Comparison of World Record Transfer Fees in Football Post-2000

Ryan Alty

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Abstract

The following paper will provide an insight into the monetary value of the six world record fees set in football since 2000 and how they would rank in today's market. Note that these are not the six largest sums spent for a player as these have all been completed over the past three seasons and not all of them are or were record-breaking. The most expensive purchases per season from the 2000/01 season to the 2018/19 season will also be included in this research paper.

Introduction

Over the years, we have seen transfer fees for football players increase all across the world. Some explanations for the increases can be related to inflation of the currencies, investment via new owners at clubs and even the increasing TV deals[11] such as the ones in the Premier League.

Despite new regulations coming into place, such as the financial fair play regulations by UEFA[1], the European governing board of football, the overall spending at clubs continues to increase.

Initial Data

An average transfer fee will be used by taking a selection of transfers from each of Europe's top five leagues based on their UEFA coefficients[1] (English Premier League[6], Spanish La Liga[7], German Bundesliga[8], Italian Serie A[9], French Ligue 1[10]) since the turn of the century. This average will be calculated looking at twenty-five transfers ranked from sixth to thirtieth for each of the aforementioned leagues, resulting in a sample size of 2375. The top 5 transfers were not used for this part as this could skew the data in favour of the years involving record-breaking transfers.

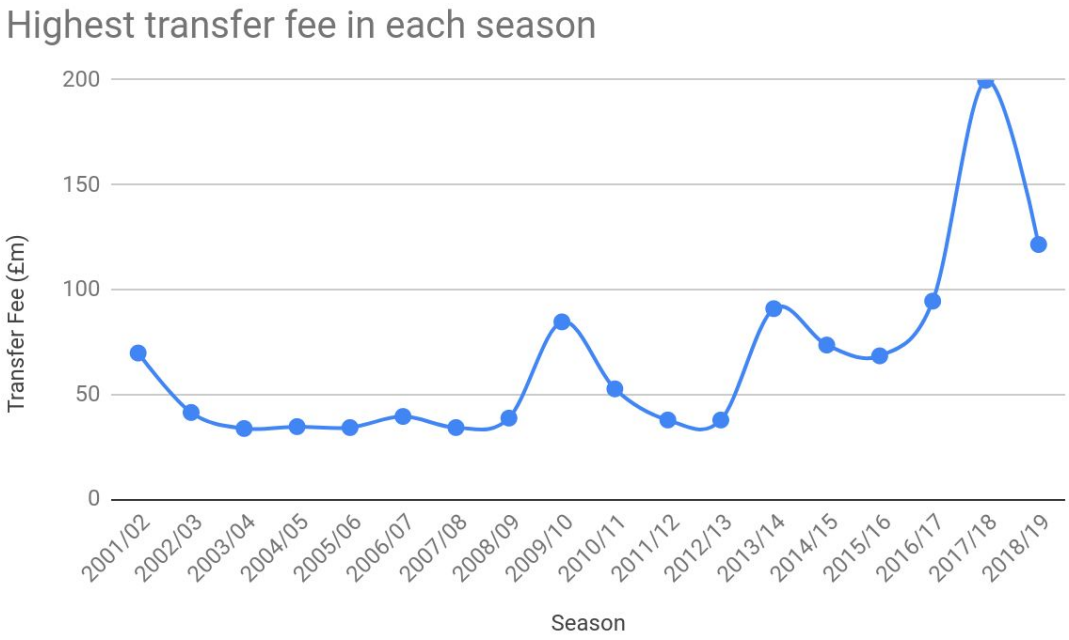
All prices will be done in Pound Sterling (£) and will be redeemed from Transfermarkt. It is not clear whether the values obtained from Transfermarkt are adjusted for inflation, so the notion of inflation will be disregarded in this research paper.

The averages are shown in Figure 1 below. This is the data that shall be used to represent the growth of spending (where applicable). These average were the mean values of the 125 transfers (25 per league for 5 leagues) per season.

Figure 1:

The other data used is the highest transfers in each season. This shall also be given in chronological order. These values are to be interpreted and altered with respect to the growth of spending in the market. A table of this same data is given later as Figure 4 to assist with comparisons later in the paper.

