

The research to analyze financial expenditure of two football clubs

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Abstract. This article shows the whole process using known datasets to estimate two football team's up-coming performances. The math process (modeling) includes linear regression, probability expectations, and using graphs to express the modeling process. In this article, from the process of modeling, there are conclusive results and conclusions which is beneficial in researching sport management and football team management which includes basic two types of management structure and basic strategy in data analyzing of football financial expenditure. The whole research contains four parts, including introduction, methods, analytical conclusions, and applications. First, the article discussed some basic assumptions and preparations for modeling, and researched on some of the topics according to the whole theme. In the part methods, the research uses linear regression to fit a suitable relationship each between the factors that affect expenditure and rankings. In the part conclusion, which includes analytical conclusion and quantized applications, which can also be separated to two parts. Analytical conclusions state some of those findings depend on the previous research process, which those findings illustrate particularly kind of relationship. In the quantized applications, the research fit data into the model and acquire an intermediate result and some beneficial suggestions to each of the studies.

Keywords: Football, financial expenditure, linear regression.

1. Introduction

Sports topics, especially for football, seem to have extensive correlations with data analyzing. Sports data, including passing and shooting rates, scores of matches in a specific premiership, however, are subjectively depending on player itself. Take Liverpool football club as an example, at 2018 European Championship, football club (FC) Barcelona made 3-0 Liverpool. Liverpool, however, at home, made 4-0 and successfully entered the final (also won the champion). As a result, results of matches, which depends on sports players' mental health, physical indicators and performances, are too intricated to quantify and analyze [1].

With the accelerated development in professional football, trans-market seems like a "Warfield" for those FCs, which they both begin to being competitive among other teams. Researches according to trans-market and financial expenditure seems begin to be important. Boyle, at 2012, once researched that since the establishment of Premier League, sports players' average salary has also been maximized [2]. Moreover, individual investors start to engage in sport investment, which bring those FCs abundant financial supplies, that allow those FCs to execute riskier investment in different aspects in order to

maximize their achievement. Consequently, research in financial management and expenditure studies seems important for each FCs to be more competitive and financially healthy [3].

Thus, this paper concentrates on financial inputs and realistic achievements as my topic of this essay. For Liverpool Football Club (LFC) and Manchester City Football Club (MCFC), these two football teams that address each other as the biggest opponent in the past 5 years of Premier League (PL), the prediction for the performances of the two teams is worth to research. Before researching, the author should first determine the main factors which mostly affects the results [4]. Despite some of those special conditions, the author can simply predict most of the performance of a single team before they start a new season. This kind of prediction depends not on datasets analysis, profound research and considering, but on a simple intuition; and this intuition, can help people easily analyzing those factors which affects a team's up-coming performances [5].

Investments and financial inputs, which affect the most, determines whether a team can enhance their competence by heading for suitable players in the transaction market. Still there are opponents that suggest which FCs aren't interested in acquiring important financial income, but the basic survival of the club [6]. However, both clubs expect the team to perform well, due to the proportional relationship between team's performance and financial income. In other words, FCs should perform well to survive, in advance, they should invest more in order to invest their up-coming performance. The author can make a simple metaphor that the coach seems like the brain to a whole football team [7]. The instructor of a team determines it skills and tactics, which helps them to improve their competence and beat their rivals better in a match. The convergence and transactions between different coaches needs to be considered. Especially for LFC, which coach Jurgen Klopp decided to retire from the club. The author has to consider the how the transaction affects LFC's performance as a whole in the next season.

2. Methods

2.1. Data source

For those datasets according to sports topics, the author can find suitable datasets on Kaggle. By finding the datasets, the author acquired data of the inputs in transaction market of LFC and MCFC in the last 6 years. Coincidentally, there no big mistakes the managers of LFC and MCFC made in the transaction market. By calculating and adding those data, the author got the whole expenditures, transaction income, and net disbursement of LFC and MCFC [8].

2.2. Method introduction

Linear regression is widely applied in analysis of correlations between two related factors, which, by building up evaluation functions to determine and minimize the difference between actual value and estimated value to figure out the best-fit line. Linear regression, as a linear relationship, helps when the datasets show an obvious increasing and decreasing tendency. After processing evaluation function, the author can apply partial derivatives, which each of the partial derivatives of the factors in terms of the variable equals zero. This helps us to find out the best-fit line and it function. When calculating large-scale datasets, the author can apply EXEL form as a tool to calculate the ideal function better [9, 10].

