

The Probability of Relegation in the First Three Seasons in The Premier League

Ryan Alty

Abstract

This paper will offer an insight into the probabilities of newly promoted English Premier League teams suffering relegation within three years of being promoted to the top flight of English football. This will be done by investigating possible trends of promoted teams and checking whether they are likely to return to the second tier of English Football within the given time period, based on results over the past 22 seasons.

Introduction

The 2018/19 English Premier League season was remarkable in many ways. We witnessed a record-breaking 100 points[3] out of a possible 114 for the first time since the introduction of the league. In this season, we also had the first English representatives in the UEFA Champions League final for the first time in 6 years. Also, all three newly promoted teams avoiding relegation for only the third time since the incarnation of the Premier League in 1992.

The fortunes of the newly promoted teams over the years shall be investigated to calculate the probability that a newly promoted team would suffer relegation within 3 years of achieving promotion to the English Premier League. The probability of relegation within one year, within two years and within three years of promotion to the top flight of English football is to be explored.

Overview

The English Premier League was formed in 1992 initially with 22 teams, however in 1995, the league was reduced to 20 teams[5]. As a result of this, the only data involved is the data since the alterations to the number of teams in the league, in order to reduce the number of variables that could skew the findings. When the change occurred, 4 teams were relegated and only two were promoted and as a result, the seasons prior to the 1995/96 season were avoided.

This means the first season to be analysed will be the 1996/97 season, due to this being the first time we had seen three newly promoted teams in a 20-team league since the introduction of the league. For the 1996/97 season, the teams investigated are those that achieved promotion the year prior, i.e 1995/96 season, and it shall be labelled as such in tables as promoted in 1995/96.

In the English media, there is a phrase that is passed around quite freely when newly promoted teams are in focus. The phrase is “second season syndrome”[7] which, as the name suggests, implies that in a clubs second consecutive season in the Premier League, they will suffer relegation, or worsened fortunes, however, the plausibility of this shall be investigated.

There are factors affecting a team's success following promotion including, but not limited to the club's style of play and investment in the playing squad and club facilities. Ultimately, in order to maintain large scale investment in an English football club, avoiding relegation is a must due to the huge financial gulf between the English Premier League and the EFL Championship. [1]

We have seen an extreme example, in the case of Leicester City, where a newly promoted team has won the title within two years of attaining promotion. This was only the second time such a feat occurred in the Premier League era. [8]

Methodology

Looking at the percentage of newly promoted teams relegated within each year from year 1 to year 3, a sample mean will be gained, which should be the expected percentage of teams relegated within 1 year, within 2 years and within 3 years of promotion. The standard deviation can also be found and using these sets of data, a 95% confidence interval can be obtained.

The following formula was used to calculate the confidence interval. [2]

The same shall be done to calculate the number of consecutive seasons a promoted team could expect to remain in the English Premier League.

$$\bar{x} \pm z \times \frac{\sigma}{\sqrt{n}} \text{ where } \bar{x} \text{ is the sample mean, } \sigma \text{ is the population standard}$$

The Z values are given in the following table. These were taken from the standard normal distribution.

The area between the negative Z value and the positive Z value approximately equates to the relevant confidence value. For example, the area between -1.28 and 1.28 for the standard normal distribution is approximately 0.8, hence outputting a confidence level of 80%.

Figure 1:

Confidence level	Z - Value
80%	1.28
90%	1.645
95%	1.96
98%	2.33
99%	2.58

As the findings are based on a 95% confidence interval, the Z value used for later calculations will be 1.96. This can then be used to give a lower bound and an upper bound for the probability of relegation for each time period.

We can then be 95% confident that the results will lie between these bounds based on the sample data.

Probability of Relegation

Initial Data

The data in Figure 2 was compiled by navigating through the league tables on the official Premier League website [9] and observing which teams were promoted and whether they finished in the relegation places in any of their first three seasons in the Premier League.

Figure 2:

Season Promoted	Number of promoted teams relegated in:		
	Season 1	Season 2	Season 3
1995/96	1	0	0
1996/97	3	0	0
1997/98	2	0	0
1998/99	1	1	0
1999/00	1	1	0
2000/01	0	0	0
2001/02	1	0	0
2002/03	2	0	0
2003/04	2	1	0
2004/05	1	0	0
2005/06	2	1	0
2006/07	2	0	0
2007/08	1	1	0
2008/09	1	1	1
2009/10	1	0	0
2010/11	0	1	1
2011/12	1	0	0
2012/13	1	1	0
2013/14	2	0	0
2014/15	1	0	0
2015/16	2	0	N/A
2016/17	0	N/A	N/A

From 1995/96, there have been 3 teams promoted to the English Premier League each season. In 1994/95, there were only 2 teams promoted, as the league was reduced to the now familiar 20 team division. The seasons as labelled above indicate the season that the teams won promotion from the second tier to the top tier of English football.

