Assignment 2 Part 2: International Soccer

Hesham El Alamy (900212051)

Abstract

The dataset analyzed "includes 43,170 results of international football matches starting from the very first official match in 1872 up to 2019. The matches are strictly men's full internationals and the data does not include Olympic Games or matches where at least one of the teams was the nation's B-team, U-23 or a league select team."

An Estimate to the probability to win/lose/draw a soccer match will be executed for the following countries.The Estimate will be corresponding 95% Confidence Intervals.
1-Brazil
2-France
3-Argentina
4-Mexico
5-Portugal

Each team will be analyzed in terms of the following:

1- Comparing the probability of win/lose/draw by match type (friendly vs official)
2- Effect of Home fans on match scores

It was concluded that national teams are more likely to win their home matches than their away matches due to several aspects such as fan's support and familiratiy with climate, etc...

Preparation for Dataset Manupilation and Analysis

In [478…
```
import pandas as pd
import matplotlib.pyplot as plt
import statsmodels.api as sm
from statsmodels.stats.proportion import proportion_confint
```

In [479…
```
df=pd.read_csv('results.csv')
```

In [480…
```
df
```

Out[480…

	date	home_team	away_team	home_score	away_score	tournament	city	country
0	1872-11-30	Scotland	England	0	0	Friendly	Glasgow	Scotland
1	1873-03-08	England	Scotland	4	2	Friendly	London	England
2	1874-03-07	Scotland	England	2	1	Friendly	Glasgow	Scotland

	date	home_team	away_team	home_score	away_score	tournament	city	country
3	1875-03-06	England	Scotland	2	2	Friendly	London	England
4	1876-03-04	Scotland	England	3	0	Friendly	Glasgow	Scotland
...	...	...	...	...	...	...	...	...
43183	2/1/2022	Suriname	Guyana	2	1	Friendly	Paramaribo	Suriname
43184	2/2/2022	Burkina Faso	Senegal	1	3	African Cup of Nations	Yaoundé	Cameroon
43185	2/3/2022	Cameroon	Egypt	0	0	African Cup of Nations	Yaoundé	Cameroon
43186	2/5/2022	Cameroon	Burkina Faso	3	3	African Cup of Nations	Yaoundé	Cameroon
43187	2/6/2022	Senegal	Egypt	0	0	African Cup of Nations	Yaoundé	Cameroon

43188 rows × 9 columns

In [481...
```
df.shape
```

Out[481...
```
(43188, 9)
```

In [482...
```
x=df['home_score']-df['away_score']
conditions=[(x>0),(x<0),(x==0)]
```

In [483...
```
x
```

Out[483...
```
0        0
1        2
2        1
3        0
4        3
        ..
43183    1
43184   -2
43185    0
43186    0
43187    0
Length: 43188, dtype: int64
```

In [484...
```
conditions=[(x>0),(x<0),(x==0)]
```

In [485...
```
values=['win','lose','draw']
```

In [486...
```
import numpy as np
```

In [487…
```
df['results']=np.select(conditions,values)
```

In [488…
```
df['results']
```

Out[488…
```
0        draw
1         win
2         win
3        draw
4         win
         ...
43183     win
43184    lose
43185    draw
43186    draw
43187    draw
Name: results, Length: 43188, dtype: object
```

In [489…
```
x=df['results'].value_counts()
```

In [490…
```
x=np.array(x)
```

In [491…
```
x
```

Out[491…
```
array([21009, 12224,  9955], dtype=int64)
```

In [492…
```
N=x.sum()
```

In [493…
```
N
```

Out[493…
```
43188
```

In [494…
```
CI_win=proportion_confint(count=x[1],nobs=N,alpha=(1-.95))
```

In [495…
```
CI_win
```

Out[495…
```
(0.27879305599044235, 0.28729011526083115)
```

In [496…
```
CI_lose=proportion_confint(count=x[0],nobs=N,alpha=(1-.95))
```

In [497…
```
CI_lose
```

Out[497…
```
(0.481740705905987, 0.49116843552218753)
```

In [498…

```
CI_draw=proportion_confint(count=x[2],nobs=N,alpha=(1-.95))
```

In [499…
```
CI_draw
```

Out[499…
```
(0.2265318471530234, 0.23447584016752862)
```

Country 1: Brazil

In [500…
```
dfbra=df[df['country']=='Brazil']
```

In [501…
```
dfbra.head()
```

Out[501…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neutra
503	5/11/1919	Brazil	Chile	6	0	Copa América	Rio de Janeiro	Brazil	Fals
505	5/13/1919	Argentina	Uruguay	2	3	Copa América	Rio de Janeiro	Brazil	Tru
507	5/17/1919	Chile	Uruguay	0	2	Copa América	Rio de Janeiro	Brazil	Tru
508	5/18/1919	Brazil	Argentina	3	1	Copa América	Rio de Janeiro	Brazil	Fals
510	5/22/1919	Argentina	Chile	4	1	Copa América	Rio de Janeiro	Brazil	Tru

In [502…
```
conditions = [
    (dfbra['tournament']=='Friendly'),
    (dfbra['tournament']!='Friendly')    ]
```

In [503…
```
values=['Friendly','Official']
```

In [504…
```
dfbra['typematch'] = np.select(conditions, values)
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/1731960260.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  dfbra['typematch'] = np.select(conditions, values)
```

In [505…
```
dfbra['typematch'].value_counts()
```

Out[505…
```
Official    373
Friendly    194
Name: typematch, dtype: int64
```

Comparing the probability of win/lose/draw by match type:

In [506…
```
x=pd.crosstab(dfbra['typematch'],dfbra['results'],margins=True)
x
```

Out[506…

typematch	draw	lose	win	All
Friendly	38	10	146	194
Official	80	103	190	373
All	118	113	336	567

In [507…
```
x=np.array(x)
x
```

Out[507…
```
array([[ 38,  10, 146, 194],
       [ 80, 103, 190, 373],
       [118, 113, 336, 567]], dtype=int64)
```

In [508…
```
CI_brawin_friendly=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_brawin_friendly
```

