT win percentage (48.55%) and T win percentage (50.98%) indicate near-even performance on both sides but struggle to secure consistent victories.

4. Correlation

To further understand the trends observed so far, I performed correlation analyses to see whether winning more rounds on a specific side correlates with a team's overall win percentage.

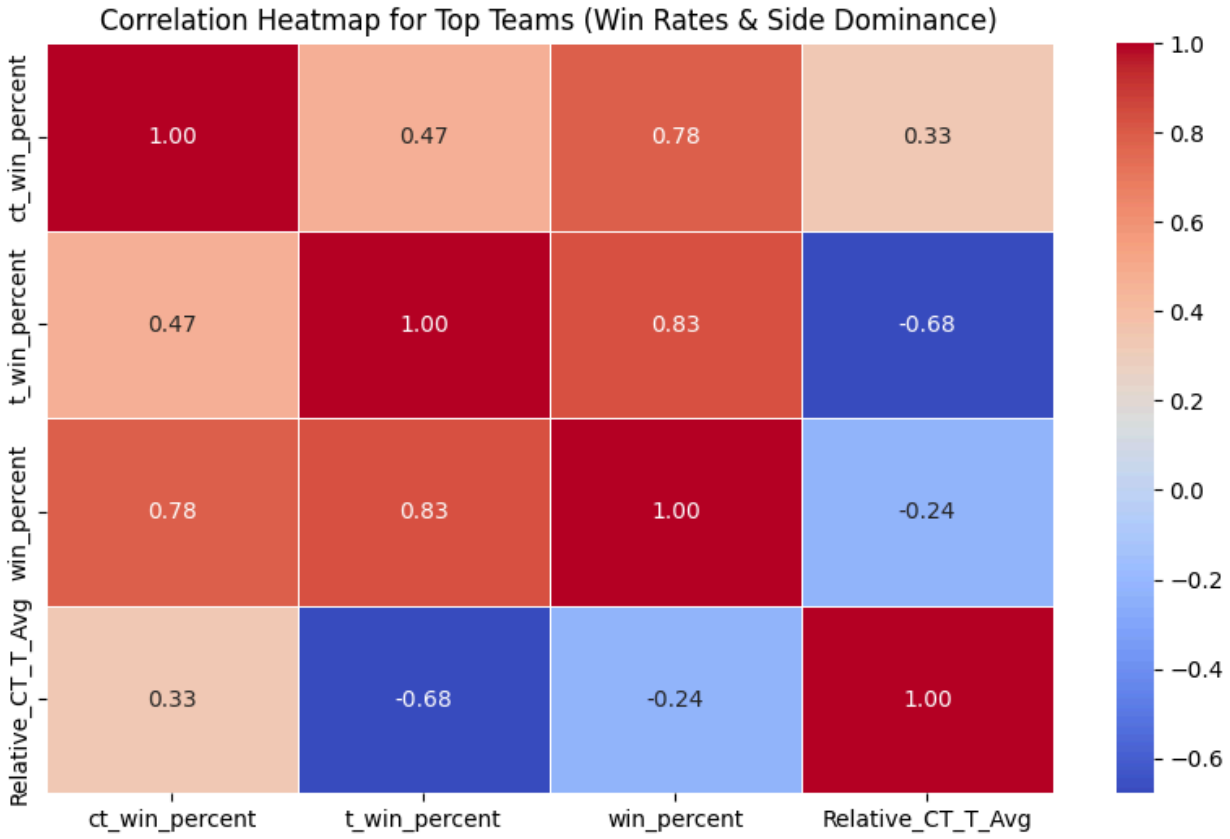

***Figure 6**. Heatmap illustrates correlations among CT Win %, T Win %, Overall Win %, and Side Dominance.*

The heatmap in Figure 6 visually represents the relationships between CT win percentage, T win percentage, overall game win percentage, and side dominance (Relative_CT_T_Avg). Each cell's color indicates the strength and direction of the correlation:

- Deeper reds (closer to +1) signal a strong positive correlation, meaning as one variable increases, the other tends to increase.
- Deeper blues (closer to -1) indicate a strong negative correlation, meaning as one variable increases, the other tends to decrease.
- Lighter shades near 0 suggest little to no correlation between the variables.