“N/A” in Figure 2 indicates the season(s) in question are in progress or are in future years, and as such, these results are inconclusive for these years. These seasons were included, however, as the results from either the first or the first and second season can be incorporated into the probabilities. This increases the sample size for the first season by two and the second season by one.

Findings

Using Figure 2, the following probability table can be formed.

Figure 3:

Season Promoted	% rel in 1st	% rel by 2nd	% rel by 3rd
1995/96	33.33%	33.33%	33.33%
1996/97	100.00%	100.00%	100.00%
1997/98	66.67%	66.67%	66.67%
1998/99	33.33%	66.67%	66.67%
1999/00	33.33%	66.67%	66.67%
2000/01	0.00%	0.00%	0.00%
2001/02	33.33%	33.33%	33.33%
2002/03	66.67%	66.67%	66.67%
2003/04	66.67%	100.00%	100.00%
2004/05	33.33%	33.33%	33.33%
2005/06	66.67%	100.00%	100.00%
2006/07	66.67%	66.67%	66.67%
2007/08	33.33%	66.67%	66.67%
2008/09	33.33%	66.67%	100.00%
2009/10	33.33%	33.33%	33.33%
2010/11	0.00%	33.33%	66.67%
2011/12	33.33%	33.33%	33.33%
2012/13	33.33%	66.67%	66.67%
2013/14	66.67%	66.67%	66.67%
2014/15	33.33%	33.33%	33.33%
2015/16	66.67%	66.67%	N/A

2016/17	0.00%	N/A	N/A
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No. of Seasons	22	21	20
Average	42.42%	57.14%	60.00%
St. Deviation	0.256	0.261	0.278

95% Confidence Interval	Lower	31.74%	45.97%	47.82%
	Upper	53.11%	68.32%	72.18%

The probabilities in Figure 3 are accumulative as the research is interested in whether relegation will happen within the three year period and not at a specific time during this period. To understand the link between Figure 2 and Figure 3, the number of teams relegated by that particular year is summed and then divided by 3 (the number of teams promoted each season). Using this table, it can be calculated that a team is likely to suffer relegation 42.42% of the time, one year after promotion, 57.14% of the time, within two years of promotion and 60.00% of the time, within three years following promotion.

These statistics give the following probabilities.

$$P(r_1) = x = 0.4242$$

$$P(r_2) = y = 0.5714$$

$$P(r_3) = z = 0.6$$

(r_i = relegation by season i)

Notice that $z = y + w$ where w is the probability that relegation occurs during the third year. Using the same fact, $y = x + v$ where v is the probability that relegation occurs during the second year. This shows that the probabilities are not mutually independent. This fact can also be used to quickly check for an error in the calculations, as $P(r_3) > P(r_2) > P(r_1)$.

Due to the nature of the data, if relegation occurs in any of the three years, it cannot also occur in a previous or consequent year. The only way this could happen in practice is if a team is relegated, promoted back into the top flight and then relegated a second time in three years. This explains why the calculations use relegation within a time frame rather than relegation in a particular year. In theory, this would reduce the probabilities of relegation occurring in subsequent years as a team can suffer relegation in the first year but if that does happen, the probability of them achieving relegation in the second and third year equals 0. This fact is shown in the data quite subtly as $P(r_3) - P(r_2) < P(r_2) - P(r_1) < P(r_1)$. In words, this inequality says the probability that relegation occurs in the third year is less than the probability that relegation

occurs in the second year which is also less than the probability that relegation occurs in the first year.

Based on the above calculations, on average, 42.42% of newly promoted teams would suffer relegation, after a single season in the English Premier League. A 95% confidence interval of between 31.74% and 53.11% was obtained, which indicates that with 95% confidence, the average percentage of teams to be relegated after a single season is between 31.74% and 53.11%.

What can also be seen is that 57.14% of newly promoted teams would suffer relegation within their first two seasons in the English Premier League. This can then be analysed further to give a 95% confidence interval of between 45.97% and 68.32%.

Finally, obtain that within three seasons in the English Premier League, 60.00% of teams will suffer relegation. A 95% confidence interval of between 47.82% and 72.18% was collected. This should mean that 95% of all outcomes should lie between these two values.