Out[508…
```
(0.6918558124106731, 0.8132988267645846)
```

In [509…
```
CI_brawin_official=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_brawin_official
```

Out[509…
```
(0.45865077000712196, 0.5601159860250496)
```

Plotting Confidence Intervals

In [510…
```
ci_brawin = {};
ci_brawin['Typematch'] = ['Friendly','Official']
ci_brawin['lb'] = [CI_brawin_friendly[0],CI_brawin_official[0]]
ci_brawin['ub'] = [CI_brawin_friendly[1],CI_brawin_official[1]]
df_ci_bra= pd.DataFrame(ci_brawin)
df_ci_bra
```

Out[510…

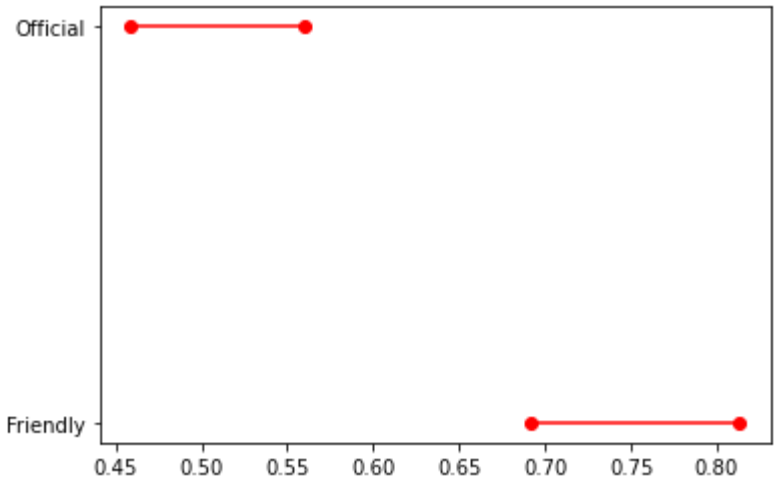
	Typematch	lb	ub
0	Friendly	0.691856	0.813299
1	Official	0.458651	0.560116

In [511…
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(df_ci_bra['lb'],df_ci_bra['ub'],range(len(df_ci_bra))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci_bra)),list(df_ci_bra['Typematch']))
```

```
([<matplotlib.axis.YTick at 0x1fb055a6e50>,
```

Out[511…

```
 <matplotlib.axis.YTick at 0x1fb05f079a0>],
[Text(0, 0, 'Friendly'), Text(0, 1, 'Official')])
```



Brazil's National Team are more likely to win a friendly than to win an official match. Putting into consideration that the number of official matches that Brazil played were more than the friendlies with approx 200 matches, the data may be prone to errors and bias since the sample size isn't the same in both groups. Brazil has a probability of 70% to win a friendly whereas they have a probability of 50% to win an official match.

Effect of Home fans on match scores

In [512…

```
dfbra['home_team'].loc[dfbra['home_team']=='Brazil']
```

Out[512…

```
503      Brazil
508      Brazil
512      Brazil
513      Brazil
515      Brazil
         ...
42513    Brazil
42529    Brazil
42756    Brazil
42916    Brazil
42956    Brazil
Name: home_team, Length: 353, dtype: object
```

In [513…

```
dfbra['home']=(dfbra['home_team']=='Brazil')
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/3044022109.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  dfbra['home']=(dfbra['home_team']=='Brazil')
```

In [514…

```
dfbra['home'].value_counts()
```

Out[514…

```
True     353
False    214
Name: home, dtype: int64
```

In [515…
```
x=pd.crosstab(dfbra['home'],dfbra['results'],margins=True)
x
```

Out[515…

home	draw	lose	win	All
False	47	90	77	214
True	71	23	259	353
All	118	113	336	567

In [516…
```
dfbra.head(4)
```

Out[516…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neutra
503	5/11/1919	Brazil	Chile	6	0	Copa América	Rio de Janeiro	Brazil	Fals
505	5/13/1919	Argentina	Uruguay	2	3	Copa América	Rio de Janeiro	Brazil	Tru
507	5/17/1919	Chile	Uruguay	0	2	Copa América	Rio de Janeiro	Brazil	Tru
508	5/18/1919	Brazil	Argentina	3	1	Copa América	Rio de Janeiro	Brazil	Fals

In [517…
```
x=np.array(x)
x
```

Out[517…
```
array([[ 47,  90,  77, 214],
       [ 71,  23, 259, 353],
       [118, 113, 336, 567]], dtype=int64)
```

In [518…
```
CI_brawin_home=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_brawin_home
```

Out[518…
```
(0.6876005470699119, 0.7798215492473685)
```

In [519…
```
CI_brawin_away=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_brawin_away
```

Out[519…
```
(0.2955098113591182, 0.42411635686518084)
```

In [520…
```
ci_brawin = {}
ci_brawin['home'] = ['Yes','No']
ci_brawin['lb'] = [CI_brawin_home[0],CI_brawin_away[0]]
ci_brawin['ub'] = [CI_brawin_home[1],CI_brawin_away[1]]
df_ci= pd.DataFrame(ci_brawin)
df_ci
```

Out[520...

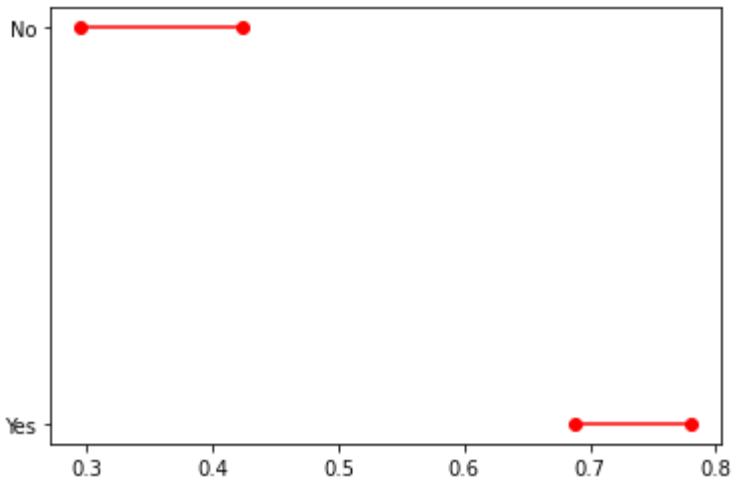
	home	lb	ub
0	Yes	0.687601	0.779822
1	No	0.295510	0.424116

In [521...