Before modeling the relationship between each factor, the author should first make some fundamental assumptions: (1) Extreme conditions and special events are not considered in this research. (2) All LFC and MCFC players stays common, their up-coming performances shouldn't exceed their best performance. (3) New instructor for LFC, as a first-year coach for this team, isn't considered to perform better than coach Jurgen Klopp's best match.

3. Results and discussion

3.1. Descriptive analysis

By plotting and applying those data into EXEL form, this paper got the figure 1 and 2 below:

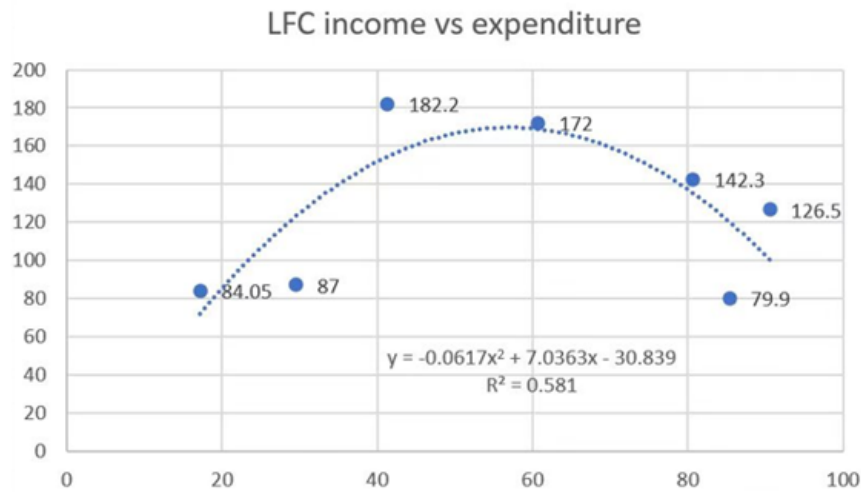


Figure 1. LFC income vs expenditure.

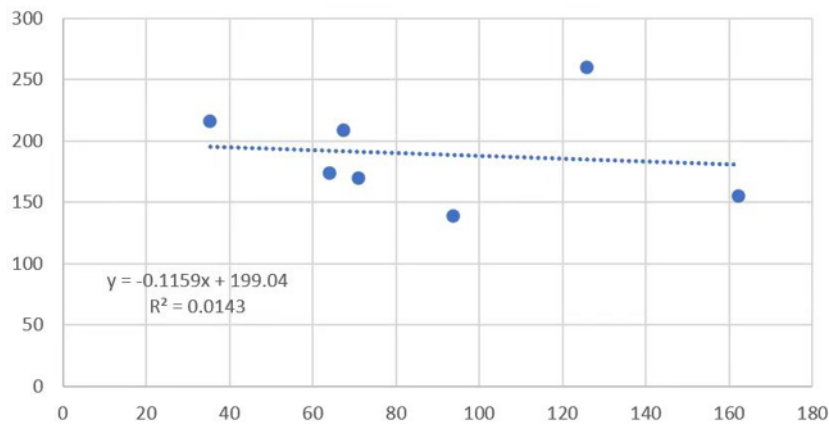


Figure 2. MCFC income vs expenditure.

Figure 1 and 2 indicate the correlation between total expenditures and total income of LFC and MCFC. As the author already know or the author can theoretically predict the total income of the two teams by knowing which player the two clubs decide to sell in the market. However, total expenditure isn't only affected by the team's income. Achievements in last season should also be counted. The author uses rankings of previous seasons as an index here. When the discussion is related to the team's performances, Stakeholder (managers and those especially investors) heterogeneity is one of the main issues regarding the performance assessment of the clubs.



Figure 3. LFC rank and expenditure.

