Are foreign owned English football clubs less efficient?
A financial statement analysis using a stochastic frontier model

Erasmus University Rotterdam

Erasmus School of Economics

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Written by:

Geoffrey Paardekooper – 369161

Under supervision of:

G.A.G. Alserda

Abstract:

In this thesis the technical efficiency for English Premier League and Championship clubs where pitch performance is the producing factor and the wages & salaries, amortization of player registrations, and other operating expenses are the input variables. To calculate the efficiency a Stochastic Cobb-Douglas production frontier model is used. The main interest for this thesis is to test whether clubs with a majority foreign ownership are significantly more inefficient than majority non-foreign owned clubs. After testing it has been found that there is no significant difference in technical efficiency between majority foreign owned clubs and majority non-foreign owned clubs.

Key words: Efficiency, Football, Foreign Ownership, Stochastic Frontier model

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Section I Introduction

On the 10th of February 2015 it was announced that Sky and BT bought the television rights for the English Premier League from the 2016/17 season to 2018/19 with a record amount of £5.136 billion. This is 71% higher than the previous television rights deal for the 2013/14 season to the 2015/16 season, which was worth £3.018 billion (BBC, 2015). The consequence of this deal is that the Premier League clubs earn a higher broadcasting income since the earnings of television deals are divided among the clubs. For the management of those clubs it means that they can spend a bigger amount of money and that goes along with a bigger responsibility. This involves a certain level of risk, because not all the clubs will spend the extra money in the same way. Clubs may overestimate their abilities and possibilities. The sky is the limit and in the recent past this has led to big problems for Portsmouth FC. Because of financial problems they relegated three times in four seasons after they became owned overseas (The Guardian, 2010). It is proven that private majority investors are a cause of this problem, because they increase investments (Lang, Grossmann, & Theiler, 2011), but also raise debts and losses (Storm & Nielsen, 2012). Furthermore, clubs owned by private investors perform financially less efficient than clubs that are listed on a stock exchange (Wilson, Plumley, & Ramchandani, 2013). Rohde & Breuer (2016) state that from a theoretical perspective the nationality of owners does not prove that such a theoretical discrimination implies a different financial impact. However, they are the first to prove that in the English Premier League foreign private majority club owners invest more, pay higher wages and generate higher losses (Rohde & Breuer, 2016). The goal of this thesis is to find if clubs with a foreign owner in the English Premier League and Championship perform significantly less efficient on the pitch based on the financial responsibilities they have compared to clubs with a non-foreign owner. Since the start of the Premier League in 1992, the television rights for broadcasting the matches within the United Kingdom have increased from £191 million for a five-year deal to £5.136 billion for a three-year deal. The biggest increase has been between 2010 and 2016 when it tripled. One of the explanations for the 71% increase in comparison with the previous deal is that the auction process is designed in such a way that the Premier League can exploit it. Therefore, the fans are harmed the most, because they will be paying more to have a subscription to Sky and BT the coming season (BBC, 2015). The television rights to broadcast Premier leagues matches in countries overseas for the 2013/14 season to 2015/16 season were sold for the total amount of £2.23 billion. The Premier League has not made a deal yet with all channels overseas, but the expectation is that the new deals are worth more than £3 billion (Daily Mail, 2015). It means that for the next three seasons the Premier League clubs may divide more than £8 billion. This is almost £3 billion more than in the previous period of three seasons. So on average a club earns £50 million extra per season, because of the new broadcasting rights deal. Because clubs with a foreign owner pay higher salaries and invest more money compared to clubs with a non-foreign owner (Rohde & Breuer, 2016), the extra broadcasting revenue could lead to even more investments and higher salaries paid by foreign owners, because more revenues can be generated by it.

The distribution of the broadcasting money is divided in such a way that the league winner will earn almost £150 million per season and the club that ends on the bottom of the league still earns almost £100 million per season (Total Sportek, 2015). Therefore, the gap between the top teams and weaker teams will not become too big. However, the amount of broadcasting money earned by Premier League clubs is the highest of all competitions, but according to the current UEFA ranking for club competitions, Spain and Germany perform better in European club competitions (UEFA, 2015). So the question that arises here is if the clubs in the Premier League earn more broadcasting money because they are strong, or if they are tried to be made strong by the higher broadcasting earnings?

The huge increase in broadcasting revenue opens more opportunities for the clubs. They can strengthen their club by signing new players, offer a higher salary to new and existing players, or decrease the match ticket prices to satisfy the fans. The last option is less likely and this has been proven by a survey over the season 2013/14. That was the first season that covered the previous broadcasting deal worth £1 billion per season. Compared to the previous season the average annual salary for a Premier League player went from £1.6 million to £2.3 million per player, an increase of almost 50%. Compared to the other competitions in Europe like Germany, Italy, and Spain, this is on average £1 million per player higher. In the English Championship, players earn on average £486,000 per season and therefore the Championship is the eight best-paying league in the world. (The Telegraph, 2014). The question that arises here is why Premier League clubs pay on average higher salaries compared to other European clubs, but in European club competitions they are not the best? From an economic perspective this can be explained by the competition between the Premier League clubs. Because even the low-ranked clubs earn high amounts of broadcasting money, also these clubs can offer high salaries to the players which leads to a raise in salaries, but the quality of the players does not increase when they are offered a higher salary. This competition is strengthened by the players' agents who earn a high amounts of salary themselves if the players, who they represent in the negotiations with the clubs, will earn higher salary and/or go to another club, because they receive a certain percentage of the players' salary. From the clubs' perspective it is not beneficial to pay high salaries, because it increases the expenses and therefore decreases the profit. In the 2011/12 season only eight clubs turned a profit and Manchester City even lost £99 million (Norris, 2014). This increase in salary could also possibly be driven by foreign investors. In Deloitte's Annual Review of Football Finance 2011/12 it is estimated that clubs with domestic private owners pay on average €66 million salary per season, while club with foreign private owners pay on average €137 million salary per season (Rohde & Breuer, 2016). The goal for this thesis is to find whether such a finding as this is caused by the foreign ownership or that the difference is driven by a better pitch performance of foreign owned clubs.

Not only the players' salaries keep on increasing but also the amount of transfer fees paid is breaking records. In the 2015/16 season the Premier League clubs spend for the first time in total over £1 billion on transfer fees. Especially the lower-ranked clubs are spending more. During the January

2016 transfer window the bottom-half of the Premier League spend £90 million on transfer fees where the total amount paid on transfer fees by all the Premier League clubs was £175 million. It looks like that the lower-ranked teams do not want to take the risk of relegating and therefore missing the increase in broadcasting money due to the new deal. So clubs are investing extra money with the hope that the next season's revenue compensates the invested money (BBC, 2016). The only problem here is that in the next season three clubs will not play in the Premier League anymore, because they will end on the bottom three places which means relegation to the Championship. Therefore, if a club invested extra money to 'survive' in the Premier League but it relegates, it has been really inefficient. The revenues in the next season drop, but if the club does not restructure their assets, such as the value of players (amortisation of players), but also other expenses such as salary will be to high compared to the revenues and therefore the club is more likely to face financial problems.

With the approval of Financial Fair Play by the UEFA in 2010 there has something changed in the clubs debt structure. Clubs are no longer allowed to have more than €5 million of losses over a three year period, but may exceed that limit if it is entirely covered by a direct contribution from the clubs' owner or a related party so the clubs do not increase unsustainable debt. It has been proven that private majority ownership correlates with a raise in the club debts and losses (Storm & Nielsen, 2012). Although, since the introduction of Financial Fair Play the spending of private investors has been limited, the side effect is that the competiveness between teams is restricted (Sass, 2016). Furthermore, Müller, Lammert & Hovemann (2012) justify the introduction of Financial Fair Play from a sport economics perspective by concluding that the sport-ethical standards need to be secured by regulating 'financial doping' (Müller, Lammert, & Hovemann, 2012). Contrary, Budzinski (2014) states that financial problems due to overinvestment are not present in European football, so therefore the restrictive effects of Financial Fair Play are not justified (Budzinski, 2014).

The increase in revenues and wage cost in the last decade, but also the introduction of Financial Fair Play has probably something to do with the takeover of football clubs such as Manchester City and Paris Saint Germain by wealthy foreigners. Often these are big companies from Asia and the Middle East that are owned by a wealthy family. Professor Simon Chadwick from the University of Coventry says the purpose for those companies to invest huge amount of money in football clubs is to establish global prominence where sport is chosen strategically for the development of the whole region on the long term. Due to the big oil industry in the Middle East, those companies survived the economic downturn western companies faced in the last decade. Where local companies owned the football clubs before, they are owned now by the more wealthy companies from the Middle East. The clubs become more stable financially, but the downside is that those companies see football clubs as powerhouses instead of having a real bond with the club. The management of the clubs will make investment decisions to compete with the other clubs and so become the best in the national league and international

competitions. However, those investment decisions involve a lot of risk the club probably would not have made without such an ownership, such as higher transfer fees and salaries (CNN, 2015).

That the nationality of the owners matters is shown in earlier research. Lensink, Meesters, & Naaborg (2008) show that banks which are owned by more than 50% by foreign investors perform more inefficient in terms of cost than banks with a non-majority foreign ownership (Lensink, Meesters, & Naaborg, 2008). Furthermore, Aitken, Harrison, & Lipsey (1996) show in their research to firms in Mexico, Venezuela, and the United States that foreign-owned firms pay higher wages than domestic firms (Aitken, Harrison, & Lipsey, 1996). This is confirmed for English Premier League clubs (Rohde & Breuer, 2016). Related to sporting success this is confirmed by Gerrard (2010) who find that a foreign-owned club like Chelsea performed really well in the league, but was very inefficient in terms of wage paid per point in the league. This could be caused by a less incentive for clubs with a bigger resource of money, such as foreign owners has, to maximise efficiency (Gerrard, 2010). The research question that arises here is the following:

"Are clubs with a foreign owner and more success in the English Premier League and Championship significantly more inefficient in terms of pitch performance related to their costs expenditure compared to clubs with a non-foreign owner?"

So far, the existing literature has not tried to find a inefficiency relationship between pitch performance and the costs expenditure. Although, measuring inefficiency based on financial statements has been done by Barros & Leach (2006 & 2007), they explain the costs expenditure by the sources of income and therefore they measure the inefficiency of costs as how well the income is spend (Barros & Leach, 2006). Furthermore, Wilson, Plumley and Ramchandani (2013) explain the league ranking of the clubs with financial statement components, but they test the relationship between the type of ownership and the clubs' performance and therefore do not test the efficiency of those clubs (Wilson, Plumley, & Ramchandani, 2013). Gerrard (2010) looks only at the wage costs of The Premier League clubs to the points awarded in the league over the 1995-2007 period. Rohde & Breuer (2016) make a distinction in the nationality of the owner, but do not measure the difference in efficiency. Finally, this thesis is unique, because it measures the performance inefficiency related to different cost components of clubs both from the English Premier League and the English Championship over the 2007/08 season to 2013/14 season time period. The goal of this thesis is to find whether clubs with a foreign owner are more inefficient than clubs with a non-foreign owner and if the clubs are less inefficient after the introduction of the Financial Fair Play rules by the UEFA. This thesis will be build up as follows. Section II contains an overview of the existing literature where this thesis is based on. Section II describes the Theoretical Framework that is applied. Section IV contains the Data and the descriptive statistics. Section V describes the methodology that will be applied and develops the hypotheses that are tested in the Results in Section VI. Section VII answers the hypotheses and the research question, what the limitations were in this thesis and suggests what can be improved for further research.