```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[521...

```
([<matplotlib.axis.YTick at 0x1fb06b3dac0>,
  <matplotlib.axis.YTick at 0x1fb06b3dfd0>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



Brazil are more likely to win a home match rather than winning an away match. The probability of winning an away match is 35%. whereas the probability of winning a home match is 75%, which is approximetly twice the probability of winning an away match More home matches were played (100 game difference), which can make the data slightly bias since the sample size isn't the same.

Country 2: France

In [522...

```
dffra=df[df['country']=='France']
```

In [523...

```
dffra.head()
```

Out[523...

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
166	2/12/1905	France	Switzerland	1	0	Friendly	Paris	France	F
185	4/22/1906	France	Belgium	0	5	Friendly	Saint-Cloud	France	F
215	4/12/1908	France	Belgium	1	2	Friendly	Colombes	France	F
257	4/3/1910	France	Belgium	0	4	Friendly	Gentilly	France	F
277	1/1/1911	France	Hungary	0	3	Friendly	Maisons-Alfort	France	F

In [524…
```
conditions = [
    (dffra['tournament']=='Friendly'),
    (dffra['tournament']!='Friendly')
    ]
```

In [525…
```
values=['Friendly','Official']
```

In [526…
```
dffra['typematch'] = np.select(conditions, values)
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/3804957663.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dffra['typematch'] = np.select(conditions, values)
```

In [527…
```
dffra['typematch'].value_counts()
```

Out[527…
```
Friendly    471
Official    347
Name: typematch, dtype: int64
```

Comparing the probability of win/lose/draw by match type:

In [528…
```
x=pd.crosstab(dffra['typematch'],dffra['results'],margins=True)
x
```

Out[528…

results	draw	lose	win	All
typematch				
Friendly	112	131	228	471
Official	77	81	189	347
All	189	212	417	818

In [529…
```
x=np.array(x)
x
```

Out[529…
```
array([[112, 131, 228, 471],
       [ 77,  81, 189, 347],
       [189, 212, 417, 818]], dtype=int64)
```

In [530…
```
CI_frawin_friendly=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_frawin_friendly
```

Out[530…
```
(0.43894415137605935, 0.5292087148659789)
```

In [531…
```
CI_frawin_official=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_frawin_official
```

Out[531…
```
(0.4922707551354989, 0.5970664206570083)
```

Plotting the Confidence Intervals

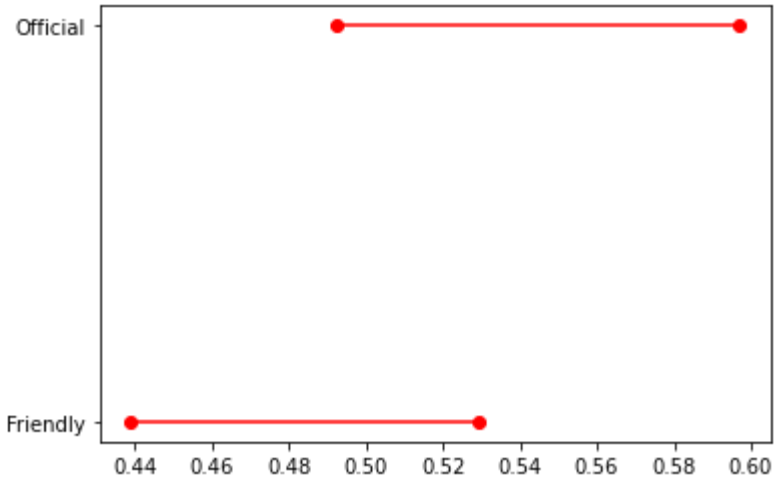
In [532…
```
ci_frawin = {}
ci_frawin['Typematch'] = ['Friendly','Official']
ci_frawin['lb'] = [CI_frawin_friendly[0],CI_frawin_official[0]]
ci_frawin['ub'] = [CI_frawin_friendly[1],CI_frawin_official[1]]
df_ci= pd.DataFrame(ci_frawin)
df_ci
```

Out[532…

	Typematch	lb	ub
0	Friendly	0.438944	0.529209
1	Official	0.492271	0.597066

In [533…
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['Typematch']))
```

Out[533…
```
([<matplotlib.axis.YTick at 0x1fb06bb29a0>,
  <matplotlib.axis.YTick at 0x1fb06bb2220>],
 [Text(0, 0, 'Friendly'), Text(0, 1, 'Official')])
```



The confidence intervals of France overlap, and are very close in terms of numerics. The probability of winning an official match is similar to winning a friendly (approx 50%) which shows that France's level doesn't change based on the match type. Also it can be concluded that France isn't consistent in terms of winning matches either they are friendly or not

Examining the effect of fans on match scores

In [534…
```
dffra['home_team'].loc[dffra['home_team']=='France']
```

Out[534…
```
166      France
185      France
215      France
257      France
```

```
277      France
          ...
42244    France
42346    France
42597    France
42723    France
42988    France
Name: home_team, Length: 443, dtype: object
```

In [535…
```
dffra['home']=(dffra['home_team']=='France')
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/1599372481.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  dffra['home']=(dffra['home_team']=='France')
```

In [536…
```
dffra['home'].value_counts()
```

Out[536…
```
True     443
False    375
Name: home, dtype: int64
```

In [537…
```
x=pd.crosstab(dffra['home'],dffra['results'],margins=True)
x
```

Out[537…

results	draw	lose	win	All
home				
False	100	118	157	375
True	89	94	260	443
All	189	212	417	818