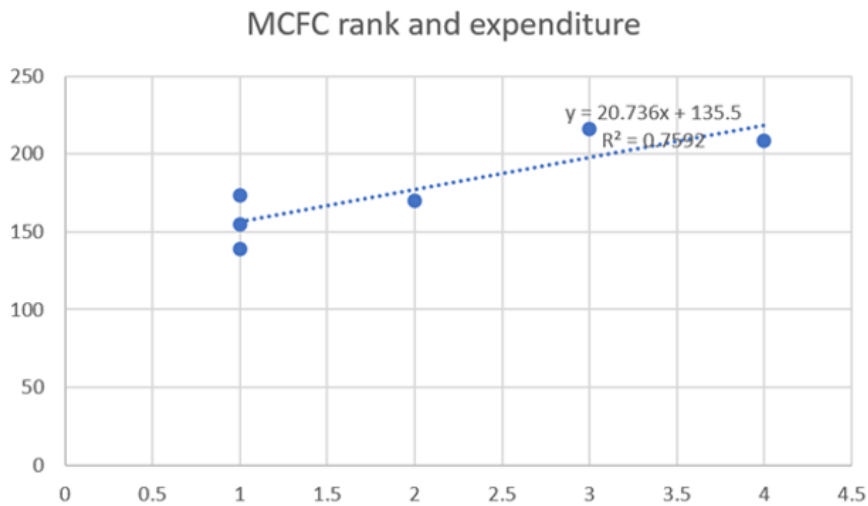


Figure 4. MCFC rank and expenditure.

Mostly, last-season performances have an unavoidable effect on both income and next-season expenditure. Rohde and Breuer have proved this phenomenon by providing income revenue of top 30 European FCs at 2016. As the current season isn't finished, the author wiped out the data of current season. From the graph the author can conclude that total willingness of LFC isn't easily affected by ranking but MCFC does. This paper can simply add these two functions together to determine the final equation for the expenditure of LFC and MCFC (Figure 3, 4). This paper defines four variables RL IL as previous ranking and total income for LFC; RM and IM for those two factors of MCFC.

For LFC TOTAL EXPENDITURE: $LTE = -0.03085IL^2 + 3.51815IL + 0.4971RL + 41.08$. For MCFC TOTAL EXPENDITURE: $MTE = 10.368RM - 0.05795IM + 167.27$.

Now, the author can start to determine the correlations between input and next-season rankings, which is the final goal. As the author has already built-up relationships between last-season rankings and expenditure, the author can simply make adjustment to it. And the author can conclude the figure 5, 6 below.

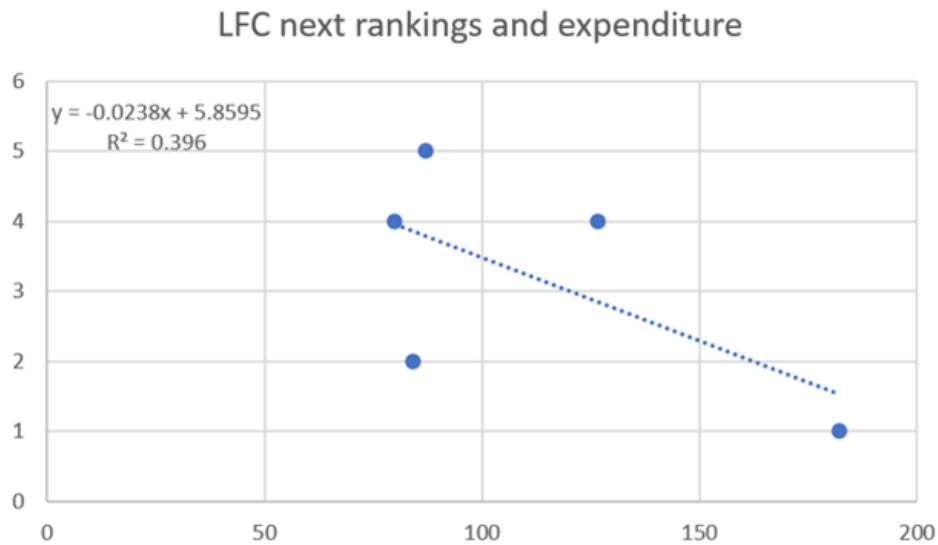


Figure 5. LFC next rank and expenditure.