Figure 2:



Mathematical Model

To achieve the desired outcome, the most expensive transfers for each year season post-2000, as shown in Figure 2, will be collected in order to be compared. These fees will be converted to an equivalent fee if the transfer had occurred during the 2018/19 season by using a formula. This formula will be a polynomial to represent the growth (or lack of, if applicable) from the 2000/01 summer transfer window to the 2018/19 January transfer window.

The mathematical model used will be the least squares interpolation method[3]. This model provides assistance to form a continuous function to approximate a discrete data set. This method outputs a set of "C values" where C_0 is the coefficient of x^0, C_1 is the coefficient of x^1 and this continues up to C_n being the coefficient of x^n when the degree of the output polynomial is n.

The least squares interpolation method provides the user with an approximation of a continuous to model a discrete set of data. Like all approximations, there are some downfalls to this method. The outputted function cannot be used for data outside of the data points. This means that a function outputted cannot be used to model future projections as the method relies heavily on the use of the inputted discrete data points. Depending on the use of outputted data, issues may be encountered.

Application of the Model

Using a least squares interpolation MATLAB formula, an output of five "C values" was obtained, which correspond to the coefficients of each of the degrees of x from 0 to 4.

This then gave the following mathematical equation to represent the change of the transfer fees from the 2000/01 season to the 2018/19 season.

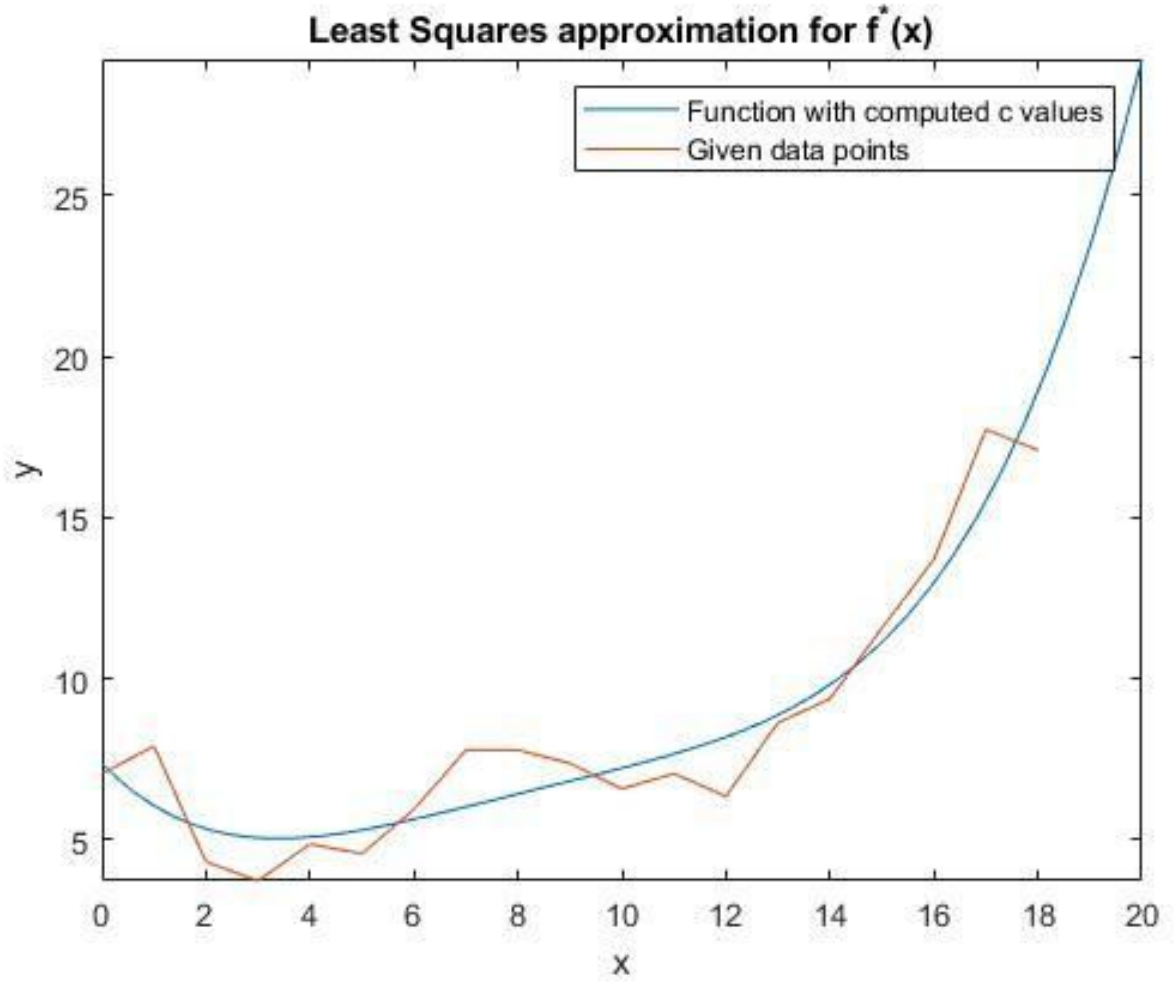
The MATLAB code will be added at the end of the paper.

