

Super Forecasting Project

SCH-MGMT 650 STATISTICS FOR BUSINESS - PROF BRETT ALBERT

Stats Family #2

- Geetha Ragiphani
- Anand Gupta
- Sumanth Nomula
- Sahibnoor Chahal

Q1: How far will England advance in the 2024 European Football Championship?

Establishing Bayesian Prior Probability: The outside view

England National Football team's current FIFA Ranking is 3rd & in UEFA it is 2nd.

Final standing of UEFA 2nd ranked country in European Football Championships since the inception of FIFA

FIFA Rank	UEFA Rank	Country	UEFA Euro Year	Final Standing
2	2	Italy	1992	DNQ
3	2	France	1996	SF
4	2	Italy	2000	2nd
4	2	Czech Republic	2004	SF
2	2	Germany	2008	2nd
2	2	Germany	2012	SF
5	2	Belgium	2016	QF
2	2	France	2020	R16

Probability of a 2nd ranked team's standing in Euros, based on last 8 editions is as under

R16 – 87.5%
QF - 75.00%
SF - 62.50%
F - 25.00%

[4]
[5]
[6]

Q1: How far will England advance in the 2024 European Football Championship?

Updating Beliefs: The Inside View

Present performance of England squad :

- England reached the finals of EURO 2020 with the same manager, Gareth Southgate and captain, Harry Kane.
- England won all their matches in EURO 2024 qualifiers and in 2023, they have won 80% of the matches played and drew 20% losing nil.
- England reached its best ranking in 2023 and the team is in great form.

Current Players :

- No key injuries have been reported so far and the squad is at full strength. Based on the above, we can assume $P(\text{RecentPerformance})$ at **85%** as they not lost a match in this year so far.

Performance in Penalty shootouts:

- England has performed poorly when it comes to Penalty shoot outs, as they won only 3 matches out of 10 in high profile tournaments., we are assigning probability of England winning in Penalty shoot outs at 30%. [8]
- Since only two matches so far have been drawn this year out of 10, the probability of a R16, QF match going to penalty shootout is 20%.
Probability of win is $0.8 * 0.85 + 0.2 * 0.3 = 0.74$.

In, finals, the probability of a match going to penalty shootout increases, hence we are increasing the probability to 40% and 50% respectively
So, the probability of win is $0.6 * 0.85 + 0.4 * 0.3 = 0.63$ (Semifinal) and $0.5 * 0.85 + 0.5 * 0.3 = 0.575$

Black Swan event:

- Key player, captain Harry Kane who has not been injured since the last 3 years getting injured and exiting the tournament – $P(\text{Black Swan}) = 5\%$ [7]

New evidence Probability = 80.75% ($85\% * 95\%$) – Round of 16

New evidence Probability = 70.30% ($74\% * 95\%$) – QF,

New evidence Probability = 59.85% ($63\% * 95\%$) – SF

New evidence Probability = 54.15% ($57\% * 95\%$) – F

Q1: How far will England advance in the 2024 European Football Championship?

Conclusion:

Upon calculating posterior probability for each instance based on Bayesian Prior and Present situation For (R16, QF, SF &F):

Variables	R16	QF	SF	F
Prior -x	0.875	0.75	0.625	0.25
New Belief -y	0.81	0.7	0.6	0.54
(x+y)/2	84%	73%	61%	40%

Table 1: Kent's Words of Estimative Probability ^[2]		
Certain	100%	Give or take 0%
The General Area of Possibility		
Almost Certain	93%	Give or take about 6%
Probable	75%	Give or take about 12%
Chances About Even	50%	Give or take about 10%
Probably Not	30%	Give or take about 10%
Almost Certainly Not	7%	Give or take about 5%
Impossible	0	Give or take 0%

Based on Kent's chart of probability, it is **Probable** England will be reaching **Quarter Finals**, as the calculated posterior probability is **73%** and they have Chances about even to reach **Semi Finals**.

Q2: Will there be a lethal confrontation between the national military forces of Russia and the United States before December 31, 2024?

Establishing Bayesian Prior Probability: The outside view

How many lethal confrontations have occurred between countries possessing nuclear weapons in the past 100 years?

In the history of mankind, there has only been one instance where nuclear weapons were used by military forces during lethal confrontations. Based on this, our Bayesian prior will be $1/100 = 1\%$

Q2: Will there be a lethal confrontation between the national military forces of Russia and the United States before December 31, 2024?