In [538…
```
dffra.head(4)
```

Out[538…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
166	2/12/1905	France	Switzerland	1	0	Friendly	Paris	France	F
185	4/22/1906	France	Belgium	0	5	Friendly	Saint-Cloud	France	F
215	4/12/1908	France	Belgium	1	2	Friendly	Colombes	France	F
257	4/3/1910	France	Belgium	0	4	Friendly	Gentilly	France	F

In [539…
```
x=np.array(x)
x
```

Out[539…
```
array([[100, 118, 157, 375],
       [ 89,  94, 260, 443],
       [189, 212, 417, 818]], dtype=int64)
```

In [540…
```
CI_frawin_home=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_frawin_home
```

Out[540…
```
(0.541055825404375, 0.6327590730154896)
```

In [541…
```
CI_frawin_away=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_frawin_away
```

Out[541…
```
(0.36873463210645324, 0.46859870122688013)
```

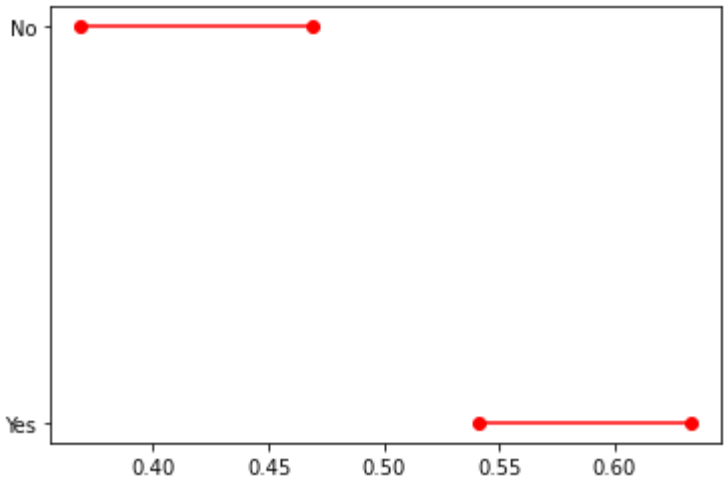
In [542…
```
ci_frawin = {}
ci_frawin['home'] = ['Yes','No']
ci_frawin['lb'] = [CI_frawin_home[0],CI_frawin_away[0]]
ci_frawin['ub'] = [CI_frawin_home[1],CI_frawin_away[1]]
df_ci= pd.DataFrame(ci_frawin)
df_ci
```

Out[542…

	home	lb	ub
0	Yes	0.541056	0.632759
1	No	0.368735	0.468599

In [543…
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[543…
```
([<matplotlib.axis.YTick at 0x1fb06c1a940>,
  <matplotlib.axis.YTick at 0x1fb06c1ae80>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



There is a signifcant difference in the probability of winning home and away matches for the French football team. As for home matches, france have a winning probability of 55%. On the other hand,

they have a very low probability of winning away games (43%). The number of away matches and home matches analyzed were slightly similar, which makes the results more reliable.

Country 3: Argentina

In [544...]
```
dfarg=df[df['country']=='Argentina']
```

In [545...]
```
dfarg.head()
```

Out[545...]

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
155	9/13/1903	Argentina	Uruguay	2	3	Friendly	Buenos Aires	Argentina	F
177	8/15/1905	Argentina	Uruguay	0	0	Copa Lipton	Buenos Aires	Argentina	F
190	10/21/1906	Argentina	Uruguay	2	1	Copa Newton	Buenos Aires	Argentina	F
226	9/13/1908	Argentina	Uruguay	2	1	Copa Newton	Buenos Aires	Argentina	F
227	10/4/1908	Argentina	Uruguay	0	1	Copa Premio Honor Argentino	Buenos Aires	Argentina	F

In [546...]
```
conditions = [
    (dfarg['tournament']=='Friendly'),
    (dfarg['tournament']!='Friendly')]
```

In [547...]
```
values=['Friendly','Official']
```

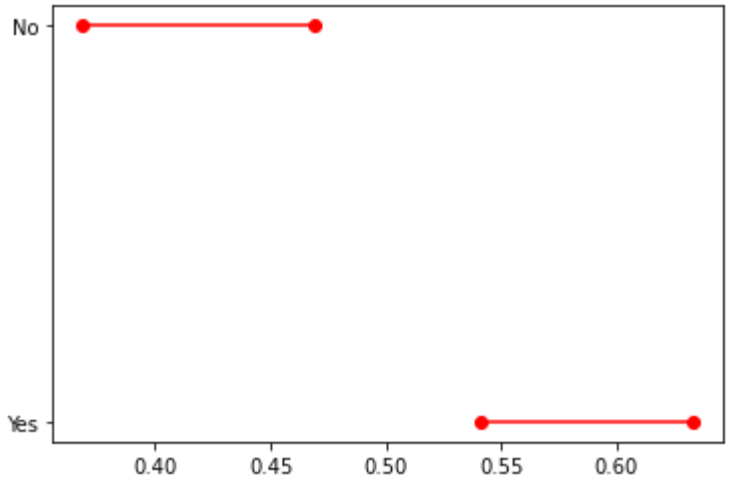
In [548...]
```
dfarg['typematch'] = np.select(conditions, values)
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/341218318.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  dfarg['typematch'] = np.select(conditions, values)
```

In [549...]
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[549...]
```
([<matplotlib.axis.YTick at 0x1fb06c7f400>,
  <matplotlib.axis.YTick at 0x1fb06c77c40>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



In [550…
```
dfarg['typematch'].value_counts()
```

Out[550…
```
Official    321
Friendly    135
Name: typematch, dtype: int64
```

Comparing the probability of win/lose/draw by match type:

In [551…
```
x=pd.crosstab(dfarg['typematch'],dfarg['results'],margins=True)
x
```

Out[551…

typematch	draw	lose	win	All
Friendly	35	11	89	135
Official	77	59	185	321
All	112	70	274	456

In [552…
```
x=np.array(x)
x
```

Out[552…
```
array([[ 35,  11,  89, 135],
       [ 77,  59, 185, 321],
       [112,  70, 274, 456]], dtype=int64)
```