$$f(x) = 7.3621 - 1.3575x + 0.3807x^2 - 0.0311x^3 + 0.0009x^4$$

$$y = f(x) = \textit{representative transfer fee at time } x.$$

$$x = (\textit{year at start of season}) - 2000.$$

Figure 3:



In Figure 3, the red line shows data points for the average transfer fee from the 2000/01 season (labelled at $x = 0$) up until the 2018/19 season (labelled at $x = 18$). These data points correspond to the data in Figure 1.

The blue line shows the polynomial found using the "C values" given by the MATLAB code.

The model cannot be used for seasons prior to 2000/01 as the function, $f(x)$, will begin to increase as x becomes more negative. This is not reflective of the real scenario. Also, the model cannot be used for future seasons due to a limitation of the method. This can be seen as the model "suggests" that transfer fees will increase exponentially at some point in the near future, yet this is not feasible in practice.

A table containing the highest transfer in each season[4] will be shown. This uses the same data as shown in Figure 2, and includes the names of each player involved. The table also includes the season the transfer occurred and the transfer fee involved. The entrants in bold are the record-breaking transfers post-2000[5]. An example of how the formula can be manipulated to attain the results will be shown and the transfers will then be ranked in order from highest to lowest based on the adjusted fee.

Figure 4:

Player	Transfer Fee (£m)	Season
Luis Figo	**54.00**	**2000/01**
Zinédine Zidane	**69.75**	**2001/02**
Rio Ferdinand	41.40	2002/03
David Beckham	33.75	2003/04
Didier Drogba	34.65	2004/05
Michael Essien	34.20	2005/06
Andriy Shevchenko	39.49	2006/07
Fernando Torres[6]	34.20	2007/08
Robinho	38.70	2008/09
Cristiano Ronaldo	**84.60**	**2009/10**
Fernando Torres[7]	52.65	2010/11
Javier Pastore	37.80	2011/12
Thiago Silva	37.80	2012/13
Gareth Bale	**90.90**	**2013/14**
Luis Suárez	73.55	2014/15
Kevin De Bruyne	68.40	2015/16
Paul Pogba	94.50	2016/17
Neymar	**199.80**	**2017/18**
Kylian Mbappé	**121.50**	**2018/19**

