Author Information

Name: Ioannis Adamou

Email: yiannis.adamou26@gmail.com

Student ID: U234N1110

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The 12th Man Effect: Does Playing at Home Really Matter in the EPL?

Project Objective

This project investigates the concept of home advantage in the English Premier League (EPL) football matches from 2017/18 to 2023/24. Using historical data, it aims to quantify the strength of home advantage, investigate which factors contribute most to it and whether this advantage was affected during the COVID-19 pandemic.

Research Questions

- Does home advantage exist in the EPL, and has it changed over the years?
- What factors influence home advantage most? (crowd presence, team strength)
- Are some teams more reliant on playing at home than others?
- Was home advantage affected during COVID-19? (empty stadiums)

We will use match statistics sourced from FBRef and NativeStats to answer these questions.

In [3]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

xls = pd.ExcelFile("C:\\Users\\Admin\\OneDrive\\Documents\\Yiannis_Unic\\Comp-24
df = xls.parse('Sheet1')

df = df.drop(columns=[col for col in df.columns if 'Unnamed' in col or df[col].i
df = df.dropna(subset=['Season', 'Squad'])
df['Season'] = df['Season'].astype(str)

for col in df.columns:
    if col not in ['Season', 'Squad', 'Rank']:
        df[col] = pd.to_numeric(df[col], errors='coerce')
```