Updating Beliefs: The Inside View:

1. US' support to Ukraine in the ongoing Ukraine-Russian war:
 - Historically, US has shown strong patterns of support for its allies in their domestic and international affairs. There have been far less instances of them not showing support due to peace treaties and other acts. [1]
 - $P(\text{US Support}) = 0.85$
2. The impact of Trade sanctions on Russia by US and its allies:
 - Russia has shown short-term resilience when sanctioned by US and its allies, but there have been long term consequences too, including shifts in economic policies, growing dependence on specific partners, and potential risks associated with isolation from global economic dynamics. [2]
 - $P(\text{Trade Sanctions Impact}) = 0.4$

[1] http://www.news.cn/english/2021-10/01/c_1310221820.htm

[2] <https://carnegieendowment.org/politika/89708>

Q2: Will there be a lethal confrontation between the national military forces of Russia and the United States before December 31, 2024?

Updating Beliefs: The Inside View:

3. Role of International Organizations such as UN, NATO, OPEC+
 - There are a lot of sub-questions that come into play when we consider the role and impact of international organizations in such situations. How long has the dispute been? Do more member nations mean less conflict onsets? Is there a moral hazard problem?
 - Taking into consideration all these factors and based on our research [3], we've found that even though there have been no nuclear confrontations since organizations like the UN were formed, the probability of International Organizations playing the role of conflict resolution is substantially lower than expected.
 - $P(\text{IO Role}) = 0.3$

[3] <https://www.jstor.org/stable/40931157?seq=16>

Q2: Will there be a lethal confrontation between the national military forces of Russia and the United States before December 31, 2024?

Conclusion:

- Predicting a lethal confrontation between Russia and the U.S. by December 31, 2024, is complex. While historical U.S. support for allies and economic sanctions on Russia play roles, the effectiveness in preventing conflict is uncertain.
- International organizations, despite their aim to resolve disputes, historically show lower-than-expected effectiveness. The outcome depends on evolving geopolitical dynamics, emphasizing the need for ongoing diplomatic efforts and international cooperation to mitigate the risk of armed hostilities.
- The outcome depends on these multifaceted dynamics, underscoring the need for ongoing diplomatic efforts, international cooperation, and proactive measures to prevent armed hostilities.
- Taking into consideration the cluster questions and the impact they have on the Bayesian Prior we set initially, we can safely say that these factors will only decrease the value of our Bayesian prior.

Q3: Will the Dow Jones Industrial Average finish 2024 higher than 43,000?

Establishing Bayesian Prior Probability: The Outside View

What is the Dow Jones Industrial Average now? **36,204.44** In order to finish the 2024 at a value higher than 43,000, it would need a year-over-year increase of about 18.77%.

The chart alongside shows year-over-year change in percent over the past 30 years. In 9 such instances, the increase was larger than the overall average. Based on this data, we can set our **Bayesian Prior** at $9/30 = 0.3$

Year	Change %
2022	-8.78
2021	18.73
2020	7.25
2019	22.34
2018	-5.63
2017	25.08
2016	13.42
2015	-2.23
2014	7.52
2013	26.5
2012	7.26
2011	5.53
2010	11.02
2009	18.82
2008	-33.84
2007	6.43
2006	16.29
2005	-0.61
2004	3.15
2003	25.32
2002	-16.76
2001	-7.1
2000	-6.17
1999	25.22
1998	16.1
1997	22.64
1996	26.01
1995	33.45
1994	2.14
1993	13.72
Average	9.09

Q3: Will the Dow Jones Industrial Average finish 2024 higher than 43,000?

Updating Beliefs: The Inside View

1. Historical relationship between GDP growth and the Dow Jones performance:
 - Over a long term, there is appositive correlation between GDP growth and DJIA performance.
 - Company specific factors: DJIA heavily and directly relies on corporate earnings, industry performances, and global market conditions.
 - Looking into all of this, we believe even though there does exist a relationship between DJIA and GDP, the correlation isn't that strong. $P(\text{DJIA} \ \& \ \text{GDP}) = 0.5$
2. DJIA vs S&P 500:
 - These 2 are widely followed stock market indices in the US. Even though the correlation between them is strong, it is important to note that correlation does not imply causation. Factors like the size of their indices, their composition, market dynamics and events, investor sentiments cause a difference in their performances. Upon comparing their historical data, $P(\text{DJIA} \ \text{vs} \ \text{S\&P} \ 500) = 0.6$

Q3: Will the Dow Jones Industrial Average finish 2024 higher than 43,000?