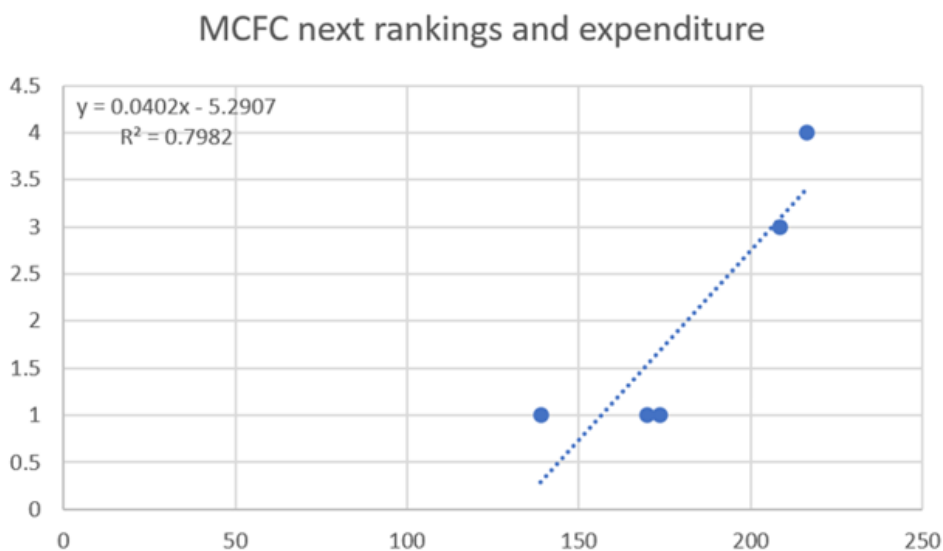


Figure 6. MCFC next rank and expenditure.

From the two figure above, the author can conclude that, for LFC, higher expenditure results in a higher next-season rankings. It's probably that the LFC's financial capacity only allows LFC managers to purchase players that are immediately effective. For MCFC, it seems that higher expenditure didn't trigger a higher ranking. Perhaps MCFC tends to purchase potential players which might be effective in the future.

3.2. Discussion

Zulch and Palme said once in their research, that traditional football clubs are start transferring to comprehensive football companies, which behaves similarly like most established corporations nowadays, especially has complete managing structures. As a result, researches based on sport management is significant, from those previous figures, there are some surprising findings the author can conclude. Moreover, researcher Keller stated, that more individual investors or stakeholders are being more dependent on well established functional managing structure.

Consequently, before the author e start qualitatively analyzing and fitting exact number into out models, the author should better conclude several findings in the process. Differences in managing between LFC and MCFC. For LFC, in the late 5 years' process of championship competing with MCFC. It seems that next-season expenditure doesn't have a direct correlation with last-season ranking. For managers of LFC, input for player transactions is annually constant. For example, LFC will not going to raise their input in trans-market due to their excellent performance in last season. This kind of managing mode seems not to be effective in other FCs, instead. However, especially for LFC, the reason why LFC can be treated as the biggest competitor for MCFC in recent years is mainly due to the established player-scout system and coach Jurgen Klopp's excellent understanding in tactics of modern football. As financial income isn't all result in trans-market, there're still abundant noticeable factors which affects financial income and expenditure. As for those who are individual investors, the extreme financial risks and limited upside data motivates beyond financial income, while fan investors prioritize influence, highlighting a deep-rooted connection to the club's legacy [8].

When researching other essays related to sport managing, LFC is much more assembling to FCs which coach is almost in charge of the responsibility as a manager, as which coach can engage in trans-decisions of the club. Take LFC as an example, at trans-period, coach Jurgen Klopp used to submit a list of players he admires to, which he thinks the most beneficial to the team's tactic enhancement. Nonetheless, some of those players are unrealistic for the LFC to purchase. Thus, the sport-manager will take the duty to check again and discuss the final decision with coach and other managers. As a result, coach and sport-manager construct the main structure for LFC and other similar FCs.

Balance Scorecard, which is developed as a balancing managing tool and is considered depends on four aspects-Financial, Customer, internal business process, and learning aspect. Balance Scorecard mode considers different aspects and is, undoubtedly, one of the most effective. One of the reasons, Kaplan and Norton suggests, is that Balance Scorecard offers managers a completed view to evaluate the team's performance, which is quite similar to LFC's management structure, that sport manager and coach occupies most of the proportion of rights, and directly communicate with the top managers [9]. One example of Balance Scorecard, Wehrle and Heinzelmann provided, is that Bundesliga football club Stuttgart trying to apply Balance Scorecard in order to make all the data in a match to be manageable and trackable [10].

For MCFC, the coach Josep Guardiola, one of the most successful coaches in the world, is always guaranteed to purchase ideal players in the trans-market. Furthermore, MCFC has integrated sport-scout system all over the world, which helps them to find those potential players immediately. Part of the young players constructs part of MCFC's youth training system, like U21 and U20, and other parts of them, participate in the player's list with other players coach Josep wants to purchase. This constructs the main structure of MCFC.

In conclusion, now, the author can explain why it cause the differences between the two figures of "LFC and MCFC's last-season ranking and next-season expenditure". Due to MCFC's established scout system, MCFC can immediately complete its loopholes in the team and it causes that MCFC's high expenditure comes with it low rankings. But for LFC, since annually investment is constant, and the sport-manager and coach make the most decisions, the total expenditure seems to behave constant, unrelated to last-season behavior. In this limited accomplishment, coach Klopp's leadership helps LFC to stays it rankings in seasons.