```
df.head()
```

Out[3]:

	Season	Rank	Squad	HomeAttendance/Game	HomeMatches	HomeWins	Home
0	23/24	1	Man City	53012.0	19.0	14.0	
1	23/24	2	Arsenal	60236.0	19.0	15.0	
2	23/24	3	Liverpool	55979.0	19.0	15.0	
3	23/24	4	Aston Villa	41858.0	19.0	12.0	
4	23/24	5	Tottenham	61482.0	19.0	13.0	

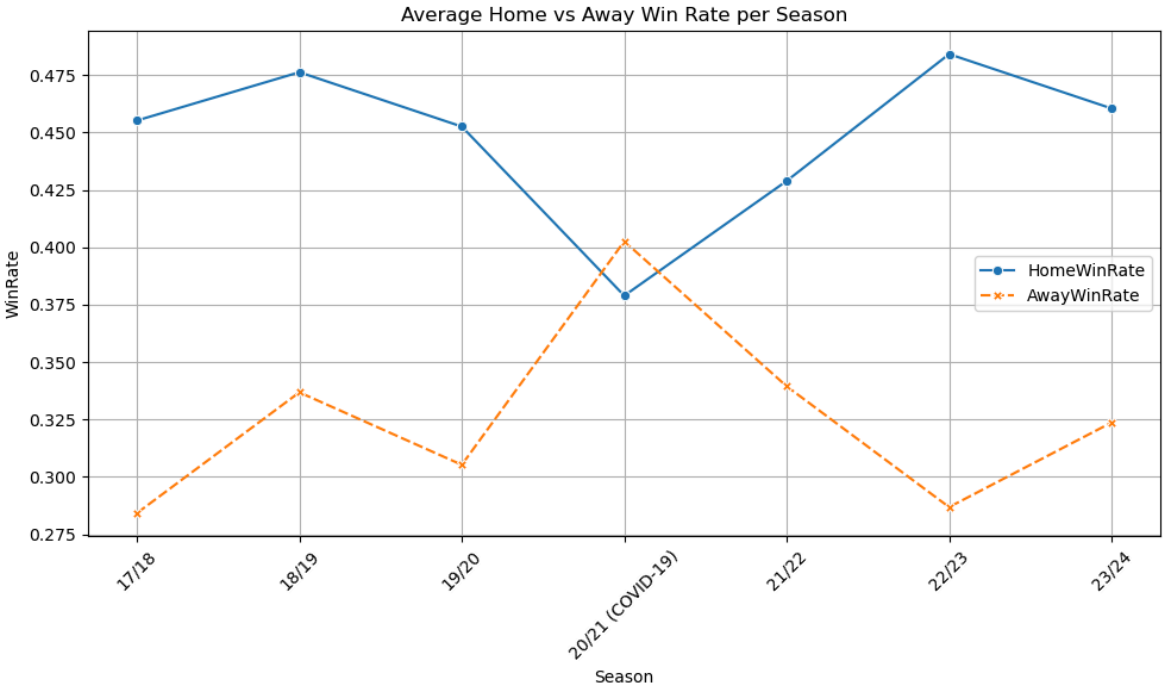
5 rows × 25 columns

League-Wide Home vs Away Trends Over Seasons

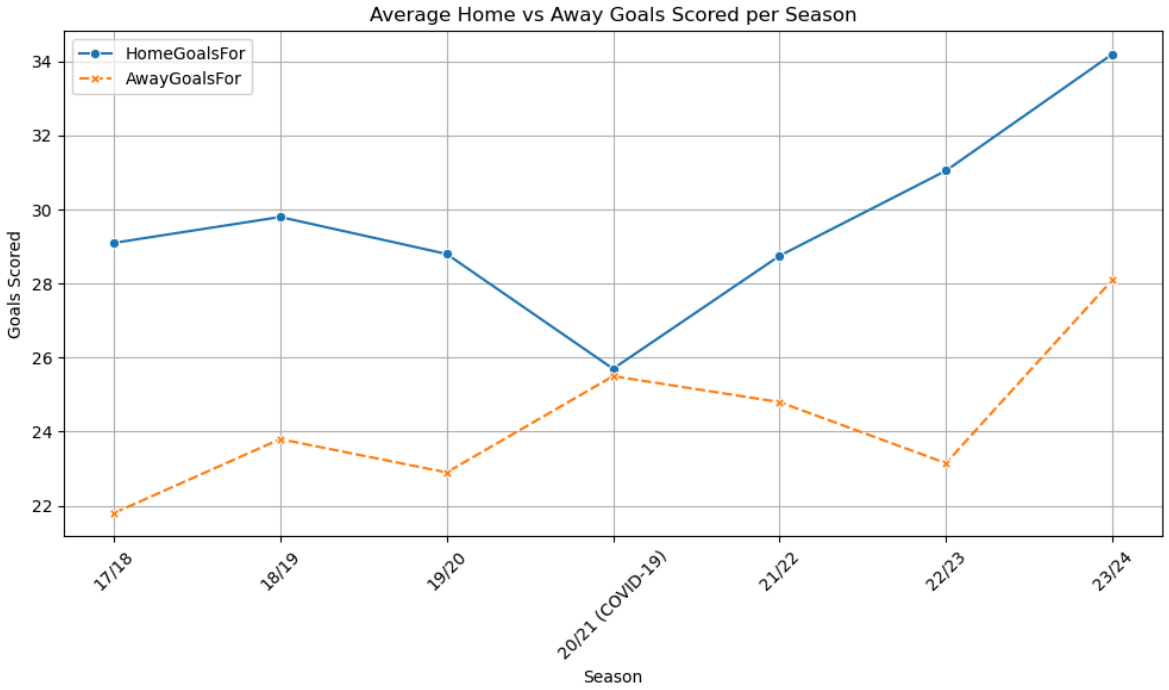
Here we analyze how home vs away win rates and goals have changed season by season

In [5]:
```
season_summary = df.groupby('Season')[[
    'HomeWinRate', 'AwayWinRate', 'HomeGoalsFor', 'AwayGoalsFor', 'HomeExpGoals'
]].mean()

plt.figure(figsize=(10, 6))
sns.lineplot(data=season_summary[['HomeWinRate', 'AwayWinRate']], markers=True)
plt.title('Average Home vs Away Win Rate per Season')
plt.ylabel('WinRate')
plt.xticks(rotation=45)
plt.grid(True)
plt.tight_layout()
plt.show()
```



In [6]:
```
plt.figure(figsize=(10, 6))
sns.lineplot(data=season_summary[['HomeGoalsFor', 'AwayGoalsFor']], markers=True
plt.title('Average Home vs Away Goals Scored per Season')
plt.ylabel('Goals Scored')
plt.xticks(rotation=45)
plt.grid(True)
plt.tight_layout()
plt.show()
```



COVID-19 Impact on Home Advantage

The 2020/21 season was played without crowds. Let's see how this affected home performance.

In [8]:
```
season_2021 = df[df['Season'] =='20/21 (COVID-19)']

home_avg = season_2021['HomeWinRate'].mean()
away_avg = season_2021['AwayWinRate'].mean()

print(f"2020/21 Home Win Rate: {home_avg:.2f}")
print(f"2020/21 Away Win Rate: {away_avg:.2f}")
```