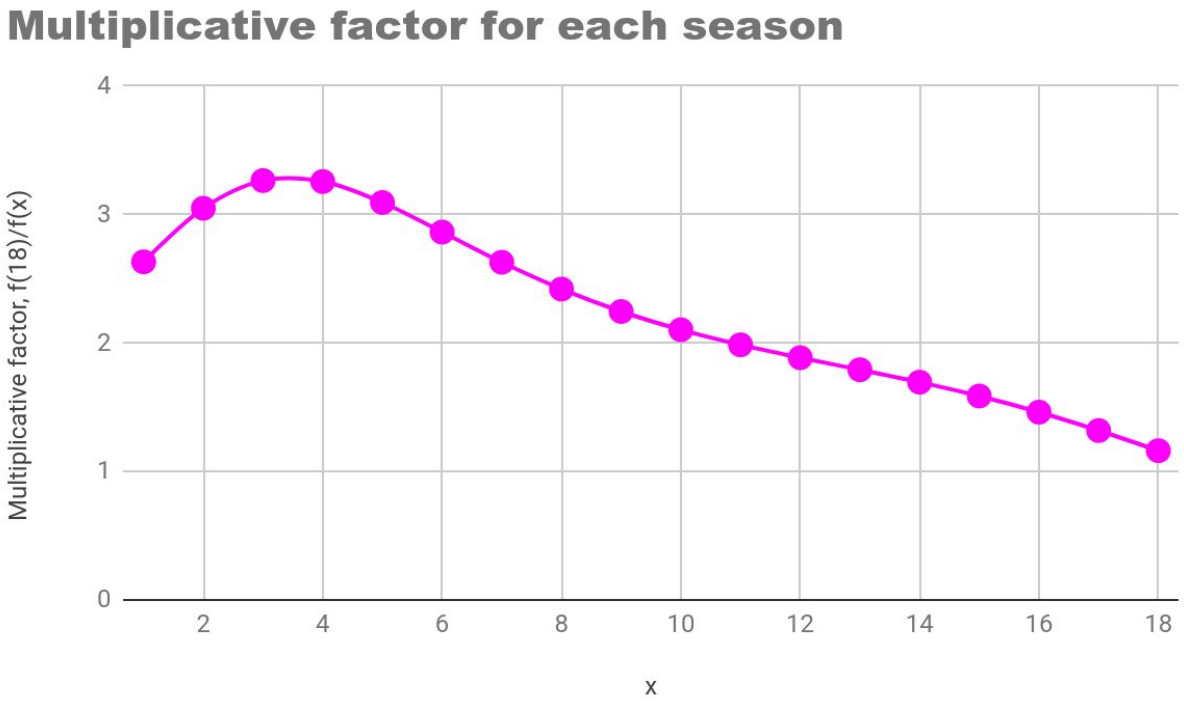
Using the outputted function, estimates can be made for the highest transfer fees from each of the seasons from the 2000/01 season to the present 2018/19 season, adjusted for the present market. Transfer fees are to be adjusted by doing the following :

- Find $f(x)\, for\, x = \{0, 1, ..., 18\}$
- Find $\frac{f(x)}{f(18)}\, for\, x = \{0, 1, ..., 18\}$. This is to work out a multiplicative growth factor from year x to the current year. These are shown below in the third column of Figure 5
- Multiply original transfer fee by the multiplicative growth factor.

An example of how this is done is shown below with the Luis Figo transfer. This will show how the solutions from the polynomial.

1. Luis Figo transferred in the 2000/01 season, and as such, $x = 0$ and the transfer fee, at time 0, is £54m.
2. Using the following chart, labelled "Figure 5", a multiplicative relation can be extracted for the transfer fees between time 0 and time 18, which in our case is approximately 2.63. This value is calculated by taking the value of the above formula $f(x)$ and dividing the value for $f(18)\ by\ f(0)$. This value is used as it gives factor by which the average transfer, amongst the top 5 leagues, has increased between the given season and the current season.

Figure 5:



3. This leads to a final value of approximately 142.13m for Luis Figo in the present season. This comes from the original fee from Figure 4 (£54.00m) multiplied together with the relation from Figure 5 (2.63).

This process will be continued as such for the remainder of the players shown in the table in Figure 4. The findings shall be observed, ordered and tabulated from most expensive to least expensive.

Observations

Figure 6:

Player	Season of Transfer	Original Transfer Fee	Adjusted Transfer Fee
Neymar	**2017/18**	**£199.80m**	**£232.09m**
Zinédine Zidane	**2001/02**	**£69.75m**	**£212.67m**
Cristiano Ronaldo	**2009/10**	**£84.60m**	**£177.91m**
Gareth Bale	**2013/14**	**£90.90m**	**£154.09m**
Luis Figo	**2000/01**	**£54.00m**	**£142.13m**
Rio Ferdinand	2002/03	£41.40m	£135.15m
Paul Pogba	**2016/17**	**£94.50m**	**£124.58m**
Kylian Mbappé	2018/19	£121.50m	£121.50m
Luis Suárez	2014/15	£73.55m	£116.72m
David Beckham	2003/04	£33.75m	£109.93m
Didier Drogba	2004/05	£34.65m	£107.20m
Fernando Torres	2010/11	£52.65m	£104.65m
Andriy Shevchenko	2006/07	£39.49m	£103.81m
Kevin De Bruyne	2015/16	£68.40m	£99.98m
Michael Essien	2005/06	£34.20m	£97.93m
Robinho	2008/09	£38.70m	£86.89m
Fernando Torres	2007/08	£34.20m	£82.76m
Javier Pastore	2011/12	£37.80m	£71.27m
Thiago Silva	2012/13	£37.80m	£67.73m

As the table shows, the world record transfer fee, when adjusting for market inflation is the transfer of Neymar da Silva Santos Júnior from FC Barcelona to Paris Saint Germain in the 2017/18 season. This coincidentally is also the current record transfer fee even without adjustment for the inflation of the market.