Section II Literature Overview

This section provides an overview of the relevant literature in measuring inefficiency. This thesis is built upon the findings from existing literature. First, a broad overview describes the developments in measuring efficiency with both the advantages and disadvantages. After that the applications of the different methods is described. These are the Data Envelopment Analysis (DEA) and the econometric models, such as the stochastic and deterministic frontier model. For this thesis, the method of the stochastic frontier model translated in a Cobb-Douglas form will be chosen, because of the distinction in stochastic shocks and inefficiency of the error term, less simplicity and decreasing effect of outliers. Furthermore, there is an overview of other relevant literature relating to the ownership, sporting performance and financial performance of football clubs. From these literature the definitions are determined that are used in this thesis. A more detailed explanation of different concepts from the literature is given in Section III.

Developments in Measuring Inefficiency

One of the first to test whether sport teams are efficient are Zak, Huang & Siegfried (1979). The type of model they use is an econometric model, specifically a Cobb-Douglas deterministic frontier model, to measure the efficiency for five basketball teams in the NBA during the 1976/77 season. The functional form of a Cobb-Douglas model assumes that the parameters become more linear when the natural logarithm is taken, because the extreme values of outliers are reduced. The function as in Zak, Huang and Siegfried (1979) is as follows:

$$\ln Y = \ln F(x) + \ln u$$

Where Y is the ratio of the final scores, F(x) is a vector of performance ratios of teams on the pitch and u denotes the error term of efficiency. Estimating efficiency is done by the Richmond method from Richmond (1974). The Richmond method is a short note on the implications of Afriat (1972), which states that the production takes the form of $y = f(x)u$, where u is an error term which can be multiplied and it should be interpreted as a random variable taking values between 0 and 1. The higher the error u, the more the output y differs from the frontier. Earlier research suggested that the value of u varies between 0 and infinity, ∞. When the function has a Cobb-Douglas form, Afriat states that the error term, $-\ln(u)$, follows a gamma distribution with parameter λ (Afriat, 1972). Zak, Huang and Siegfried (1979) use the Richmond method by estimating the parameter u. This estimation reveals the distribution of efficiency across games of a team and leads to estimating the average efficiency of teams.

The advantages of the econometric model is that the coefficients are easy to interpret, the method is widely known and the model can be estimated with Ordinary Least Squares (OLS). The coefficients must be interpreted as elastics, because a change in the independent variable influences the dependent variable. Both the sign and the height of the coefficient determines the relationship between the independent and dependent variable and therefore the coefficient reflects the percentage change in the dependent variable for one unit change in the independent variable. The disadvantage of this method is

that it is too simplistic, because it assumes that all teams have the same production elasticities. This means that each club has the same coefficients (University of Queensland, 2008). The deterministic part of this model is the interpretation of the error term. Deterministic frontier models assume that errors are due to technical inefficiency, which means that teams do not produce optimally with the available players, and that there is no data noise (University of Queensland, 2008). Although Zak, Huang and Siegfried (1979) find extremely large numbers of efficiency levels, they do not doubt on the Richmond method, but state that the sale of professional sports entertainment like the NBA is not as competitive as that of individual sports like the athletic contests (Zak, Huang, & Siegfried, 1979). As described in Section I, the sale of the rights for the Premier League has become more competitive over the years so if this thesis finds extremely large efficiency scores, the conclusion from Zak, Huang & Siegfried (1979) cannot be used as explanation.

The extension on this work is from Hofler and Payne (1997). They extend it to a total of twenty-seven NBA teams and use less variables. Furthermore, they use a Stochastic production frontier to explain the actual number of wins with the ratios of performance of the teams on the pitch. Compared with Zak, Huang and Siegfried (1979), Hofler & Payne (1997) find lower numbers of efficiency levels for teams (Hofler & Payne, 1997). The function as in Hofler and Payne (1997) is as follows:

$$Y_i = \boldsymbol{X_i B} + v_i + u_i$$

Where Y_i is the number of wins for team i according to the model. $\boldsymbol{X_i}$ is a row vector of team-specific ratios of pitch performance, $\boldsymbol{B}$ is a column vector of regression coefficients, v_i and u_i are both error terms where v_i controls for stochastic shocks in the data and u_i controls for inefficiency (Hofler & Payne, 1997). Here, u_i has the same meaning as earlier in this section. The distinction in the error term is introduced by Aigner, Lovell & Schmidt (1977) and is a development based on Afriat (1972) and Richmond (1974). Aigner, Lovell & Schmidt (1977) criticise the estimation method of Afriat (1972) and Richmond (1974) by stating that it gives extreme sensitivity to outliers. The first development of this problem is from Timmer (1971) and Dugger (1974), who developed the probabilistic frontier model which allows a proportion of the observations to lie above the frontier (Timmer, 1971). Aigner, Lovell & Schmidt (1977) criticise this probabilistic frontier model by stating that the selection of the proportion is arbitrary which suggests a lack of economic and statistical justification. Another problem is the possibility for an observation to lie above the frontier, because it is assumed that the frontier is the maximum possible output which should make it impossible to exceed the frontier. The stochastic frontier from Aigner, Lovell & Schmidt (1977) has v_i as the first error term, which is independently identically distributed (i.i.d.) as N(0, σ_v^2). The second error term is u_i, which is a one-sided variating error term which only takes non-positive values and represents the inefficiency of teams. A variating error means that the inefficiency is not the same for all the teams, but it is assumed to vary among teams. Together, $v_i + u_i$ is the distance between the actual production and the maximal production (Aigner, Lovell, & Schmidt, 1977). The difference in the interpretation of the frontier between the stochastic production

frontier and the Cobb-Douglas deterministic frontier model is that the first one estimates what the highest attainable production is for a given level of output while the second one estimates if the team could be more efficient for a given level of output. The stochastic frontier analysis is a combination of both the OLS approach and the deterministic approach. With the two error terms this frontier function is less simplistic, but each team has still the same coefficients (University of Queensland, 2008).

Another method for measuring efficiency is the Data Envelopment Analyses (DEA) developed by Farrell (1957) and Charnes, Cooper & Rhodes (1978). Farrell (1957) distinguishes technical efficiency and allocative efficiency, where the first refers to obtaining the maximum possible output for the given input and the latter refers to purchasing the best package of input for the lowest price and the best marginal productivity (Farrell, 1957). Charnes, Cooper & Rhodes (1978) extends this by developing a measure for technical efficiency for multiple inputs and outputs, whereas Farrell (1957) only did for a single input and output. They develop a non-parametric procedure to measure technical inefficiency when there is a small amount of observations. For a specific public sector Decision Making Unit (DMU), such as a school or hospital, the procedure indicates what types of inputs and outputs could be improved, without the information on prices. The efficiency is calculated as the ratio of the weighted sum of inputs and the weighted sum of outputs, so the more pronounced factors are given more weight in the DEA. The weights for these factors should reach a level where there is no better combination possible without a decline in the weight of one of the factors. This is called Pareto efficiency. (Charnes, Cooper, & Rhodes, 1978). This is known as the DEA-CCR method, Data Envelopment Analysis - Charnes, Cooper & Rhodes. Another form of DEA is the one developed by Banker, Charnes & Cooper (1984). They allow for variable returns to scale (VRS) to exist across observations. Therefore, in a particular industry small firms have a different optimal efficiency level than big firms (Banker, Charnes, & Cooper, 1984). This method is known as the DEA-BCC method. One of the conditions of the DEA method is that the minimum number of observations should be at least three times the sum of the input and output variables that are used to measure efficiency (Raab & Lichty, 2002).

Applications of DEA and Econometric Models

Haas (2003a & 2003b) uses both the DEA-CCR and DEA-BCC method in his papers to measure efficiency for the Major League Soccer (2003a) and the English Premier League (2003b). Haas (2003a) measures the efficiency for twelve Major League Soccer teams for the year 2000 with players' wages, wage of the head coach, and stadium utilization rate as input variables and points awarded, number of spectators, and total revenue as output variables. The results indicate that the efficiency scores are highly correlated with the league ranking. Furthermore, all teams are technical efficient, so the inefficiency is driven by scale inefficiency (Haas, 2003a). Haas (2003b) measures the efficiency for twenty Premier League teams during the 2000/01 season with total wages, wage of the head coach, and home town population as input variables and points awarded, number of spectators, and total revenue as output

variables. Contrary to the Major League Soccer, the efficiency of Premier League teams is not correlated with the league ranking, but similarly one third of the teams are optimal efficient (Haas, 2003b).

Most of the existing findings in measuring English football clubs' efficiency in terms of the clubs' financial statements are from Carlos Barros. From 2003 till 2008 he published papers together with various other researchers. The first papers, written in Portuguese together with Santos, use the DEA method. The first paper of Barros that uses the DEA method and is published in English is from 2006. Barros & Leach (2006b) measure the efficiency of twelve Premier League football clubs that played in each season for the 1998/99 season to 2002/03 season. The output variables are points awarded in the season, attendance, and turnover. The input variables are the number of players, wages, net assets, and stadium facilities expenditures. According to the DEA-BCC with variable returns to scale, all clubs are efficient. However, according to the DEA-CCR method with constant returns to scale, the clubs do not have equivalent scale efficiency. Furthermore, there is no significant correlation between the turnover of clubs and the efficiency ranks of the DEA-CCR method. However, there is a significant correlation between points awarded and efficiency ranks (Barros & Leach, 2006b)

Earlier that year, Barros & Leach (2006a) published a paper were they apply the stochastic frontier model, an econometric frontier model, just like Hofler and Payne (1997) did. In the first paper, Barros & Leach (2006a) use is a cost function where the operational costs of a club is the dependent variable and the independent variables for measuring the drivers to reach optimal efficiency are divided among input variables (average wage and average amortization of players) and output variables (points, attendance and turnover). Furthermore, the dependent variable and the input variables are divided by the ratio of a clubs' stadium facility expenditures by its net assets and liabilities. The whole function is then translated into logarithms, a Cobb-Douglas setting, because this reduces the effect of outliers. The formula as in Barros and Leach (2006a) is as follows:

$$\log\left(\frac{C_{it}}{PK2_{it}}\right) = \beta_0 + \beta_1 \log\left(\frac{PL_{it}}{PK2_{it}}\right) + \beta_2 \log\left(\frac{PL1_{it}}{PK2_{it}}\right) + \beta_3 \log(Points)_{it} + \beta_4 \log(Attendance) + \beta_5 \log(Turnover)_{it} + (V_{it} + U_{it})$$

For the regression of Barros & Leach (2006a) all variables, except for points, are significant and the output elasticity, the sum of the coefficients β_3, β_4 and β_5, indicates the scale is a major issue for English Premier League clubs, because the sum of the coefficients does not equal one. Moreover, sporting success and financial success are the main drivers for cost efficiency (Barros & Leach, 2006a).