Updating Beliefs: The Inside View

3. Impact of global events:

- The US National Elections or significant political changes in major economies can affect the market sentiment.
- Geopolitical tensions like the ongoing Ukraine – Russia war can create uncertainty in financial markets. These could also include issues like trade disputes, territorial conflicts and diplomatic tensions.
- Key economic indicators such as GDP growth, employment figures and inflation rates can shape market sentiment. Positive or negative surprises in economic data can influence investor perceptions.
- Considering these factors, the probability of global events occurring and causing a positive change in the DJIA value can be set at $P(\text{Global Events}) = 0.75$

Q3: Will the Dow Jones Industrial Average finish 2024 higher than 43,000?

Conclusion:

Using Nate Silver’s formula, to calculate posterior probability:

$$x*y/(x*y + z(1-x))$$

x: Bayesian Prior 0.3
y: Probability given prior is true $(0.5 + 0.6 + 0.75)/3 = 0.6$
z: Probability given prior is not true 0.38

Posterior Probability = $0.3*0.62/(0.3*0.62 + 0.38*(1-0.3))$
= $0.186/0.452$
= **0.4115 = 41.15%**

Table 1: Kent's Words of Estimative Probability ^[2]		
Certain	100%	Give or take 0%
<i>The General Area of Possibility</i>		
Almost Certain	93%	Give or take about 6%
Probable	75%	Give or take about 12%
Chances About Even	50%	Give or take about 10%
Probably Not	30%	Give or take about 10%
Almost Certainly Not	7%	Give or take about 5%
Impossible	0	Give or take 0%

Based on our calculations, there’s a **41.15%** chance of DJIA finishing 2024 higher than 43,000. As per Kent’s “Words of Estimate Probability”, chances are about even of this event happening or not happening.

Summary



[1]

Based on Kent's chart of probability, it is **Probable** England will be reaching **Quarter Finals**, as the calculated posterior probability is **73%** and they have Chances about even to reach **Semi Finals**.



[2]

Based on our research and analyses, the Bayesian prior of 1% will most likely drop by certain points. Using Kent's Chart of Probability into consideration, we can label this event as an impossible event.



[3]

There's a **41.15%** probability of DJIA actually finishing 2024 higher than 43,000.

DOW JONES

- [1] https://www.google.com/url?sa=i&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FEngland_national_football_team&psig=AOvVaw1F2jcagP_IO46ISdkLTrr&ust=1701791919510000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCLDmk4mT9oIDFQAAAAAdAAAAABAE
- [2] https://www.google.com/imgres?imgurl=https%3A%2F%2Fcloudfront-us-east-1.images.arcpublishing.com%2Fpmn%2FF5CJ5L3UCNCS7GNXDJBLYZAH4.jpg&tbnid=SAZjE5wGJTCTIM&vet=12ahUKEwiNnunRk_aCAxVCF1kFHcLOAZQQMygKegQIARBK..i&imgrefurl=https%3A%2F%2Fwww.inquirer.com%2Fopinion%2Fbiden-putin-summit-trump-helsinki-ukraine-belarus-navalny-20210610.html&docid=gcEupDZcV0vPcM&w=2400&h=1472&q=putin%20and%20biden&ved=2ahUKEwiNnunRk_aCAxVCF1kFHcLOAZQQMygKegQIARBK
- [3] https://www.google.com/url?sa=i&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FDow_Jones_%2526_Company&psig=AOvVaw0j_HGZBFssyQYRp4ss7Yub&ust=1701792258621000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCKim1qqU9oIDFQAAAAAdAAAAABAE
- [4] https://en.wikipedia.org/wiki/England_national_football_team
- [5] <https://www.kaggle.com/datasets/cashncarry/fifaworldranking/>
- [6] https://en.wikipedia.org/wiki/UEFA_European_Championship
- [7] <https://www.transfermarkt.us/harry-kane/verletzungen/spieler/132098>
- [8] <https://www.sportingnews.com/us/soccer/news/england-penalty-shootout-record-world-cup-history/aqnm0cdyj1orqjbxg9s9lczg>

References

Thank you