In [553…
```
CI_argwin_friendly=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_argwin_friendly
```

Out[553…
```
(0.5793087273506131, 0.7392097911679053)
```

In [554…
```
CI_argwin_official=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_argwin_official
```

Out[554…
```
(0.5222677442170198, 0.6303802308608617)
```

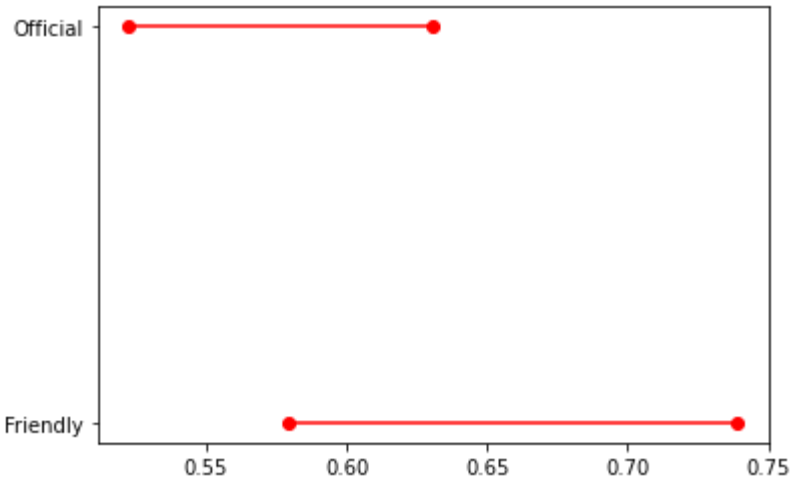
In [555…
```
ci_argwin = {}
ci_argwin['Typematch'] = ['Friendly','Official']
ci_argwin['lb'] = [CI_argwin_friendly[0],CI_argwin_official[0]]
ci_argwin['ub'] = [CI_argwin_friendly[1],CI_argwin_official[1]]
df_ci= pd.DataFrame(ci_argwin)
df_ci
```

Out[555…

	Typematch	lb	ub
0	Friendly	0.579309	0.73921
1	Official	0.522268	0.63038

In [556…
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['Typematch']))
```

Out[556…
```
([<matplotlib.axis.YTick at 0x1fb07d6f550>,
  <matplotlib.axis.YTick at 0x1fb07d68d90>],
 [Text(0, 0, 'Friendly'), Text(0, 1, 'Official')])
```



Argentina played approx 200 official matches more than friendlies, which makes the sample size of friendlies prone to error. Argentina have a 60% probability of winning official matches, whereas they have a 65% probability of winning friendlies. The percentages are not very different, which shows that Argentina deal with friendlies and official matches similarly.

Examining the effect of fans on match scores

In [557…
```
dfarg['home']=(dfarg['home_team']=='Argentina')
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/705306775.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  dfarg['home']=(dfarg['home_team']=='Argentina')
```

In [558…
```
dfarg['home'].loc[dfarg['home_team']=='Argentina']
```

Out[558…
```
155      True
177      True
190      True
226      True
227      True
         ...
42272    True
42755    True
42853    True
42915    True
43063    True
Name: home, Length: 340, dtype: bool
```

In [559…
```
dfarg['home_team'].loc[dfarg['home_team']=='Argentina']
```

Out[559…
```
155      Argentina
177      Argentina
190      Argentina
226      Argentina
227      Argentina
           ...
42272    Argentina
42755    Argentina
42853    Argentina
42915    Argentina
43063    Argentina
Name: home_team, Length: 340, dtype: object
```

In [560…
```
dfarg['home'].value_counts()
```

Out[560…
```
True     340
False    116
Name: home, dtype: int64
```

In [561…
```
x=pd.crosstab(dfarg['home'],dfarg['results'],margins=True)
x
```

Out[561…

results	draw	lose	win	All
home				
False	27	39	50	116
True	85	31	224	340
All	112	70	274	456

In [562…
```
dfarg.head(4)
```

Out[562…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
155	9/13/1903	Argentina	Uruguay	2	3	Friendly	Buenos Aires	Argentina	F
177	8/15/1905	Argentina	Uruguay	0	0	Copa Lipton	Buenos Aires	Argentina	F

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
190	10/21/1906	Argentina	Uruguay	2	1	Copa Newton	Buenos Aires	Argentina	F
226	9/13/1908	Argentina	Uruguay	2	1	Copa Newton	Buenos Aires	Argentina	F

In [563…
```
x=np.array(x)
x
```

Out[563…
```
array([[ 27,  39,  50, 116],
       [ 85,  31, 224, 340],
       [112,  70, 274, 456]], dtype=int64)
```

In [564…
```
CI_argwin_home=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_argwin_home
```

Out[564…
```
(0.6084290783071029, 0.7092179805164265)
```

In [565…
```
CI_argwin_away=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_argwin_away
```

Out[565…
```
(0.34091512726528816, 0.5211538382519532)
```

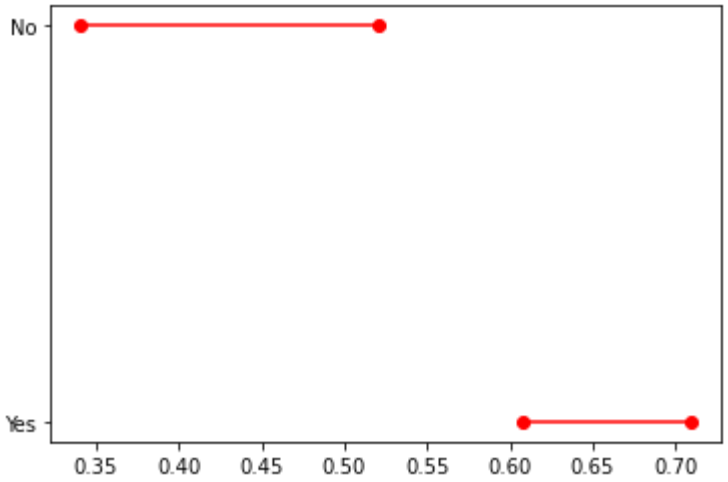
In [566…
```
ci_argwin = {}
ci_argwin['home'] = ['Yes','No']
ci_argwin['lb'] = [CI_argwin_home[0],CI_argwin_away[0]]
ci_argwin['ub'] = [CI_argwin_home[1],CI_argwin_away[1]]
df_ci= pd.DataFrame(ci_argwin)
df_ci
```

Out[566…

	home	lb	ub
0	Yes	0.608429	0.709218
1	No	0.340915	0.521154

In [567…
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[567…
```
([<matplotlib.axis.YTick at 0x1fb07dccd90>,
  <matplotlib.axis.YTick at 0x1fb07dcc610>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