The next paper published by Barros and Leach (2007) builds upon their previous mentioned paper. They use the same method to measure efficiency, the stochastic frontier model, but this time they define the error term U_i. The error term U_i consists of so-called contextual variables, such as home town population, average home town income and a dummy for participating in an European cup. The error function U_i as in Barros and Leach (2007) is as follows:

$$U_i = \delta_0 + \delta_1 \log(Population_{it}) + \delta_2 \log(Income_{it}) + \delta_3 \log(European_{it})$$

Points and attendance contribute negatively to the operational costs. Barros and Leach (2007) say this means that pitch performance does not contribute to the turnover of football clubs. Additionally they conclude that big clubs like Manchester United, Arsenal and Chelsea are financially the least efficient and the smallest clubs in the sample are financially the most efficient. This may be due to a difference in objectives between big clubs and smaller clubs (Barros & Leach, 2007).

Ownership

Sloane (1971) is one of the first to describe the reasons for the ownership of English Premier League football clubs. Contrary to other industries, Sloane (1971) finds that the owners of football clubs aim for utility maximization instead of profit maximization. The utility maximization is accomplished when the club reaches maximum success on the pitch (Sloane, 1971). Until the late eighties, all English football clubs were limited companies, so Sloane's theory was not criticised. From the mid-nineties some English clubs listed their shares on the London Stock Exchange and the shares came in hands of investors. Leach & Szymanski (2015) test if during the mid-nineties the English clubs, that became listed on the stock exchange, changed significantly in their objectives, assuming that the clubs' directors acted as utility maximisers prior to they went publicly listed and that investors in publicly listed corporations are mainly interested in financial returns. However, Leach & Szymanski (2015) find that the profitability of publicly listed clubs declined and that the relative spending and league performance increased relative to the period prior to publicly listing. One of the reasons is that the shareholders and directors tried to increase their public profile and status by investing in the football clubs. This is related to the increase in commercialization and internationalization during the nineties. They conclude by stating that all clubs prior to publicly listing were profit maximisers and that the directors made a mistake by investing more in playing talent to generate high future profits (Leach & Szymanski, 2015).

The trend that followed is that nowadays sixty per-cent of the Premier League clubs and almost half of the Championship clubs are owned by non-England investors, with most investors coming from the United States, South-East Asia, and the Middle East. Rohde & Breuer (2016) are the first to test whether private majority ownership and specifically foreign private majority ownership influences the profits and wage expenditure relative to distributed ownership. They find that clubs that have a foreign majority ownership have higher wage expenditures and have bigger losses. Furthermore, they suggest that the main reason for foreign investors to invest in a football club is that they have high private wealth (Rohde & Breuer, 2016). A comparison between the three possible ownership structures in terms of profitability, debt, turnover, and other types of financial health, leads to the conclusion of the stock market ownership structure being a better structure in terms of financial health, such as profit maximisation and return on investments for shareholders, than domestically and foreign private ownership. However, foreign privately owned clubs and public listed clubs perform better in the league than domestic privately owned clubs (Wilson, Plumley, & Ramchandani, 2013).

In other industries, such as the banking industry, foreign ownership also has a negative effect on cost efficiency. Lensink, Meesters, and Naaborg (2008) compare the efficiency of 2095 foreign and domestic owned banks in 105 countries using a stochastic frontier model. Foreign owned banks are defined here as a bank where more than 50% of the shares is owned by non-domestic residents. So, if a bank is established in more than one country, the bank is a domestic bank in the country where more than 50% of the shares is owned by investors from that country, but that same bank is a foreign bank in the other countries. They conclude that foreign banks are on average less efficient than domestic banks. However, quality of the bank and distance between the host country (country of establishment) and the home country has a significant effect on efficiency. The higher the quality, and the smaller the distance between the host and home country, the higher the efficiency level of foreign banks (Lensink, Meesters, & Naaborg, 2008). One of the explanations of this finding is the higher wage expenditure by foreign firms relative to domestic firms. Aitken, Harrison & Lipsey (1996) find a significant relationship between foreign investment and wage expenditure, testing for all industries in Venezuela, Mexico, and the United States. For Venezuela and Mexico, foreign ownership is defined as the proportion of equity that is owned by foreign residents. The wage expenditure for firms in these countries is than allocated between foreign and domestic ownership of the shares in equity. Firms in the United States have foreign ownership when at least 10% of the shares is owned by foreign residents. The results indicate that for Venezuelan and Mexican firms only foreign owned firms have high wages. For domestic firms there was no indication that wage spill overs leads to higher wages. This effect remains after controlling for size. In the United States the difference in wage expenditure between foreign owned firms and domestic owned firms is small. Foreign owned firms and domestic owned firms both have wage spill overs, but after controlling for size this effect disappears (Aitken, Harrison, & Lipsey, 1996).

Sporting Performance and Financial Performance

The relationship between sporting performance and financial performance is the major interest of this thesis. Existing literature contributes to this such as Gerrard (2010), who finds that lower ranked teams are more efficient in terms of wage expenditure. Especially newly promoted clubs spend less wages per point achieved than other clubs. For the Premier League clubs over the sample period of 1995 to 2007 Gerrard (2010) additionally finds that the financially small-resourced clubs perform more efficient in terms of wage expenditure than financially big-resourced clubs (Gerrard, 2010). Furthermore, Samagaio, Couto & Caiado (2009) find for the Premier League for the same sample period that the increase in turnovers is strongly correlated with the increase in operational expenses. The utility of sport managers is maximized with a minimum level of profit and maximum sporting success. So the extra turnover nowadays due to the new broadcasting deal will increase the operating expenses according to the findings by Samagaio, Couto & Caiado (2009). This objective of sporting managers does not differ when the club is owned by a group of investors. The method they use to measure this relationship is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which takes values

between 0 and 1 and a value of at least 0.5 is considered as satisfactory. The variables they use for financial performance are turnover, wages & salaries, other operational costs before player trading, net transfer fees, amortization of player registrations, net profit related to with sale of players registrations, and other net income. The variables for sporting performance are the performances in the Premier League, FA Cup, League Cup, and UEFA competitions. All variables for financial performance have a KMO of above 0.5 and for sporting performance only the League Cup performance does not have a satisfactory KMO. Not for all the clubs this relationship is persistent. For Manchester United and Liverpool the investment in new players and wages & salaries did not result in an increase of sporting performance (Samagaio, Couto, & Caiado, 2009). Hamil & Walters (2010) confirm the relationship between the increase in broadcasting revenue and the failure of posting a pre-tax profit. They compare the trend of rising debt in the Premier League with the 'inconvenient truth' by former United States Vice-President Al Gore. The authors state that in any other industry the debt levels would not have become so high without going into bankruptcy. Although, the English football clubs still survive, they are not immune for financial instability. Hamil & Walters (2010) conclude by stating that stronger financial regulation is inevitable (Hamil & Walters, 2010).

These regulations by the UEFA, introduced in 2011, are justified from a sport economics perspective, state Müller, Lammert & Hovemann (2012). The regulation of external funding, which is called 'financial doping', secures the sport-ethical standards and avoids a decline of interest and demand. However, the side effect of this regulation is that club will account creatively and therefore avoid the sanctions of not meeting the financial regulations (Müller, Lammert, & Hovemann, 2012). Budzinski (2014) states there is no need for financial regulation by the UEFA, because overinvestment is not present in European football. Therefore, a regulation is not legitimate as it contradicts the European competition policies (Budzinski, 2014). This is confirmed by Szymanski (2014), who states that the main target of the UEFA regulations are the 'sugar daddies', the overinvesting private majority owners. The UEFA claims that the regulations are introduced to increase the efficiency of the clubs, but the ways this should be accomplished are not clear. Therefore, Szymanski (2014) states that the regulations do not met the competition law in the European Union (Szymanski, 2014). Relating to sporting performance Sass (2016) states that due to the financial regulation on the long run small clubs are not capable to balance the competition strength, because they may not overspend or overinvest. The big clubs stay big and the small clubs stay small, whereas the market size does not shift between clubs (Sass, 2016).

Section III Theoretical Framework

This section describes the theoretical framework that is applied in this thesis. This consists of the league structure and rules of The Premier League and The Championship, the two highest professional football divisions in England. Furthermore this section defines the foreign ownership of the clubs based on existing literature and the theoretical background of the variables that are possible to be applied.

League Structure

The Premier League was founded in 1992 and contained twenty-two clubs at the start of the 1992/93 season. From the 1995/96 season the number of clubs participating in the Premier League has been reduced to twenty (The Premier League, 2015). Only clubs from England and Wales are allowed to participate in The Premier League (Rule B.2.). The ownership of The Premier League is divided in equal shares among the twenty clubs participating in the league for that season. After a club has been relegated from The Premier League, it has to transfer its ordinary share in the league to such of the three clubs promoted to The Premier League (Rule B.4.). During the season, each club plays two league matches against each other club, being once the home club and once the visiting club against each club (Rule C.1.). Therefore, each club plays thirty-eight matches each season. The winner of a league match receives three points and both the clubs participating in a match which is drawn receive one point (Rule C.2.). The league ranking is based on the number of points scored bases on Rule C.2., so the club with the most points scored is at the top of the league table, the club with the least points scored is at the bottom of the league table (Rule C.4.). The club that is at the top of the league table after thirty-eight matches shall be called to League Champions (Rule C.8.). The bottom three clubs of The Premier League table after thirty-eight matches relegate to the Football League's Championship (Rule C.11.) (The Premier League, 2015).

In each season, by the 1st of March, each club, or the group where the club is a member of, has to submit a copy of its annual accounts of the most recent financial year to the secretary of The Premier League (Rule E.3.) One of the things these annual accounts should contain, is a breakdown within the profit and loss account (Rule E.4.2.). So the Premier League clubs have to report the different components of their costs during the season, one of the major interests of this thesis. Furthermore, the club has to publish the identities of the ultimate owner of each significant interest in the club (Rule G.5.) (The Premier League, 2015). Therefore, the ownership of the club is likely to be incorporated in the annual accounts of the club.

The Championship is part of the Football League, where the clubs playing in the Championship, League 1, and League 2 are member of (Rule 5.1). The Championship and the League 1 should both consist of twenty-four clubs (Rule 5.2). Just like in The Premier League, the clubs in The Championship play each club once as the home club and once as the visiting club. Therefore, each club plays forty-six matches during the season. Furthermore, the club scoring the highest number of points will be the

League Champions, where three points are scored for every league match won and one point will be awarded to each club for a drawn match (Rule 9.1). Every season, the three relegated clubs from The Premier League are accepted as members of The Football League (Rule 10.1.1a). The two clubs finishing at the top two places of The Championship league table promote to The Premier League. The four next highest ranked clubs in The Championship compete in a play-off competition for the remaining promotion. The winner of this play-off competition promotes to The Premier League (Rule 10.1.1b). The two clubs finishing at the top two place of the League 1 table promote to The Championship and the same play-off competition applies for the four next highest ranked clubs in the League 1 for promotion to The Championship (Rule 10.1.2a). The bottom three clubs of The Championship league table after forty-six matches relegate to the League 1 (Rule 10.1.2b). Clubs playing in The Championship shall submit a copy of its annual accounts of the most recent financial year to The Football League before the 1st of March (Rule 16.2, 16.2.1 & 16.3). One of the things these annual accounts should contain, is a breakdown within the profit and loss account (Rule 16.9.3). Finally, it cannot be concluded from the rules that the clubs should publish the identities of the ultimate owner of each significant interest in the club (The Football League, 2015).