Number of Consecutive Seasons in the English Premier League

Initial Data

The data in Figure 4, as shown below was compiled in the same manner as the data in Figure 2. This data was compiled by navigating through the league tables on the official Premier League website [9] and observing which teams were promoted and when they did get relegated, if applicable. The entrants are listed as such where “Team 1” were the champions of the EFL Championship, formerly The Championship (2004-2016), the First Division (1992-2004). “Team 2” represents the team finishing second in the second tier and “Team 3” represents the play-off winners. The entrants in bold indicate the teams currently competing in the English Premier League as of the start of the 2018/19 season.

Figure 4:

Year Promoted	# Of Consecutive Seasons		
	Team 1	Team 2	Team 3
1995/96	1	6	6
1996/97	1	1	1
1997/98	1	11	1
1998/99	4	2	1
1999/00	7	1	2
2000/01	13	11	11
2001/02	17	1	5
2002/03	7	1	1
2003/04	1	2	1

2004/05	1	8	6
2005/06	2	1	1
2006/07	10	1	1
2007/08	1	10	2
2008/09	3	2	1
2009/10	6	8	1
2010/11	2	3	7
2011/12	1	7	7
2012/13	1	2	6
2013/14	5	1	1
2014/15	4	4	1
2015/16	<u>3</u>	<u>1</u>	<u>1</u>
2016/17	<u>2</u>	<u>2</u>	<u>2</u>
2017/18	1	1	1

When analysing this data in the next section, I will be disregarding any data from the 2014/15 season onwards as the majority of these teams are yet to suffer relegation and as a result, we will not obtain a reliable expected value. As an example, say the average number of consecutive seasons was 5; all teams after the 2014/15 season can only have, at most, 4 consecutive seasons to date, and so these are excluded from the subsequent calculations.

Findings

Using the data in Figure 4, an average number of consecutive seasons can be calculated. Some of the data points were anomalies, and as such, the data for the first team promoted in 2001/02 (Manchester City) was removed. Figure 5 shows the calculated average, as well as the standard deviation and a 95% confidence interval

Figure 5:

Number of teams	56	
Average number of consecutive seasons	3.71	
Standard deviation	3.45	
95% Confidence Interval	Lower	2.81
	Upper	4.62

From Figure 5, a 95% confidence interval of between 2.81 and 4.62 can be obtained. This means that on average, we should expect, with 95% confidence, that a newly promoted team

should be in the English Premier League for between 2.81 and 4.62 seasons. Fractions of a season do not exist so these figures can be rounded to 2 and 5 seasons respectively. As the lower bound for our confidence interval is less than 3, we can conclude that it is viable to say a team will be relegated within their first three seasons following promotion.

Please note as there are teams yet to be relegated following promotion, the figures will change once a new season starts.

Conclusion

We have analysed the probability of relegation within 3 seasons of promotion as well as the number of consecutive seasons without suffering relegation.

Due to the above results, we are able to conclude that a newly promoted team should expect to stay in the English Premier League for between 2 and 5 seasons 95% of the time. This value may be skewed as a result of some teams avoiding relegation and staying in the league for over 10 years. The table shows that the most common number of years is 1, and therefore, we will say that this analysis is inconclusive. Further studies could be done using this paper as a guide to further analyse the true predicted outcome.

Based on the results, of the 3 teams promoted each season, a deduction can be made that between roughly 1 and 1.5 teams will suffer relegation the season after achieving promotion. Also, of the 3 teams promoted each season, between 1.35 and 2.05 teams will suffer relegation the season after achieving promotion.

Finally, when looking at the trends over a three-season period, close to 2 out of the promoted 3 should, unfortunately, expect to return to the EFL Championship within three seasons of being promoted from the league.

These results will not be reflective of other major leagues across Europe, due to the nature of the competition in each of these leagues. The second tier of English football, the EFL Championship, is one of the largest spending leagues in the world. In the most recent season (2018/19), the clubs in the EFL Championship spent a combined £207.34m[4], which firmly places the league as the 7th highest transfer expenditure in world football. The leagues above are the top 5 in Europe, based on the UEFA coefficients, and the Chinese Super League. This high level of spending puts the league far above the next highest spending second tier, the Italian Serie B, whose spending was £44.59m for the same period. This will have an effect on the quality of the promoted teams in each of the leagues and as such, the findings may not be representative for other leagues in world football where promotion exists.

Only four times in the twenty years surveyed have all three newly promoted teams been relegated within three seasons, most recently the three teams promoted in 2008/09. There is, however, a lack of data and as a result, the findings may not be conclusive.

Overall, based on the data investigated we can be 95% confident, one of the three newly promoted teams each season should survive in the English Premier League for at least three full seasons.

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