It is very clear that Argentina are more likely to win a home match than an away match. Argentina has a prob of 65% to win a home match where as they have a prob of 42% of winning an away match. This shows that Argentina are weaker on away grounds, and that their fans can have a strong impact on the player's performance.

Country 4: Mexico

In [568…
```
dfmex=df[df['country']=='Mexico']
```

In [569…
```
dfmex.head()
```

Out[569…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
776	12/9/1923	Mexico	Guatemala	2	1	Friendly	Mexico City	Mexico	F
777	12/12/1923	Mexico	Guatemala	2	0	Friendly	Mexico City	Mexico	F
778	12/16/1923	Mexico	Guatemala	3	3	Friendly	Mexico City	Mexico	F
1654	3/4/1934	Mexico	Cuba	3	2	FIFA World Cup qualification	Mexico City	Mexico	F
1657	3/11/1934	Mexico	Cuba	5	0	FIFA World Cup qualification	Mexico City	Mexico	F

In [570…
```
conditions = [
    (dfmex['tournament']=='Friendly'),
    (dfmex['tournament']!='Friendly') ]
```

In [571…
```
values=['Friendly','Official']
```

In [572…

```
dfmex['typematch'] = np.select(conditions, values)
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/1511792898.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  dfmex['typematch'] = np.select(conditions, values)
```

In [573…
```
dfmex['typematch'].value_counts()
```

Out[573…
```
Official    231
Friendly    167
Name: typematch, dtype: int64
```

Comparing the probability of win/lose/draw by match type:

In [574…
```
x=pd.crosstab(dfmex['typematch'],dfmex['results'],margins=True)
x
```

Out[574…

typematch	draw	lose	win	All
Friendly	41	32	94	167
Official	45	39	147	231
All	86	71	241	398

In [575…
```
x=np.array(x)
x
```

Out[575…
```
array([[ 41,  32,  94, 167],
       [ 45,  39, 147, 231],
       [ 86,  71, 241, 398]], dtype=int64)
```

In [576…
```
CI_mexwin_friendly=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_mexwin_friendly
```

Out[576…
```
(0.4876429212433331, 0.6381055817506789)
```

In [577…
```
CI_mexwin_official=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_mexwin_official
```

Out[577…
```
(0.574329829784305, 0.6983974429429677)
```

In [578…
```
ci_mexwin = {}
ci_mexwin['Typematch'] = ['Friendly','Official']
ci_mexwin['lb'] = [CI_mexwin_friendly[0],CI_mexwin_official[0]]
ci_mexwin['ub'] = [CI_mexwin_friendly[1],CI_mexwin_official[1]]
```

```
df_ci= pd.DataFrame(ci_mexwin)
df_ci
```

Out[578…

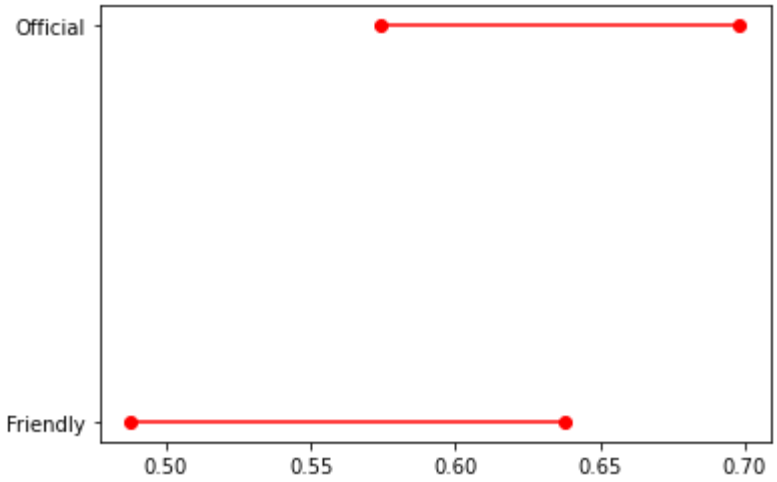
	Typematch	lb	ub
0	Friendly	0.487643	0.638106
1	Official	0.574330	0.698397

In [579…

```
import matplotlib.pyplot as plt
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['Typematch']))
```

Out[579…

```
([<matplotlib.axis.YTick at 0x1fb07e36cd0>,
  <matplotlib.axis.YTick at 0x1fb07e365b0>],
 [Text(0, 0, 'Friendly'), Text(0, 1, 'Official')])
```



Mexico played more official matches than friendlies, which can be reflected on the friendly wide confidence interval. Also both confidence intervals overlap. Mexico have a probability of 55% to win a friendly where as they have 63% of winning an official match.

Examining the effect of fans on match scores

In [580…

```
dfmex['home_team'].loc[dfmex['home_team']=='Mexico']
```

Out[580…

```
776      Mexico
777      Mexico
778      Mexico
1654     Mexico
1657     Mexico
          ...
41476    Mexico
41673    Mexico
42642    Mexico
42778    Mexico
42841    Mexico
Name: home_team, Length: 270, dtype: object
```

In [581…

```
dfmex.head(4)
```

Out[581...