Ownership

The football clubs playing in England and Wales can be either a privately owned company or a public limited company (plc). The difference between these two types of structure is that for a privately owned company the residual rights of control and the residual claims are allocated to the same person(s), the owner(s), but the owners of a public limited company do not have the residual rights of control. Therefore, the owner of a privately owned company bears the risks of his or her decisions. Another difference is that the shares of a public limited company are traded on a stock exchange, whereas the shares of a privately owned company are not publicity traded on an exchange. Stockholders of a public limited company elect directors, but they have no say in investment and acquisition decisions and on business strategies. When the club liquidates, the stockholders receive the remaining profit after payment of debt and taxes (Franck, 2010). If an investor want to take over a privately owned company it has to make an appropriate bid and this has to be accepted by all existing owners. To take over a public limited company, an investor is required to own a certain number of shares, but this has not have to be accepted by all the existing owners. For example, when the Glazer family took over Manchester United in 2004 it acquired over seventy-five per-cent of the shares so the shares could be removed from the stock market. After that, the remaining shareholder, which were mostly fans who had a small share in the club, were forced to sell their shares to the Glazer family. Therefore, it is easier to become an owner of a public limited company than of a privately owned company (Brown, 2007).

For determining what the foreign ownership of the football clubs is, there has to be made an important distinction between company registration and the nationality of the owner. First, the ownership structure has some different aspects. For a club it is possible to have a holding company

where the different divisions of the club are consolidated, such as the stadium property, youth academy, and the accounts related to the first squad of the club. If the club is not divided in different divisions, then there does not have to be a holding company. Often, football Clubs are owned by a parent company, which is a company that invests in the football club by contributing partly or wholly to its equity by buying stocks of the club. If the parent company is not owned by another company, then this parent company is considered as the ultimate parent company. If the parent company is owned by another company, then the company at the end of the chain that is not owned by another company should be considered as the ultimate parent company, which is the head of the group and consolidates the accounts of all the companies it directly and indirectly owns. This means that the ultimate parent company combines all the accounts of the other companies it owns into one report. The advantage is that profits from one company can be compensated by losses of another company. Therefore, the ultimate parent company is the only company in the chain that has to pay the corporate tax (Monsenego, 2012).

In 2015, twenty-eight English football clubs were owned by an ultimate parent company that are registered in tax havens like The Cayman Islands, Bermuda, the Isle of Man, and the Bahamas. The reason for the ultimate parent company to be registered in tax havens is that there is a different jurisdiction like a lower corporate tax rate compared with England, where it is 28%. Although there is no prove, it is possible that those companies try to avoid tax. The other reason for companies to register in tax havens is that the company does not have to publish their shareholder's names, so the owners stay anonymous (The Guardian, 2015). For the owners of ultimate parent companies that own football clubs this is less likely the reason, because under the regulation of The Premier League the clubs have to publish the identities of the ultimate owner of each significant interest in the club (Rule G.5.) (The Premier League, 2015). Foreign ownership could be the registration of the ultimate parent company in a non-England country. However, in this thesis the nationalities of the owners of the ultimate parent company are the benchmark for determining foreign ownership. Following Rohde & Breuer (2016), domestic ownership means that the nationality of the owner is the same as the country of origin of the football club. As stated in the rules of the Premier League, clubs from both England and Wales are allowed to participate in the league (Rule B.2.), so clubs originating from England with an English owner are considered to have a domestic ownership and clubs originating from Wales with a Welch owner are considered to have a domestic ownership (Rohde & Breuer, 2016). Clubs where the nationality of the owners differs from the originating country of the club are considered to have a foreign ownership. Therefore, it is possible that an ultimate parent company of a football club is registered in a tax haven, but the owner(s) originate from the same country as the club. On the other hand, the ultimate parent company could be registered in England & Wales, but has an owner with a non-English/Wales nationality. The majority of the shareholdings will be important, so if more than 50% of the club is owned by foreign owners, the club is considered to be foreign owned. For clubs where the majority owner differs from the person who is considered to have the control of the club according to the financial

statements, the nationality of the majority owner will be decisive. The reason for this is that although Rohde & Breuer (2016) do not consider the possibility for this difference, they use the nationality of the majority owner as benchmark for foreign ownership (Rohde & Breuer, 2016). To determine if a club was majority foreign or non-foreign owned during a season when the majority ownership changed during a season, the ownership structure for the majority of the season will be decisive. So if a club changed from a majority non-foreign ownership to a majority foreign ownership on June 1, 2012 and the accounting period ends on June 30, 2012, the club had for the majority of the season a majority non-foreign ownership, so the club will be considered to have a majority non-foreign ownership during the 2011/2012 season. The same applies when the accounting period ends on May 31, 2012 and July 31, 2012.

Variables

In the existing literature different variable are used to measure inefficiency. Sometimes the same type of variable is used as input variable and as output variable among different studies. For the input variables stadium utilization, home town population, number of players, net assets, and different drivers of costs such as wages, wage of the head coach and operational costs are used. The stadium utilization is the percentage which reflects how much of the stadium capacity was used during the home matches of the club. In other words, stadium utilization is the percentage of tickets sold for the home matches relative to the maximum amount of tickets that could possibly be sold (Haas, 2003a). The home town population accounts for the different demand for football entertaining. Although this input variable is beyond the control of the clubs' management, the population of the home town influences the revenues generated by the club and therefore the production (Haas, 2003b). The number of players simply reflects the number of players that are under contract with the club. The net assets are the total assets minus the total liabilities and it reflects the book value of the equity (Barros & Leach, 2006b).

The activities where the management has the most influence on are the operating activities, because these activities reflect the core business of the club: football. The operating activities are separated in operating revenues and operational expenses (Palepu, Healy, & Peek, 2013). The main driver of the operational expenses on the profit and loss account of football clubs is the expenses for wages & salaries. Carmichael, McHale & Thomas (2011) show that on average 65% of the revenue is spent on wages (Carmichael, McHale, & Thomas, 2011). Wages & salaries are paid to the players, training staff, administrative staff, and ground staff. Therefore, in 2013, Arsenal Holding plc, the holding company of Arsenal, paid wages & salaries to 537 employees (Arsenal Holdings plc, 2013). Besides wages & salaries, the football club has social security costs and other pension costs. The contributions to social security are a form of tax that is paid by the employer to the government and guarantees the employees to receive a future social benefit, such as unemployment insurance benefits, old-age benefits, and disability pensions (OECD, 2016). The other pension costs are the contributions according to The

Football League Pension and Life Assurance Scheme and is calculated as the remaining service life of the clubs' employees who are members of the Scheme (Arsenal Holdings plc, 2013).

Another driver of the operational expenses is the amortization of player registrations. According to Samagaio, Couto & Caiado (2011) amortization of player registrations represents 19.8% of the turnover in the 2005/06 season (Samagaio, Couto, & Caiado, 2009). It is the depreciation of the value of the players, including agents' fees, over their total contract life. The transfer fee the club paid to acquire the player is used to determine the value of the player that should be amortized. If the club did not pay cash to acquire the player, for instance when the club exchanges a player with a player from another club or when a player did not had a contract with another club, the market value of the player is used for amortization. When a players' contract is renegotiated before the old contract has ended, the unamortized costs together with the new costs relating to the contract extension are amortized over the period of the new contract. The transfer fee the club receives when it sells one of its own players is reduced with the unamortized costs when accounting for a profit or loss on the player (Arsenal Holdings plc, 2013). For example, when Liverpool FC bought Luis Suárez from AFC Ajax in January 2011, Liverpool paid Ajax £22.8 million and Luis Suárez signed a 5.5 years contract. Therefore, every season Liverpool amortizes £4.1 million annually (£22.8m / 5.5 years). After 1.5 years, in August 2012, Luis Suárez signed a new five-year contract with Liverpool. The unamortized costs in August 2012 were £16.65 million $[£22.8\text{m} - (1.5 * £4.1\text{m})]$. So, for the new contract life time the annual amortization for Luis Suárez will become £3.33 million (£16.65 / 5 years) instead of £4.1 which means a £0.8 cut in amortization costs by renegotiating Luis Suárez' contract. In December 2013 Luis Suárez signed another 4.5 years contract whereby the unamortized costs were £11.66 million and the new annually amortization of Luis Suárez became £2.57 million (Rowland, 2014). In July 2014, Liverpool sold Luis Suárez to FC Barcelona for approximately £60 million (Transfermarkt, 2016). With the unamortized costs of around £10 million, Liverpool made a profit on the transfer fee of Luis Suárez of around £50 million excluding transaction costs. So, spending less money on transfer fees and renegotiating contracts reduce the costs on amortization of player registrations. Therefore, it is important for a football club to negotiate efficiently by trying the transfer fees it has to pay to other clubs for buying players to be as low as possible, but also negotiating efficiently with the player to let the player sign a contract with a longer life time and a salary that is as low as possible.

Furthermore, there are other operating expenses such as the depreciation and impairment of property, plant, and equipment. The depreciation of fixed assets is a certain percentage the club uses to write-off, mostly on a straight-line basis. Mainly, there are two types of fixed assets, freehold properties and leasehold properties. When the property is owned by freehold the club is the unlimited owner of the property, so the club does not have to pay a lease or a rent to another party and it does not have to return the property at any time in the future. When the property is owned by leasehold the club owns the property for a limited time. The club leases the property from the actual owner and it has to pay a lease

or rent to that owner. After the end of the lease contract, the ownership of the property returns to the actual owner (GOV.UK, 2016). Leasehold property is amortized over the life time of the lease contract, so similar as for the amortization of player registrations the annual amortized amount changes when the lease contract is renegotiated (Tottenham Hotspur Limited, 2013). If non-current assets, including property, plant and equipment, and intangible assets have lower estimated future economic benefits an impairment is applied. Impairment means an adjustment of an asset on the balance sheet when due to certain events the economic damage is unrecoverable. For instance, Tottenham Hotspur estimates future economic benefits by estimating future ticket income, media and sponsorship and on pitch performance (Tottenham Hotspur Limited, 2013). For the players it is also possible to apply an impairment when due to an injury or extremely misbehaviour the player will have unrecoverable damage that influences his economic value. However, it is difficult to estimate the economic loss of an individual player and separate him from the income generating unit. Therefore, the impairment is the difference between the players' old book value and the newly estimated fair value of the player by the club minus the costs to sell the player (Arsenal Holdings plc, 2013). Other costs made by the football clubs do not have a substantial contribution to the expenses, such as the costs for auditors to create the annual reports and consolidate the accounts. Most of the non-substantial expenses are presented as 'other operating expenses'.