Upon adjustment, the previous world record fee, set by the transfer of Paul Pogba from Juventus to Manchester United, is the lowest fee of all of the record-breaking transfers in this observation.

From Figure 6, five of the six highest fees in our study after adjustment were the record-breaking transfers. This may suggest that the record fees had a larger impact on the market than the other transfers and consequently, this would have had an impact on the formula obtained.

In summary, across all five of Europe's top five leagues, transfer expenditure has seen an increase. This can be accounted to many factors, some of which hold more weight than others, particularly the TV rights deals in the English Premier League. This has had an impact on the general market and as such, two world record transfer fees have been set in the past three seasons. These are the Paul Pogba transfer in the 2016/17 season and the Neymar transfer in 2017/18.

The monetary value of the Neymar transfer was astronomical in contrast to the previous record set only one season prior. Paris Saint Germain had paid over two times the previous world record in order to complete the deal. The vast sum spent on this transfer has meant that even after adjustment due to increased expenditure in the market, this transfer remains the highest paid for a single player post-2000, and possibly of all time.

The next highest fee in the list is the 2001/02 season transfer for Zinédine Zidane, which would stand at £212.67m when adjusted for today's market.

What may come as a surprise is that the fee which set the world record a mere two years ago actually comes below one transfer that was not a record-setting fee. This would highlight that although the general market prices have increased with time, the highest fees have increased at a lower rate or by a lower factor.

Conclusion

In summary, the results, displayed in Figure 6, showcased that even with adjustment, the 2017 transfer of Neymar from FC Barcelona to Paris Saint Germain remains the most expensive transfer in world football to date. This should come as no surprise as the fee massively increased the world record (by a factor of over two) which had only been set in the previous summer transfer window.

More recently, professional athletes, but in particular professional footballers, have increased in commercial value. As a result of this, a particular team may invest in a player with more regards for their commercial assets as opposed to solely their footballing ability. This is due to the fact that a player is a financial asset and as a result, a club's stock price could increase or decrease and they could even land larger commercial deals with kit sponsors. Buying a big name player will increase shirt sales as there are many supporters around the world who want the new

What we can see from this investigation is that it seems the trend looks set to continue in years to come and, although it may not lead to a new world record being set, financial spending in world football shows no signs of slowing.

MATLAB Code

```
f = @(c,x) c(1) + c(2)*x +c(3)*x^(2) + c(4)*x^(3) +c(5)*x^(4)

x_values = [0:1:18]
y_values = [7.05 7.90 4.31 3.72 4.86 4.56 5.94 7.78 7.78 7.37 6.58 7.05 6.34 8.63
9.37 11.57 13.70 17.73 17.09]

data_points = [x_values',y_values']
plot(x_values,y_values)

g_x = {@(x) 1,@(x) x,@(x) x^(2),@(x) x^(3),@(x) x^(4)}

c_values = least_squares_approx(g_x,data_points)

fplot(@(x) f(c_values,x),[0,20])
hold on
      plot(data_points(1:end,1),data_points(1:end,2))
            title('Least Squares approximation for f^{*}(x)')
            xlabel('x')
            ylabel('y')
            legend('Function with computed c values','Given data points')
hold off
```

Functions

```
function c_values = least_squares_approx(g_x,data_points)
%The number of operation could be reduced due to it being a symetric matrix
%for large matrices this could increase speed of the computation
for j = 1:length(g_x)
    for i = 1:length(g_x)
        d(j,i) = 0;
        for k = 1:length(data_points)
            d(j,i) = d(j,i) + g_x{j}(data_points(k,1))*g_x{i}(data_points(k,1));
        end
    end
end
for i = 1:length(g_x)
    e(i) = 0;
    for k = 1:length(data_points)
        e(i) = e(i) + data_points(k,2)*g_x{i}(data_points(k,1));
    end
end
c_values = e/d;
end
```

References

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