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
776	12/9/1923	Mexico	Guatemala	2	1	Friendly	Mexico City	Mexico	F
777	12/12/1923	Mexico	Guatemala	2	0	Friendly	Mexico City	Mexico	F
778	12/16/1923	Mexico	Guatemala	3	3	Friendly	Mexico City	Mexico	F
1654	3/4/1934	Mexico	Cuba	3	2	FIFA World Cup qualification	Mexico City	Mexico	F

In [582...

```
x=np.array(x)
x
```

Out[582...

```
array([[ 41,  32,  94, 167],
       [ 45,  39, 147, 231],
       [ 86,  71, 241, 398]], dtype=int64)
```

In [583...

```
CI_mexwin_home=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_mexwin_home
```

Out[583...

```
(0.574329829784305, 0.6983974429429677)
```

In [584...

```
CI_mexwin_away=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_mexwin_away
```

Out[584...

```
(0.4876429212433331, 0.6381055817506789)
```

In [585...

```
ci_mexwin = {}
ci_mexwin['home'] = ['Yes','No']
ci_mexwin['lb'] = [CI_mexwin_home[0],CI_mexwin_away[0]]
ci_mexwin['ub'] = [CI_mexwin_home[1],CI_mexwin_away[1]]
df_ci= pd.DataFrame(ci_mexwin)
df_ci
```

Out[585...

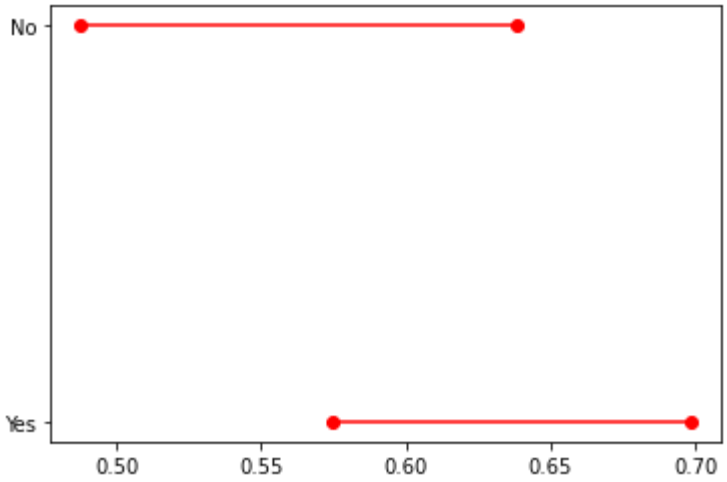
	home	lb	ub
0	Yes	0.574330	0.698397
1	No	0.487643	0.638106

In [586...

```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[586...

```
([<matplotlib.axis.YTick at 0x1fb07e89fd0>,
  <matplotlib.axis.YTick at 0x1fb07e89880>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



Mexico played more home matches than friendlies, which can be reflected on the friendly wide confidence interval. Also both confidence intervals overlap. Mexico have a probability of 55% to win a home match where as they have 63% of winning an away match.

Country 5: Portugal

In [587…
```
dfpor=df[df['country']=='Portugal']
```

In [588…
```
dfpor.head()
```

Out[588…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
689	12/17/1922	Portugal	Spain	1	2	Friendly	Lisbon	Portugal	Fa
896	6/18/1925	Portugal	Italy	1	0	Friendly	Lisbon	Portugal	Fa
1028	12/26/1926	Portugal	Hungary	3	3	Friendly	Porto	Portugal	Fa
1035	3/16/1927	Portugal	France	4	0	Friendly	Lisbon	Portugal	Fa
1111	1/8/1928	Portugal	Spain	2	2	Friendly	Lisbon	Portugal	Fa

In [589…
```
conditions = [
    (dfpor['tournament']=='Friendly'),
    (dfpor['tournament']!='Friendly')   ]
```

In [590…
```
values=['Friendly','Official']
```

In [591…
```
dfpor['typematch'] = np.select(conditions, values)
```

```
C:\Users\h\AppData\Local\Temp/ipykernel_8568/1856830226.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
```

```
guide/indexing.html#returning-a-view-versus-a-copy
  dfpor['typematch'] = np.select(conditions, values)
```

In [592…]
```
dfpor['typematch'].value_counts()
```

Out[592…]
```
Friendly    193
Official    179
Name: typematch, dtype: int64
```

Comparing the probability of win/lose/draw by match type:

In [593…]
```
x=pd.crosstab(dfpor['typematch'],dfpor['results'],margins=True)
x
```

Out[593…]

typematch	draw	lose	win	All
Friendly	54	53	86	193
Official	44	34	101	179
All	98	87	187	372

In [594…]
```
x=np.array(x)
x
```

Out[594…]
```
array([[ 54,  53,  86, 193],
       [ 44,  34, 101, 179],
       [ 98,  87, 187, 372]], dtype=int64)
```

In [595…]
```
CI_porwin_friendly=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_porwin_friendly
```

Out[595…]
```
(0.3754740248527574, 0.5157176849918021)
```

In [596…]
```
CI_porwin_official=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_porwin_official
```

Out[596…]
```
(0.49160569342990423, 0.6368859266818276)
```

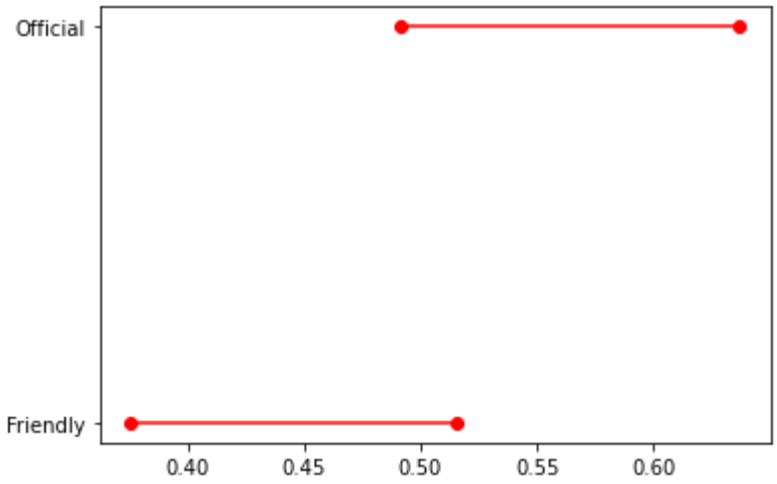
In [597…]
```
ci_porwin = { }
ci_porwin['Typematch'] = ['Friendly','Official']
ci_porwin['lb'] = [CI_porwin_friendly[0],CI_porwin_official[0]]
ci_porwin['ub'] = [CI_porwin_friendly[1],CI_porwin_official[1]]
df_ci= pd.DataFrame(ci_porwin)
df_ci
```