For the output variables attendance, turnover, league ranking, number of points awarded and also operational expenses can be used. The difference between attendance and stadium utilization is that attendance is the average amount of tickets sold whereas the stadium utilization is the percentage of capacity used. Turnover is the total of operating revenue which contains broadcasting money, ticket sales and other types of income such as money from sponsor deals and merchandise. League ranking and number of points reflect roughly the same, because the league ranking is based on the number of points awarded. However, the number of points awarded allows for more specification, because the difference in amount of points between league rankings is not fixed but variable.

Section IV Data

This section describes the data retrieving process for measuring the inefficiency of the football clubs. This contains the databases that are available and those that will be used for the annual reports and the ownership of the football clubs. Furthermore, the sample period for the data and the variables that are chosen for the regression are motivated. Finally, the limitations in the data is mentioned and the descriptive statistics will show the main statistics for the data that is used.

Databases

Data from the clubs' annual reports is needed to check whether the clubs perform inefficient. As described in Section III, the football clubs have different ownership structures. This means that for privately owned clubs the annual reports are less likely to be found than for stock market listed clubs, because the latter are obliged to report their financials to the shareholders and to the market while the privately owned clubs do not have this obligation (Monsenego, 2012).

Financial databases such as Orbis by Bureau van Dijk, Thomson One Banker and Thomson Research do not meet the above criteria. Although Orbis provides annual reports from both public and privately owned firms, there is no specification in the financial reports, for instance for the drivers of costs and revenues. Orbis also only provides the latest owners of the companies, where for this thesis it is needed to have information about the owners of the football clubs for every year. Thomson One Banker and Thomson Research only have available information on public listed companies and, similar to Orbis, only the latest owners are provided, but not the historical owners. Therefore, Thomson One Banker and Thomson Research are incomplete databases.

The best source for both the information on financial performance and ownership is the database provided by the United Kingdom government, Companies House. The Companies House is legally provided with the rights to incorporate and dissolve limited companies in the United Kingdom. Furthermore, it registers the information that companies are legally required to provide and it makes that information available to the public (Companies House, 2016). Because of the latter, the annual reports can be accessed by every individual without any restrictions. Another advantage is that it is possible to find the historical ownership of the football clubs. This brings also a disadvantage of the Companies House, because the historical ownership can only be obtained by looking in the annual reports for notes about (ultimate) parent companies and/or controlling party. Therefore, the quality of the ownership information depends on the trueness of reporting and the amount of information the club wants to provide besides their legal requirements The nationality of the owner(s) is also retrieved from the Companies House. Searching for the name of an owner immediately gives the nationality and the companies he or she owns or takes a position in. If it is not possible to find the names of the owners in the annual reports, for instance because the ultimate parent company is not registered in the United Kingdom, then the annual reports of the ultimate parent company are retrieved from Thomson One Banker to find only the name(s) of the owner(s). For the data related to the financial accounts the criteria

for the usefulness of the parent company's report is that the parent company should be registered in the United Kingdom and that only accounts related to the football club may be consolidated. Otherwise, accounts will be made up in different currencies which makes the data vulnerable to foreign exchange rate risk. Also only operations related to the operating activity of the football club should have an influence on the data. Non-relating operating activities are not relevant for measuring the inefficiency of the football clubs.

Data on the pitch performance is retrieved from the official website of the Premier League and the official website of The Football League. For reliability purposes the official website of the Sky, the organization that broadcasts the Premier League matches, is used to control for wrong data points.

The sample period ranges from the 2007/08 season to 2013/2014 season. This time period is chosen, because it allows to test for changes over a longer time range such as changes in financial results due to new broadcasting deals, but also the changes in inefficiency of clubs and the possibility for the clubs' management to change the inefficiency level of these clubs. Moreover, a time range like this will contain some clubs which changed from non-foreign ownership to foreign ownership or vice versa. Therefore it is possible to test for significant changes in inefficiency within a club over time due to foreign ownership. The time period starts with the 2007/08 season, because according to Rohde & Breuer (2016) from 2008 the trend of majority ownership was present for 90% of the Premier League clubs whereas before 2008 this was only 70%. Also the amount of foreign owners increased to 45% in 2008 whereas this was not more than 35% before 2008 (Rohde & Breuer, 2016). So from the 2007/2008 season the amount of clubs with foreign ownership is not limited to a few observations and is more reliable than before the 2007/2008 season. The 2013/2014 season is the final season of the sample period, because not all the clubs have reported their 2014/2015 results at the moment of testing or the reports are not made public yet by the Companies House. Therefore, the 2013/2014 season is the most recent season which has the lowest percentage of missing reports as possible. Furthermore, two subsets will be tested. The first subset is the 2007/08 season up to and including the 2009/10 season and the second subset is the 2010/11 season up to and including the 2013/14 season. This allows to compare the period before and after the approval/introduction of Financial Fair Play by the UEFA.

Variables

A few options are available to define performance on the pitch, such as number of wins, points awarded, league ranking, and ratio of goal differences. The decision is made to use the number of points awarded in a season as a measure for performance on the pitch for the dependent variable. Number of points awarded reflects the performance the best, because the actual ranking of the clubs in the league is based on the number of points. Also the broadcasting money, the major resource of money, is divided based on the final league ranking. Number of wins would be sufficient when a sport where no draws are possible, such as basketball, is studied. Because of the possibility of draws in football, a club can have a higher rank even with less wins than a club with a lower rank and therefore it is possible to earn more

broadcasting money with less wins than another club. The other possibility to measure performance on the pitch, ratio of goal difference, is also not sufficient because of the same reasons as mentioned for number of wins. The ratio does not indicate the exact rank of a club, because of the possibility of a lower rank even with a higher ratio. Compared with the number of points, league ranking does not allow for measuring differences between league positions. Because the difference in points between league positions is not the same across the league ranking, number of points reflect the team strengths the best.

For defining the independent variables the goal of this thesis has to be taken into account. It is not in the interest to find how stadium utilization or the attendance influences the pitch performance. Also the existing literature has not tested for a relationship between attendance and foreign ownership or proposed any possibility of a significant difference in attendance between foreign owned clubs and domestic owned clubs which makes it an irrelevant variable to use. Using net assets is also problematic, because of non-standardization in accounting assets and liabilities in the clubs' reports. For instance, clubs that are overseas owned and had a high value of loans outstanding to their owner are converting their debt to equity (Independent, 2010). This phenomenon makes it difficult to interpret the absolute value of net assets per club. The variable Turnover is most likely strongly correlated with the dependent variable, the number of points awarded, because the main drivers of turnover such as broadcasting income and sponsor revenue are based on the final league ranking. So turnover is the final result of the activities of the club where the management does not have a direct influence on. Because this thesis aims on inefficiency caused by the clubs' management turnover is not a helpful variable.

Because the operating activities are the activities the football clubs' management have the most influence on, these activities should be included in the regression. Turnover is the main result of operating activities, but is considered as not being a good variable to use. What remains are the operating expenses of the football clubs. Existing literature uses this variable in various ways. Barros and Leach (2006a and 2007) consider operational expenses as the result of production explained by for instance sporting success whereas it is more likely that the operational expenses are the causes of the main productivity of football clubs: sporting success. The sporting success in the league is only achievable by awarding as many points as possible. Wages & salaries are the main drivers of operating expenses and is a common used variable in the existing literature. It also has a significant relationship with foreign ownership in terms of inefficiency (Gerrard, 2010). However, testing the direct relationship between wage and pitch performance in terms of inefficiency caused by foreign ownership has not been tested yet, which makes it an useful variable to use for a contribution to the existing literature. Amortization of player registrations is the other main driver of operational expenses and has been proven to have a strong correlation with sporting performance (Samagaio, Couto, & Caiado, 2009). Barros and Leach (2006a and 2007) prove that the amortization of player registrations is significant for reaching a higher level of cost efficiency. Similar for wages, the amortization of player registrations has not been linked yet to inefficiency of foreign ownership. Therefore, it will be used as a variable for explaining pitch

performance and whether it causes inefficiency. Because the other operating expenses are not defined in specific activities among the clubs it is impossible to add a variable that captures an activity of the operating activities besides wages & salaries, and amortization of player registrations. Therefore, the third and final independent variable are the other operational expenses which is the total operating expenses minus the wages & salaries, and amortization of player registrations. All three independent variables are notated in the British Pound (£) which is the same currency as that is used in the annual reports of the clubs. Inflation is ignored, because the wages & salaries are not influenced by inflation changes. When players sign their contract, the wages and bonuses are the same throughout the seasons that are covered in the contract. Inflation changes do not change the wages and bonuses paid to the player. Also currency changes are difficult to implement, because it is not clear what the exact amount of transfer fees paid are for which player.

The chosen three variables are the only variables from the clubs' annual reports that are uniform across all the observations and directly influence the production, the number of points awarded. Other variables that could influence the production do not have a direct relationship with the nationality of the ownership, such as match statistics, and/or are highly unmeasurable, such as the ability of the head coach.

Data Limitations

During the collection of the data a few difficulties were encountered which are worth mentioning. First of all, eight of the fifty-four clubs that played for at least one season in the Premier League or Championship for the period 2008-2014 have completely missing or incomplete annual reports. For instance, Doncaster Rovers has not reported anything about their income statements in the annual reports, but also their (ultimate) parent company could not be find in the databases. Both Liverpool and Watford have one missing annual report due to the change in ownership. Portsmouth has missing annual reports due to multiple bankruptcies and Middlesbrough is the only club that reported their annual accounts on December 31 before the accounting period was extended in 2011. The latter is also a limitation for the whole dataset, because there is no standardized accounting period for the clubs. Across the whole dataset, besides Middlesbrough, clubs made up their annual reports to May 31, June 30, or July 31. These dates all lie between the end of the most recent season and the beginning of the upcoming season, so therefore these dates are appropriate for assigning the annual report to the most recent season. In the case of Middlesbrough this is not possible because a part of the annual report applies to the second half of the previous season and the first half of the current season. For the other clubs there is a small limitation in the accounting period difference. For instance, when a club ends their accounting period on July 31, 2013 and it has bought a new player on July 1, 2013, the amortization expenses for this player will be included in the annual report of 2013, but if the accounting period ends on May 31, 2013 or June 30, 2013, the amortization expenses for the new player will be included for the first time in the annual report of 2014. However, the difference is at most two months of earlier

amortization expenses recognition when accounts are made up to July 31 compared to May 31. This is a limitation of the dataset, but not such a limitation that it will make the data not useful to work with.

Another limitation is the change in ownership for the football clubs. This change might cause accounting errors in the annual reports, because the new parent company has little experience with the organization of the club and therefore managers are more likely to make accounting errors, especially when there is a cultural difference (Chan, Lin, & Mo, 2003). On the other hand, managers can make accounting errors on purpose, for instance when the manager applies earnings management by overstating and understating the expenses. By overstating the expenses in good seasons the managers creates space for understating the expenses in bad seasons (Palepu, Healy, & Peek, 2013). Because the solution to correct for earnings management is not available for this thesis, this limitation will not influence the data availability, but it needs to be taken into account when conclusions are drawn from the results.