4.2. Heatmap Observation

- **T Win % and Overall Win % (0.83):** A strong positive correlation, indicating that teams with high T-side success generally win more games. This contradicts the common belief that CT-sided maps dominate, as T success contributes more to overall wins.
- **CT Win % and Overall Win % (0.78):** Also strongly correlated, confirming that CT performance contributes significantly to a team's overall success. While CT rounds matter, T rounds still hold stronger correlation (0.83) with overall game wins.
- **Relative CT/T Win % Difference & T Win % (-0.68):** A strong negative correlation, meaning teams that have a higher CT win bias tend to struggle more on the T-side.
- **Relative CT/T Win % Difference & Overall Win % (-0.24):** A weak negative correlation, implying that a team's preference for CT or T dominance has little effect on their total game win rate.

4.2. Correlation Tests

Spearman vs. Pearson Correlation Differences

Spearman and Pearson correlation tests measure relationships between variables but do so in different ways. Pearson correlation assumes a linear relationship, meaning it only detects straight-line trends between two variables. If the data follows a curved or inconsistent pattern, Pearson may not fully capture the strength of the relationship. On the other hand, Spearman correlation focuses on monotonic relationships, meaning it looks at whether one variable consistently increases or decreases as the other changes, regardless of the exact shape of the trend. This makes Spearman better for capturing rank-based relationships that might not be perfectly linear.

Pearson (r)

Pearson's correlation coefficient (r) is the ratio of the covariance between two variables to the product of their standard deviations. [1] Lower or higher values of r indicate weaker or stronger linear relationships, respectively.

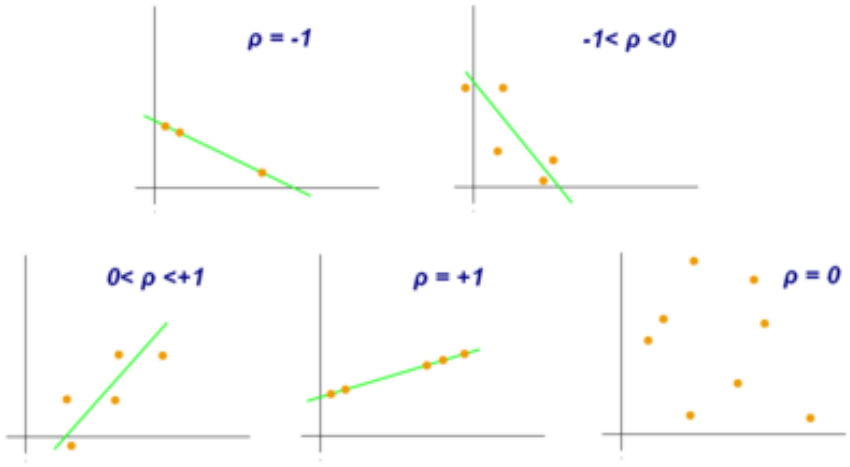

Figure 7: *Examples of scatter plots illustrating varying correlation coefficient (ρ) values. [1*

Spearman Rank Correlation (ρ)

Spearman's rank correlation (ρ) is a nonparametric measure of the statistical dependence between the rankings of two variables. [2] It assesses how well the relationship between them can be described using a monotonic function.

By analyzing these correlations, we can determine whether CT- or T-side performance is more influential in match success.

Null Hypothesis (H_0)

The default assumption that there is no *real* relationship between two variables.