Out[597…]

	Typematch	lb	ub
0	Friendly	0.375474	0.515718
1	Official	0.491606	0.636886

In [598…
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['Typematch']))
```

Out[598…
```
([<matplotlib.axis.YTick at 0x1fb07eeb3d0>,
  <matplotlib.axis.YTick at 0x1fb07ee2c10>],
 [Text(0, 0, 'Friendly'), Text(0, 1, 'Official')])
```



Portugal played approx similar number of friendly and offical matches, which makes the confidence intervals more reliable despite the wide intervals. As for official matches, Portgual has a win percentage of 55%. On the other hand, portugal has a 44% of winning a friendly. This shows that portgual takes official matches more seriously.

Examining the effect of fans on match scores

In [599…
```
dfpor['home_team'].loc[dfpor['home_team']=='Portugal']
```

Out[599…
```
689      Portugal
896      Portugal
1028     Portugal
1035     Portugal
1111     Portugal
           ...
42373    Portugal
42594    Portugal
42834    Portugal
42882    Portugal
43002    Portugal
Name: home_team, Length: 296, dtype: object
```

In [600…
```
dfpor.head(4)
```

Out[600…

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
689	12/17/1922	Portugal	Spain	1	2	Friendly	Lisbon	Portugal	F
896	6/18/1925	Portugal	Italy	1	0	Friendly	Lisbon	Portugal	F
1028	12/26/1926	Portugal	Hungary	3	3	Friendly	Porto	Portugal	F

	date	home_team	away_team	home_score	away_score	tournament	city	country	neu
1035	3/16/1927	Portugal	France	4	0	Friendly	Lisbon	Portugal	F

In [601…
```
x=np.array(x)
x
```

Out[601…
```
array([[ 54,  53,  86, 193],
       [ 44,  34, 101, 179],
       [ 98,  87, 187, 372]], dtype=int64)
```

In [602…
```
CI_porwin_home=proportion_confint(count=x[1,2],nobs=x[1,3],alpha=(1-.95))
CI_porwin_home
```

Out[602…
```
(0.49160569342990423, 0.6368859266818276)
```

In [603…
```
CI_porwin_away=proportion_confint(count=x[0,2],nobs=x[0,3],alpha=(1-.95))
CI_porwin_away
```

Out[603…
```
(0.3754740248527574, 0.5157176849918021)
```

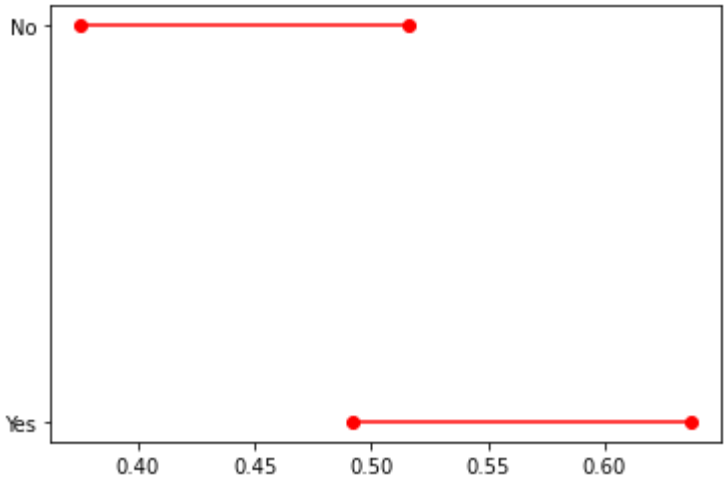
In [604…
```
ci_porwin = {}
ci_porwin['home'] = ['Yes','No']
ci_porwin['lb'] = [CI_porwin_home[0],CI_porwin_away[0]]
ci_porwin['ub'] = [CI_porwin_home[1],CI_porwin_away[1]]
df_ci= pd.DataFrame(ci_porwin)
df_ci
```

Out[604…

	home	lb	ub
0	Yes	0.491606	0.636886
1	No	0.375474	0.515718

In [605…
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['home']))
```

Out[605…
```
([<matplotlib.axis.YTick at 0x1fb07f41880>,
  <matplotlib.axis.YTick at 0x1fb07f197f0>],
 [Text(0, 0, 'Yes'), Text(0, 1, 'No')])
```



As for away matches, Portgual has a win percentage of 42%. On the other hand, portugal has a 55% of winning a home match. This shows that portgual home fans have a slight impact on their player's performance.

Conclusion and Discussion

Part 1: By the Numbers

Examining the Numbers, it can be concluded that France has the biggest portion of the data from the countries analyzed in this notebook with 818 matches. The lowest national team is portugal with 372 matches. This surely negatively impacts the conclusion since not all countries have the same sample size, which makes teams with less number of matches have a less accurate estimate.

Part 2: Official or Friendly?

In most of the countries analyzed, there was a vivid difference between official and friendly matches. Brazil was the strongest national team in friendlies with a win probability of 70%. On the other hand, France had the lowest probability of winning a friendly with 50%. As for official matches, mexico had the highest win probability with 63%, and in second place came Argentina with 60%. As for portugal, they had a very low win probability of official matches with 44%.

Part 3: Home or Away?

The long lasting debate of whether home matches are easier to win or not has been stastically examined. All 5 teams had a higher probability of winning home matches than away matches. Brazil had the highest probability of winning a home match, which can be concluded that the brazilian fans do impact their national team's performance. However, all 5 teams had very low chance of winning away matches, which is an area of concern. National teams should focus on doing extensive research on the purpose behind such low probabilities especially since nowadays friendlies started impacting the countries' overall fifa rank.