Descriptive Statistics

First, the data is transformed to panel data by defining *i*, an individual club, and *j*, the year. The values for wages & salaries (Wage), amortization of player registrations (Amort), and other operating expenses (Other) are given in millions of pounds (£). Because the data is defined in *i* and *j*, the summary statistics are ordered in the *overall* statistics, but also the *between* and *within* statistics. The *overall* statistics do not make a distinction between different clubs or different years, so the mean, standard deviation, minimum and maximum only tell something about the raw data, but it does not tell how the data varies between clubs or within the clubs over the years. The *between* statistics show how the data varies between the clubs. These statistics are calculated by taking the average values of the points, wages & salaries, amortization of player registrations, and other operating expenses over the entire sample period.. For example, from the 2007/08 season to the 2013/2014 season Manchester United awarded 87, 90, 85, 80, 89, 89 and 64 points in the Premier League. On average this is 83.42857 which makes Manchester United the club with the highest points awarded on average over the entire sample period. This can be verified in Table 1.

The sample size for the *between* statistics is lower than for the *overall* statistics, because the *between* statistics reflect the total amount of clubs in the sample where the *overall* statistics reflect the total amount of observations. Because multiple clubs play for more than one season in the Premier League (Table 1) or in the Championship (Table 2), there are more observations than amount of clubs. The maximum is seven observations for one club when it played in the Premier League or Championship over the entire sample period and at least one when a club played in the Premier League or Championship for one season. For example, from the 2007/08 season to the 2013/2014 season Hull City played in total three seasons in the Premier League and four in the Championship. Therefore, they have three observations in the Premier League statistics and four in the Championship statistics. The difference in the amount of observations is due to data limitations which can be found in the previous

paragraph. The *within* statistics show how the data varies within the clubs. This is calculated using the sum of least squares. This is a straight-line linear relationship for various data points. This regression line has the best fit when the sum of the squared distances between the regression line and the data points is minimized (Moore, McCabe, Alwan, Craig, & Duckworth, 2011).

In Table 1 the *overall* statistics for the Premier League point out the highness of the standard deviation relative to the mean for all the variables. Especially, the standard deviation for the amortization of player registrations (£17.64 million) is almost as high as the mean of this variable itself (£23.45 million). In other words, one or more clubs spend high amounts of money on transfer fees when buying players and/or have contracts with a short life time. Otherwise, the standard deviation would not be so high because a higher standard deviation means a bigger dispersion in the data. Also for the other operating expenses the standard deviation is close to the mean. This can be explained by for instance the exceptional costs a club had during a year that were marked as operational expenses. Furthermore, it is worth mentioning that for the points awarded the standard deviation of the *within* statistics is more than two times smaller than the *overall* and *between* statistics' standard deviations. The *within* standard deviation means how, on average, the amount of points awarded fluctuates for a club over the period of seven seasons. Because this *within* standard deviation is smaller compared to the *overall* and *between* standard deviations for points awarded, it is statistically proven that it is on average difficult to influence the success significantly in a short amount of time and maintain that position. If success is the number of points awarded by the clubs, these statistics show that a club does not differ that much on average in the number of points awarded over time, but that the dispersion in the number of points awarded in the league table is way higher on average. So it is difficult for a club to increase the average number of points, subsequently to make a significant jump in the league table and then maintain that position in seven seasons. Looking at the operating expenses the wages & salaries are the main driver. On average, a club in the Premier League has £137.3 million expenses on operating activities per season from which 56.3% is spend on wages & salaries. The amortization of player registrations covers on average 17.1% of the total operating expenses per season.

Variable		Mean	Std. Dev.	Min	Max	Observations	
Points	overall	52.05714	17.48495	11	90	N =	140
	between		15.76029	11	83.42857	n =	32
	within		7.885286	31.2	70.72381	T-bar =	4.375
Wage	overall	77.24864	47.55005	22.372	233.106	N =	135
	between		39.54045	22.372	178.2551	n =	31
	within		19.14462	-23.3975	155.4865	T-bar =	4.35484
Amort	overall	23.45224	17.64281	1.958371	83.847	N =	135
	between		15.04382	1.958371	65.71843	n =	31
	within		6.737759	-16.87719	43.74824	T-bar =	4.35484
Other	overall	36.60426	33.40089	2.969509	208.539	N =	135
	between		26.88104	2.969509	113.3789	n =	31
	within		13.84634	-3.596595	131.7644	T-bar =	4.35484

Table 1: Descriptive Statistics Premier League. The descriptive statistics for the clubs in the Premier League from the 2007/2008 season to the 2013/2014 season. The statistics are divided in *overall*, *between* and *within*. The variable *Points* is the number of points awarded in a season. *Wage* is the wages & salaries paid by a club during a season. *Amort* is the amortization of player registrations during a season. *Other* is the other operating expenses of a club during a season. Values for *Wage*, *Amort* and *Other* are given in millions of pounds (£).

In Table 2 the descriptive statistics for the Championship show similar results for the amortization of player registrations and other operating expenses variables compared to the descriptive statistics of the Premier League clubs. The wages & salaries and amortization of player registrations cover on average 59.3% and 10% respectively per season. This shows that Championship clubs have on average a slightly larger fraction on other operating expenses than Premier League clubs. Furthermore, the higher mean of the number of points awarded compared to the Premier League is explained by higher amount of matches Championship clubs play in a single season which is forty-six compared to thirty-eight for Premier League clubs. Remarkably, the *overall* standard deviation of the number of points is lower for the Championship than for the Premier League. This means that the dispersion in the league table is smaller for the Championship.

To test whether a point awarded in the Premier League has the same value as in the Championship, the standard deviations for the number of points awarded are compared using a F-test. the null-hypothesis of no difference is rejected at the 1% level (P-value = 0.001). So a point awarded in the Championship has more value than in the Premier League. Although there is a difference in the amount of clubs for both leagues, this is compensated by the higher amount of matches that Championship clubs play during the season. So because the standard deviation is lower for the Championship, less points are needed to make this jump in the league table. For the *between* standard deviations on the number of points awarded there is no significant difference at the 10% level (P-value = 0.143). The *within* standard deviations do also not significantly differ at the 10% level (P-value =

0.277). Therefore, it cannot be stated that a point awarded in one league has more value than in the other league.

Variable		Mean	Std. Dev.	Min	Max	Observations
Points	overall	62.49405	13.36229	34	102	N = 168
	between		12.38685	37	102	n = 44
	within		9.51339	37.99405	92.66071	T-bar = 3.81818
Wage	overall	16.65653	9.471914	3.059109	75.387	N = 153
	between		9.759784	4.558796	47.458	n = 41
	within		5.780767	-2.922865	62.06613	T-bar = 3.73171
Amort	overall	2.809459	2.625854	.13101	16.596	N = 152
	between		2.708964	.446181	11.529	n = 41
	within		1.77338	-2.782058	14.17086	T-bar = 3.70732
Other	overall	8.639799	6.478402	.373173	45.05718	N = 153
	between		6.931703	1.641121	34.84101	n = 41
	within		3.953844	-2.464256	36.31092	T-bar = 3.73171

Table 2: Descriptive Statistics Championship. The descriptive statistics for the clubs in the Championship from the 2007/2008 season to the 2013/2014 season. The statistics are divided in *overall*, *between* and *within*. The variable *Points* is the number of points awarded in a season. *Wage* is the wages & salaries paid by a club during a season. *Amort* is the amortization of player registrations during a season. *Other* is the other operating expenses of a club during a season. Values for *Wage*, *Amort* and *Other* are given in millions of pounds (£).

Table 3 shows the frequencies of the clubs' foreign ownership per season for the Premier League and Championship respectively. The variable Foreign can only take values of 0 and 1, where a value of 0 means no majority foreign ownership and a value of 1 means the club has a majority foreign ownership. Rohde & Breuer (2016) find that 45% of the Premier League clubs in the season 2007/2008 had a majority foreign ownership. This is not confirmed in Table 3 where eleven out of the twenty clubs (55%) had a majority foreign ownership in the Premier League for the 2007/2008 season. However, the increasing trend in Rohde & Breuer (2016) find in majority foreign ownership for the Premier League clubs until 2008 has not continued after 2008. From the 2008/2009 season to the 2012/2013 season the ratio between majority non-foreign ownership and majority foreign ownership was completely in balance for Premier League clubs. In the season 2013/2014 the ratio increases back to the 2008-level of 55%. This is caused by the relegation of only one majority foreign owned club from the Premier League, Queens Park Rangers, and the promotion of two majority foreign owned clubs from the Championship, Cardiff City and Hull City. The differences in the amount of clubs with a foreign majority ownership compared with Rohde & Breuer (2016) are probably caused by the different source of information and possible different allocation of mid-season change in ownership. This thesis acquired the information on ownership from the financial statements and other annual reports while Rohde & Breuer (2016) used sources from Forbes and Deloitte (Rohde & Breuer, 2016). Also the ownership of some clubs changed during the season or at the end of the season, but before the end of the booking year. As described in

Section III, the ownership structure that was applicable for the majority of the season is used to make a distinction whether the club was majority foreign or non-foreign owned during a season.. Overall, the sample period is well balanced in terms of foreign and non-foreign ownership of the Premier League clubs.

	Premier League		Championship	
Year	**Non-Foreign**	**Foreign**	**Foreign**	**Non-foreign**
2008	9	11	21	3
2009	10	10	19	5
2010	10	10	18	6
2011	10	10	16	8
2012	10	10	13	11
2013	10	10	11	13
2014	9	11	11	13

Table 3: Frequency of Foreign Ownership for the Premier League (left) and Championship (right). The frequencies for majority foreign ownership per season from 2007/2008 season to the 2013/2014 season for the Premier League (left) and the Championship (right). The year 2008 refers to the 2007/2008 season, the year 2009 to the 2008/2009 season, etc.

For the Championship the majority foreign ownership structure was not as developed in the 2007/2008 season as in the Premier League. Only three (12.5%) of the twenty-four Championship clubs had a majority foreign ownership in the 2007/2008 season. This percentage increased every season after 2008 until the 2012/13 season where for the first time in the sample period the amount of clubs with a majority foreign ownership (13) was more than the amount of clubs with a majority non-foreign ownership (11). Although, the amount of clubs in the Championship with a majority foreign ownership is not as high as for Premier League clubs throughout the sample period, the clubs are more divers in the Championship compared to the Premier League, because after every season six clubs leave the Championship (three promote, three relegate) where only three clubs leave the Premier League because of relegation. Therefore, the lower frequency of majority foreign ownership in the Championship compared to the Premier League will most likely not cause problems for the conclusion whether majority foreign owned clubs are less efficient than majority non-foreign owned clubs.

Table 4 shows the correlations of the variables for the Premier League and Championship respectively. For the Premier League (left), the three variables for the operating expenses are strongly positively correlated with the number of points awarded. The correlation between the different operating expenses show that wages & salaries and amortization of player registrations are correlated most strongly (0.882) and the other operating expenses and amortization of player registrations are correlated least strong (0.662). This could possibly lead to multicollinearity and/or insignificant coefficients for one or more variables. Furthermore, all the variables are positively correlated with the majority foreign ownership which could indicate that for the Premier League there is a significant difference between

majority foreign owned clubs and majority non-foreign owned clubs. Moreover, it is worth mentioning that the correlation between majority foreign ownership and number of points awarded is less pronounced than the correlation between the majority foreign ownership and the operating expenses. This could mean that the payoff between higher operating expenses and more points awarded in the league for majority foreign owned clubs is less than for non-foreign owned clubs which could already possibly mean that majority foreign owned clubs are less efficient than majority non-foreign owned clubs, but this conclusion is premature.