```
2020/21 Home Win Rate: 0.38
2020/21 Away Win Rate: 0.40
```

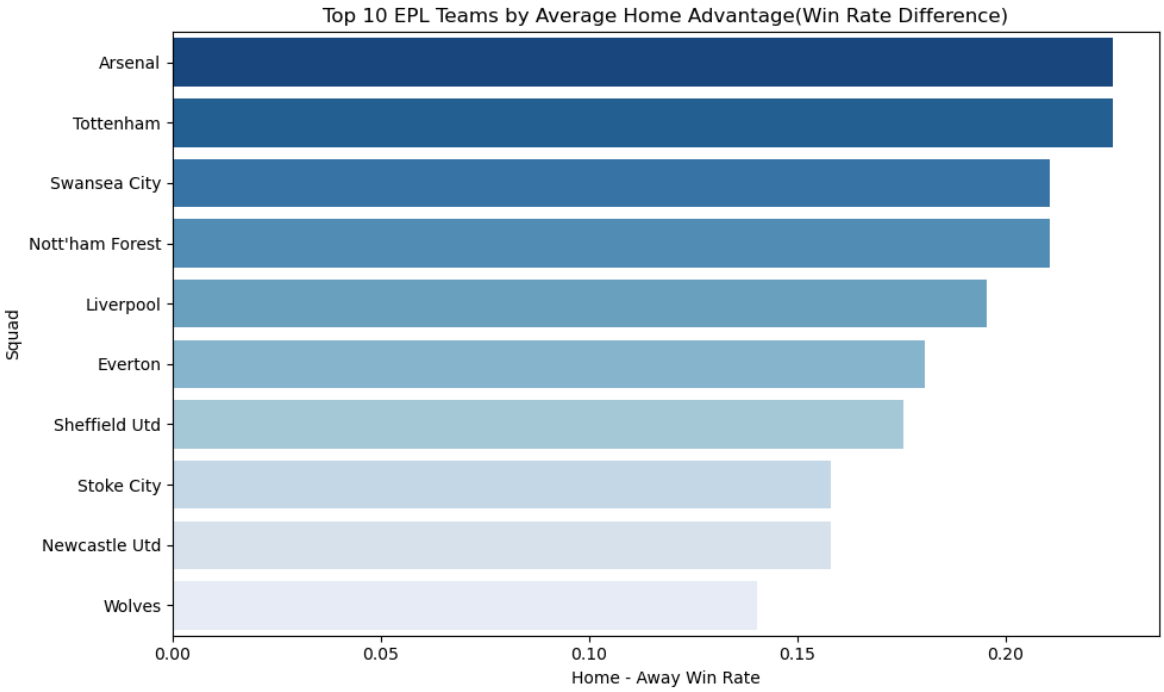
Team-Level Home vs Away Advantage

Let's find out which teams benefited most from playing at home.

In [10]:
```
df['WinRateDiff'] = df['HomeWinRate'] - df['AwayWinRate']
top_advantage = df.groupby('Squad')['WinRateDiff'].mean().sort_values(ascending=

plt.figure(figsize=(10, 6))
sns.barplot(x=top_advantage.values, y=top_advantage.index, hue=top_advantage.ind
```

```
plt.title("Top 10 EPL Teams by Average Home Advantage(Win Rate Difference)")
plt.xlabel("Home - Away Win Rate")
plt.tight_layout()
plt.show()
```



Conclusions

- Home advantage **exists**, but it has **weakend** slightly in recent seasons.
- The **2020/21 season** recorded the lowest home win rate, likely influenced by the absense of fans in the stadiums.
- Some teams rely heavily on their home performance.
- Further research could explore **referee behavior**, **travel effects** and **crowd noise**.

Appendix

- **Data source:** FBRef, NativeStats (via Excel)
- **Code is available at:** https://github.com/Yiannis26/DataScienceProject.git
- **Video is available at:** https://youtu.be/Pe55Y1RSHsI