3.3. Applications and qualitative analysis

As the author has already got those conclusive equations and inspirations, to achieve the purpose of researching, the author should first fit in those data to estimate the next-season expenditure and rankings. From the graph above, which the author has concluded in the previous process, to figure out IL and IM (which income affects expenditure), the author should firstly confirm which player is on the list for sale. For LFC, according to those news and data posted, Mohamed Salah, Thiago, and Joel Matip are supposed to leave. But Thiago and Matip's contract is going to be invalidated, which they will not bring income to LFC. According to Al-Hilal Saudi FC, they want to offer Salah with 70 million euros. As a

result, LFC's next-season income will be close to 70 million euros (record it as 70 million). For MCFC, those who are supposed to leave in next season is Bernado Silva or Kevin Debruyne, if one of those two players leaves this summer, MCFC will acquire at least 60 million euros (especially for Bernado Silva, PSG is willing to offer MCFC 58 million for B-Silva). All in all, IL is 70+ (70) and IM is 60+ (60).

For those RL and RM (ranking-affected), since this season hasn't finished, which LFC, MCFC and Arsenal are still chasing for the first-place, the author has can choose Expectation of probability to estimate RL and RM. For probability for each result of LFC and MCFC, the author has can take the prediction of probability of 4.14, which LFC is 28.1% and MCFC is 36.5% for the champion; each 98.2% for the top four ranks. Thus, the probability for getting second, third and fourth place is 70.1% and 61.7% for LFC and MCFC. As a result:

$$RL = E(LFC) = 28.1\% \times 1 + 70.1\% \times [(2 + 3 + 4)/3] = 2.384 \quad (1)$$

$$ML = E(MCFC) = 36.5\% \times 1 + 61.7\% \times [(2 + 3 + 4)/3] = 2.216 \quad (2)$$

Consequently, the author has can fit those data in to the previous equations which are: For LFC TOTAL EXPENDITURE: $LTE = -0.03085IL^2 + 3.51815IL + 0.4971RL + 41.08$.

$$LTE = -0.03085 \times (70)^2 + 3.51815 \times 70 + 0.4971 \times 2.384 + 41.08 = 137.37. \quad (3)$$

For MCFC TOTAL EXPENDITURE: $MTE = 10.368RM - 0.05795IM + 167.27$.

$$MTE = 10.368 \times 2.216 - 0.05795 \times 60 + 167.27 = 186.733 \quad (4)$$

As a result, the final instant LTE is 137.37 and MTE is 186.73 (million euros). NOTE: the two numbers of LTE and MTE is just instant and estimated, the final results should depend on the final confirmed rankings and income, these two results are just examples. Furtherly, the author can apply those two LTE and MTE into estimating the next-season rankings, which the two conclusive equations are: For LFC, NRL (rankings of LFC in next season) $= -0.0238 * LTE + 5.8595 = 2.590094$. For MCFC, $NRM = 0.0402 \times MTE - 5.2907 = 2.2158$.

Conclusively, in next season, and in this set of data, the rankings of MCFC will be close to 2.21 (second-place), and the rankings of LFC will be close to 2.59(third-place). As the coach Jurgen Klopp will leave before next season, LFC will not exceed this kind of expectation, even far less than this result. In conclusion, except the successor of Klopp really execute the best-fitted up-coming tactics and make every sensible decision in all aspects; or the players of LFC perform extremely competitive, LFC, will not possibly get a better result than MCFC in the end of the next season due to the estimation process.

4. Conclusion

Is that LFC will never be possible to be more successful than MCFC in the next season? The author can make some suggestions that will extremely helpful for LFC in certain aspects and these are the aims that why the author builds up this model-to bring out solutions due to different situations.

First, selects those coaches that has same purpose with the previous coach. Since coach Jurgen Klopp left lots of players and tactics that are talented and can immediately bring out perfect performances, what the up-coming coach should do is that to sensibly choose the players that best-fit nowadays' players' list, and try to bring new tactics based on the original one made by Klopp. Furthermore, those coaches should give more chances to young players which the financial budget of LFC doesn't allow the coach to purchase all the suitable players.

Second, managers should unconditionally support the up-coming coach and give it enough financial budget to new players. Many of those famous FCs, who dies in the process of coaching transition, is because that the managers and boss of the club haven't give enough patience and supplies to their new coach. As a result, managers of LFC should be patient and generous in order to build up a "New Liverpool team"

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