Premier League					
Variable	Points	Wage	Amort	Other	Foreign
Points	1.000				
Wage	0.785	1.000			
Amort	0.712	0.882	1.000		
Other	0.720	0.790	0.662	1.000	
Foreign	0.326	0.502	0.498	0.500	1.000

Championship					
Variable	Points	Wage	Amort	Other	Foreign
Points	1.000				
Wage	0.524	1.000			
Amort	0.398	0.863	1.000		
Other	0.194	0.567	0.568	1.000	
Foreign	0.020	0.214	0.113	0.066	1.000

Table 4: Correlation between variables Premier League (left) and Championship (right). The correlation table shows the correlations between the variables *Points*, *Wage*, *Amort*, *Other* and *Foreign* for both the Premier League (left) and Championship (right) from the 2007/2008 season to the 2013/2014 season.

For the Championship the correlation between the number of points awarded and the measures for operating expenses is less strongly positively correlated than for the Premier League. The less strongly positive correlations mean that it is in the Championship less automatically that higher operating expenses lead to higher number of points awarded compared with the Premier League. The correlation between wages & salaries and amortization of player registrations is similar to the correlation coefficient of the Premier League, but the other operating expenses are less strongly positively correlated with the other two measures for operating expenses compared to the Premier League. Looking at the majority foreign ownership in the Championship, the clubs with such an ownership pay more wage relative to clubs with a majority non-foreign ownership. However, the effect is less than in the Premier League. Furthermore, it can be concluded that majority foreign ownership does not automatically lead to a higher number of points awarded, higher transfer fees paid and higher other operating expenses.

Section V Methodology

This section defines the step-by-step guide for translating the collected data into reliable results. It contains the mathematical notation of the regression that is build, based on the chosen variables in

Section IV. Also the mathematical background on measuring inefficiency is explained in more detail. Although STATA already integrated these steps in the software it is important to understand how the mechanism works, because the results and possible recommendations can only be valuable if the relation between all the relevant inputs and outputs is known. Furthermore, the hypotheses are defined for answering the research question.

The Model

In Section II the decision is made that the Stochastic Cobb-Douglas Production Frontier Model is used to measure inefficiency of the Premier League clubs and Championship clubs. The reason behind this is that the Stochastic Frontier Model is easier to estimate than DEA. Moreover, the coefficients are easy to interpret and the Cobb-Douglas transformation of the variables reduces the effect of outliers in the data. Compared with the DEA models, the Stochastic Frontier Model distinguishes the error term in stochastic shocks and inefficiency whereas DEA classifies the whole error term as inefficiency. Furthermore, DEA models do not allow for statistical tests to test the validity of the model whereas a Stochastic Frontier Model allows for these tests such as a test for heteroscedasticity of the error terms. Taking together the Stochastic Cobb-Douglas Production Frontier Model and the variables that are most likely to explain the relationship between pitch performance and financial performance from Section IV, the regression looks as follows:

$$Log(Points_{i,t}) = \alpha + \beta_1 * Log(Wage_{i,t}) + \beta_2 * Log(Amortization_{i,t}) + \beta_3 * \left(OtherOpExp_{i,t}\right) + (V_{i,t} + U_{i,t})$$

Where $Points_{i,t}$ is the number of points awarded for club *i* in the current season *t*. $Wage_{i,t}$ is the total amount of page paid by club *i* in the current season *t*. $Amortization_{i,t}$ is the total amount of amortization of player registrations by club *i* in the current season *t*. $OtherOpExp_{i,t}$ is the other operating expenses by club *i* in the current season *t*. $V_{i,t}$ is the stochastic shock and $U_{i,t}$ is inefficiency of the club.

The expectation is that the wage coefficient has a positive sign, because Carmichael, McHale & Thomas (2011) proves that wage has a positive and significant correlation of 0.6924 with the points awarded in the league (Carmichael, McHale, & Thomas, 2011). The interpretation of the wage coefficient is not really clear. A positive and significant coefficient means that if the club pays more salary to their players, the club awards more points in the league. This reflects an incentive for the players to perform better if they are rewarded with a higher salary. However, the quality of players is limited, so at some point the increase in salary for the current players of the club will not lead to an increase of the points awarded. If the club wants to perform better it has to buy new players with more quality which is costly. It has been considered to use the last season's wage costs, but in the current circumstances of the Premier League with strongly increasing revenues and overseas takeovers, the last season's wage costs are not representative for the quality of players in the current season.

For the amortization of player registrations the expectation is that the sign of the coefficient is also positive. The only prove from the existing literature for this expectation is from Samagaio, Couto & Caiado (2009). They find that the amortization of player registrations has a significant factor loading in financial performance which indicates that the amortization of player registrations is a good parameter for measuring how well the club performs financially. Next, they find that the sporting performance, where league performance is the major contributing factor, has a positive and significant correlation of 0.81 with financial performance at the 1% significance level. So, indirectly the amortization of player registrations and the league performance are positively correlated, although this conclusion cannot be drawn because it has not been directly proven. The interpretation of a positive coefficient is that clubs with the combination of higher transfer fees paid for the current squad, shorter contract life for the players, and more recent transfers perform better in the league. This could mean that more ambitious clubs perform better than less ambitious clubs. On the other hand this could also mean impatience of the clubs' management is rewarded with better pitch performance, because the squad is more often renewed and higher transfer fees are paid which result in more points awarded. If the coefficient comes out to be negative it means that ambitious clubs and impatient clubs' management are punished with a worse pitch performance relative to less ambitious and less impatient clubs' management.

The expectation for the sign of the Other Operating Expenses coefficient is unclear, because it is the residual of the operating expenses and therefore more factors are influencing this variable. However, it is more likely that clubs with higher revenues have higher costs, so the expectation is that also the other operating expenses are positively correlated with the number of points award. For the coefficient this would mean that it has a positive sign.

Measuring Efficiency

In the regression the inefficiency of the clubs are calculated to see how well the clubs perform up to their potential according to their annual reports. Every season the club inefficiency differs, because the data varies over time and therefore the inefficiency over the whole (sub)period needs to be calculated. Because it is impossible to conclude from the data what part of the error term is a stochastic shock and what part is inefficiency, the inefficiency term has to be calculated indirectly (Greene, 2003). This is done by making a distinction in the error term of the regression between stochastic shocks, $V_{i,t}$, and inefficiency, $U_{i,t}$. Where $V_{i,t}$ and $U_{i,t}$ are independent, $V_{i,t}$ is independently and identically distributed as N(0, σ_V^2), and $U_{i,t}$ is independently and identically distributed as N(0, σ_U^2) and takes only non-negative values so $U_{i,t} \geq 0$.

Similar to Barros & Leach (2006), panel data is used and therefore the method as described there will be the guidance. They calculate the mean productive inefficiency as the conditional expectation of $U_{i,t}$ divided by the error term ε, as an estimator for $U_{i,t}$. So, $E[U_{i,t}/\varepsilon_{i,t}]$

Because the inefficiency may only have non-negative values, it is assumed that $U_{i,t}$ follows a half-normal distribution with mean zero. From Barros & Leach (2006) over the whole sample period this distribution looks as follows:

$$E\left[U_i/\varepsilon_{i,1}, \ldots \varepsilon_{i,t}\right] = \mu_i^* + \sigma_i^* \left[\frac{\Phi\left(\frac{\mu_i^*}{\sigma_i^*}\right)}{\boldsymbol{\Phi}\left(-\frac{\mu_i^*}{\sigma_i^*}\right)}\right]$$

Where $\mu_i^* = \gamma_i \mu + (1-\gamma_i)(-\varepsilon_i)$, $\gamma_i = \frac{1}{\left(1+\frac{\lambda}{T_i}\right)}$, and $\sigma_i^* = \sqrt{\left(\frac{\sigma_U^2}{1+\lambda T_i}\right)}$

μ_i^* is the mean value of the distribution, Φ is the standard normal distribution and $\boldsymbol{\Phi}$ is the cumulative distribution function. Lambda (λ) is an indicator of the relative contribution of U_i and V_i to ε_i and is as follows: $\lambda = \frac{\sigma_U^2}{\sigma^2}$. Because $\sigma^2 = \sigma_V^2 + \sigma_U^2$, it means that $\sigma_U^2 = \sigma^2\lambda^2/(1+\lambda^2)$. The gamma ($\gamma_i$) for each club is the discount factor of the relative contribution divided over the amount of seasons in the sample, *T*. In this thesis the amount of season is equal to seven. The values of U_i and V_i are calculated using Maximum Likelihood Estimator in STATA. Then the technical efficiency for a specific club in a specific scan be calculated using U_i. This is as follows:

$$TE_{i,t} = E\{\exp(-U_{i,t}|q_{i,t}\} = \left[\Phi\left(\frac{\mu_i^*}{\sigma^*} - \sigma^*\right)\Big/\Phi\left(\frac{\mu_i^*}{\sigma_i^*}\right)\right] exp\left\{\frac{\sigma_*^2}{2} - u_i^*\right\}$$

Where q_i is the dependent variable of the frontier model, so what is produced (University of Queensland, 2008). For this thesis $q_{i,t}$ is the number of points awarded by a specific club i in the current season t.

Hypotheses

In this thesis four hypotheses are tested which help to answer the research question from Section I. These hypotheses are independent of each other. This means that the result of one hypothesis does not have any influence on the result of the other hypotheses.

The first hypothesis is based on the significant relationship in terms of the ability to increase the efficiency of pitch performance through financial expenditures. This is the first condition that needs to be met before it can be tested whether clubs with foreign ownership and more success have significant different efficiency levels than clubs with a non-foreign ownership. Existing literature proves that wage expenditure is positively and significantly correlated with the points awarded (Carmichael, McHale, & Thomas, 2011). Moreover, there is a strong correlation between league position and wage per point awarded which indirectly suggests that clubs with higher amount of wages paid, award more points (Gerrard, 2010). For the amortization of player registrations and other operating expenses, Samagaio, Couto & Caiado (2009) find an indirect positive and significant correlation. Amortization of player registrations and other operating expenses have a significant factor loading in financial performance

where consequently they find a positive and significant correlation between sporting performance and financial performance (Samagaio, Couto, & Caiado, 2009). Based on these findings the first hypothesis is as follows:

"The relation between pitch performance and financial performance is significantly positive"

The second hypothesis relates to difference in efficiency levels between English Premier League Clubs and Championship clubs. Existing literature suggests that the more efficient clubs in terms of wage per point awarded, end on the lower places in the league (Gerrard, 2010). Although this does not say anything about the difference in efficiency between the two leagues, it might suggest that efficiency is negatively correlated with wage. However, this conclusion is premature, especially because the efficiency of the English Championship clubs has, as far this thesis could find, never been tested before, not to mention the relationship between efficiency scores of English Premier League and Championship clubs. Therefore, the second hypothesis is as follows:

"English Championship clubs are more efficient than clubs in the English Premier League."