- **Failed to reject H_0 ($p > 0.05$):** Indicates no statistically significant relationship.
- **Reject H_0 ($p < 0.05$):** Indicates a statistically significant relationship between the two variables.

```
# Compute correlation matrix
correlation_matrix_top_teams = temp1[["ct_win_percent", "t_win_percent", "win_percent", "Relative_CT_T_Avg"]].corr()

# Plot correlation heatmap
plt.figure(figsize=(10, 6))
sns.heatmap(correlation_matrix_top_teams, annot=True, cmap="coolwarm", fmt=".2f", linewidths=0.5)
plt.title("Correlation Heatmap for Top Teams (Win Rates & Side Dominance)")
plt.show()

# Compute Pearson & Spearman correlations
pearson_corr_ct, pearson_p_ct = pearsonr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])
pearson_corr_t, pearson_p_t = pearsonr(temp1["t_win_percent"], temp1["win_percent"])
spearman_corr_ct, spearman_p_ct = spearmanr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])
spearman_corr_t, spearman_p_t = spearmanr(temp1["t_win_percent"], temp1["win_percent"])

# Store correlation results
correlation_results = {
    "Metric": ["CT Win % vs Match Win %", "T Win % vs Match Win %", "Side Dominance vs Match Win %"],
    "Pearson Correlation": [pearson_corr_ct, pearson_corr_t, pearsonr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])[0]],
    "Pearson p-value": [pearson_p_ct, pearson_p_t, pearsonr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])[1]],
    "Spearman Correlation": [spearman_corr_ct, spearman_corr_t, spearmanr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])[0]],
    "Spearman p-value": [spearman_p_ct, spearman_p_t, spearmanr(temp1["Relative_CT_T_Avg"], temp1["win_percent"])[1]]
}

print(json.dumps(correlation_results, indent=4))
```

Figure 8. *Python code used to generate Heatmap and calculate correlations.*

Pearson Correlation Values & p-Values

The Pearson correlation values and P-Value for CT Win %, T Win %, and Side Dominance vs Game Win % are as follows:

- **CT Win % vs. Match Win %** → r = 0.092, p = 0.203
    - Failed to reject H_0 ($p > 0.05$) → No significant relationship.
- **T Win % vs. Match Win %** → r = 0.675, p = 2.90 x e^{-27}
    - Rejected H_0 ($p < 0.05$) → Significant relationship.
- **Side Dominance vs. Match Win %** → r = 0.092, p = 0.203
    - Failed to reject H_0 ($p > 0.05$) → No significant relationship.

Because 2.90 x e^{-27} is far below the 0.05 threshold, T Win % vs. Match Win % is strongly significant, indicating that winning more T-side rounds is a robust predictor of match success.

Spearman Correlation (r_s) & p-Values

- **CT Win % vs. Match Win %** → $\rho = 0.062$, $p = 0.389$
    - Failed to reject H_0 ($p > 0.05$).
- **T Win % vs. Match Win %** → $\rho = 0.621$, $p = 3.73 \times e^{-22}$
    - Rejected H_0 ($p < 0.05$).
- **Side Dominance vs. Match Win %** → $\rho = 0.062$, $p = 0.389$
    - Failed to reject H_0 ($p > 0.05$).

The Spearman test's p-value ($3.73 \times e^{-22}$) for T Win % vs. Match Win % again confirms a statistically significant relationship between T-side performance and overall team success. Meanwhile, neither CT Win % nor Side Dominance showed a significant association with game outcomes under either correlation test.

These findings suggest that, contrary to the common perception of certain maps being heavily CT-sided, a strong T-side appears to be a more reliable predictor of match victories. In other words, the ability to secure rounds on the T side can have a stronger impact on a team's final result than the conventional wisdom around CT advantages might imply.

5. Conclusion

A statistically significant correlation exists between T-side round win percentage and game win percentage. Teams with strong T-side performance tend to secure more match victories, whereas CT dominance alone shows little to no correlation with overall success. A prime example might be a team that excels on the CT side but struggles to close out matches due to a weak T side, resulting in lost series against more balanced opponents.

It is crucial to note that Counter-Strike is a complex game involving mechanical skill, strategy, teamwork, and adaptability. While this analysis focused on CT/T-side balance, one major factor that was *not* included here is the in-game economy. A team's ability to manage their economy—buying the right weapons, saving at opportune times, and leveraging round momentum—can drastically affect outcomes.

Still, these findings highlight the importance of T-side strategy in CS2's current meta, raising questions about how economic factors might further amplify or mitigate side advantages. Further research into how economy interacts with side dominance could offer deeper insights into why T-side performance remains so pivotal in CS2.

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