For this hypothesis a robustness check will be conducted to check whether the results are consistent. For the robustness check the final league ranking is used instead of points awarded, so it is possible to use both Premier League and Championship clubs in the same regression. This means that the sum of the amount of clubs in the Premier League and Championship, which is forty-four, will be ranked from highest to lowest. Therefore, the first place in the Premier League is ranked as forty-four while the first place in the Championship is ranked as twenty-four.

The third hypothesis relates to the difference in efficiency levels between the periods 2008-2010 and 2011-2014. As described in Section IV these are the subsets to test for any difference in efficiency levels before and after the approval of Financial Fair Play by the UEFA in 2010 and introduction in 2011. The theory suggests that the clubs will operate more efficient after the approval, because the clubs will be punished if the financial criteria are not met. The financial regulations are about the losses the clubs may have in a fiscal year, but the determination of the loss is caused by the revenues and the expenses. Because the revenues are based on the league performance and the expenses relate to the costs, the effect of the regulation can also be measured by the pitch performance efficiency based on the operating expenses. The theory from Sass (2016) suggests that the big teams stay big and small clubs stay small due to the regulations. If this theory holds the clubs are more likely to maintain their efficiency levels, because the clubs will have less variance in their pitch performance and costs which causes a more predictable income and profit for the management. Therefore, the management of the clubs will have less uncertainty compared to the situation before the financial regulation by the UEFA. The third hypothesis is as follows:

"English Premier League and Championship clubs are less inefficient after the approval/introduction of Financial Fair Play by the UEFA."

The fourth hypothesis is based on the difference in inefficiency between foreign ownership clubs and non-foreign ownership clubs. Existing literature proves that the nationality of the owner matters for non-football related industries. For instance, foreign ownership contributes negatively to efficiency in the banking industry (Lensink, Meesters, & Naaborg, 2008). It is likely that this would also apply for the football industry, because clubs with a foreign majority ownership have higher wage expenditures and bigger losses (Rohde & Breuer, 2016). So this would imply that the higher wage expenditure is not compensated by evenly growing revenues, because that explains the bigger losses for foreign majority owned clubs. Because the revenues are highly determined by pitch performance, this finding means that a higher wage expenditure does not result in proportionally better pitch performance. Therefore, the findings of Rohde & Breuer (2016) imply that clubs with a foreign majority ownership are more inefficient than clubs with a non-foreign majority ownership. The fourth hypothesis is as follows:

"Clubs with a foreign majority ownership are more inefficient than clubs with a non-foreign majority ownership."

A panel data analysis for the whole period will be conducted for both the Premier League and Championship apart. It is not possible to use both the Premier League clubs and Championship clubs in one regression, because the dependent variable is the number of points awarded and that does not allow for a comparison between two different leagues. Only for the robustness check of the second hypothesis the data for the two leagues are integrated into one regression. For the results a 1%, 5%, and 10% significance level is used. For the first hypothesis a time varying decay model is chosen, because it allows for different efficiency scores for every season, while a time-invariant model calculates one single efficiency score for the club for the whole sample period. Because the majority foreign ownership is not constant throughout the sample period, a time varying decay model allows for a better comparison between the differences and changes in majority foreign-ownership.

Section VI Results

This section presents the results of the tests that are conducted using the defined theory from Section III, the data that is described in Section IV, and the methodology and hypothesis from Section V. First, the order of Section V is the guidance for reporting the results related to the hypotheses. This means that first the regression is analysed, next the efficiency scores, and finally the differences for majority foreign ownership. The hypotheses are not been answered yet. This is done in the final section of this thesis. In between the most efficient clubs will be compared and also the most inefficient clubs will be compared. The results are calculated using the statistical software program STATA.

Pitch performance versus Financial performance

In this paragraph the most important findings from the conducted regressions are reported. These results of the regressions of the data in a stochastic Cobb-Douglas production frontier model are reported in Table 5 and Table 6, where Table 5 relates to the Premier League Table 6 to the Championship, both from the 2007/2008 season to the 2013/2014 season. Before the regressions are conducted, the data for the number of points awarded, wages & salaries, amortization of player registrations, and other operating expenses are transformed to logarithms.

First, the data for the Premier League is regressed in a stochastic Cobb-Douglas production frontier model for the full sample period. Table 5 shows that variables for the operating expenses cannot fully explain the number of points awarded. Only the constant term and *Wage* are significant at the 1% level, but *Amort* and *Other* are not significant at all. This can be explained by the previous finding from the correlation table in Table 4 where the correlations between the various operating expenses and the number of points awarded are very similar. Therefore, the *Wage* coefficient captures most of the variance in the number of points awarded, allowing little variance left to explain by the *Amort* coefficient and *Other* coefficient. Also, because the wages & salaries has the biggest fraction in the total operating expenses, it is not surprising that the *Wage* coefficient explains most of the variance in the number of points awarded.

The coefficients need to be interpreted as percentage changes of the independent variables on the dependent variable, because the data input is transformed in logarithmic numbers. The interpretation of the *Wage* coefficient is that if the wages & salaries increases by one per cent, the number of points awarded will increase by 0.488%, assuming all other independent variables remain constant. In Section IV it was predicted that the sign of the *Wage* coefficient would be positive. This prediction holds for the Premier League with a significance at the 1% level (P = 0.000). The *Amort* coefficient is not significant at the 10% level (P = 0.195) and therefore it has no statistical value in the frontier model. Although the *Amort* coefficient is not significant, the interpretation of the coefficient is that if the amortization of player registrations increases by one per cent, the number of points awarded decreases by 0.061%, assuming all other independent variables remain constant. This implies that if a clubs spends more money on transfer fees, it awards less number of points. It is not impossible, because as explained in

Section I the clubs in the bottom places spend more money on transfer fees in the January transfer window than higher ranked clubs (BBC, 2016). However, it is highly unlikely that higher transfer fees paid, would directly mean that a club awards less amount of points. Not only because this is contrary to the prediction made in Section IV, but also that in the descriptive statistics a strong positive correlation was found between the number of points awarded and the amortization of player registrations.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-4.134	0.675	0.000	μ	0	-	σ^2	0.156
Wage	0.488	0.079	0.000	η	-0.635	0.095	γ	0.828
Amort	-0.061	0.044	0.195	Ln(σ^2)	-1.855	0.000	σ_U^2	0.129
Other	0.022	0.675	0.615				σ_V^2	0.027

Table 5: Stochastic Cobb-Douglas Production Frontier Model output for the Premier League. The regression output for the Premier League with the number of points awarded as the production factor. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

The *Other* coefficient for other operating expenses is 0.022, but it is also not significant at the 10% level (P = 0.615). The value of the coefficient means that if the other operating expenses increase by one percent, the number of points awarded increases by 0.022%, assuming all other independent variables remain constant. The sign of the coefficient corresponds with the prediction made in Section IV, but since the coefficient is not statistically significant there cannot be drawn any conclusions on it. From the other statistics in Table 5 there can be drawn several conclusions. First of all, the eta (η) has a value of -0.635 which is significant at the 10% level (P = 0.095). This means that the inefficiency of the clubs increases over time. The gamma (γ) has a value of 0.828 which means that on average 82.8% of the variance in the error term is due to inefficiency and 17.2% is due to stochastic shocks.

In Table 6 the regression output for the Championship is given. Also here the variables for the operating expenses cannot fully explain the number of points awarded. However, where the other operating expenses does not significantly add information to the frontier model for the Premier League, it does to the frontier model for the Championship at the 1% level (P = 0.004). Both frontier models have in common that the *Wage* coefficient is significant at the 1% level (P = 0.000) and that the *Amort* coefficient is not significant at the 10% level (P = 0.214). These findings can be explained by the correlation tables (Table 4 & Table 5) where in Table 5 the other operating expenses does have a less strong correlation with the wages & salaries and amortization of player registrations than the for the same variables in Table 4. This means that the correlations already show that the other operating expenses for the Championship is more likely to provide more additional information in the frontier model than the other operating expenses for the Premier League.

The *Wage* coefficient for the Championship has a value of 0.3881 which means that a one per-cent increase in wages & salaries results in a 0.3881% increase in the number of points awarded, assuming all other independent variables remain constant. The prediction made in Section IV for the sign of the *Wage* coefficient holds at the 1% level (P= 0.000). The sign of the coefficient is similar to that of the *Wage* coefficient in the frontier model of the Premier League, but the effect of wages & salaries in on the number of points awarded is smaller for the Championship. The *Amort* coefficient has a negative value of -0.0374 which means that a one per-cent increase in amortization of player registrations results in a 0.0374% decline of the number of points awarded, assuming all other independent variables remain constant. The sign prediction made in Section IV for the *Amort* coefficient does not hold here, because the prediction was that the sign would be positive. However, because the coefficient is not significant there cannot be drawn any conclusions about it. The *Other* coefficient has a negative value of -0.088 which means that a one per-cent increase in other operating expenses results in a 0.088% decline in the number of points awarded. Also because this coefficient is significant at the 1% level (P = 0.004), it can be concluded that the prediction made in Section IV, which was that the sign of the *Other* coefficient would be positive, is wrong. What also can be concluded is that Championship should avoid high other operating expenses, because high other operating expenses directly reduces the number of points awarded in the league.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-0.122	0.227	0.591	μ	0	-	σ^2	0.011
Wage	0.388	0.062	0.000	η	-0.812	0.006	γ	0.607
Amort	-0.037	0.030	0.214	Ln(σ^2)	-4.524	0.379	σ_U^2	0.007
Other	-0.088	0.031	0.004				σ_V^2	0.004

Table 6: Stochastic Cobb-Douglas Production Frontier Model output for the Championship. The regression output for the Championship with the number of points awarded as the production factor. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

From the other statistics in Table 6 there can be drawn several conclusions. First of all, the eta (η) has a value of -0.811 which is significant at the 1% level (P = 0.006). This means that the inefficiency of the clubs increases over time. Furthermore, the gamma (γ) has a value of 0.607 which means that on average 60.7% of the variance in the error term is due to inefficiency and 39.3% is due to stochastic shocks. This ratio is lower than for the Premier League, but also the average variance of the inefficiency error term, $U_{i,t}$, is lower for the Championship (0.0066) than for the Premier League (0.1295). Therefore, these numbers might already suggest that the Championship clubs are more efficient than Premier League clubs. However, a short note has to be made that such a comparison of regression coefficients

in the first place and values related to error term in the second place is rough, because comparing raw values from different frontier models with each other can cause conclusions to be made on results that may be not significant at all. Because the conclusions related to only the regression output are tested with help from the efficiency scores and t-tests for mean comparison, there are not any tests conducted for a significant difference of regression coefficients.

Efficiency Scores

In this paragraph the efficiency scores are described and compared with each other. This contains the results from the technical efficiency scores calculation, resulted from the regression outputs described in the last paragraph. The efficiency scores for the Premier League clubs and Championship clubs are presented in Table 7 and Table 8 respectively. Comparing both leagues in terms of their efficiency scores is the best way, because it shows the efficiency in the output with the input. Although the average money spend per point awarded in the Premier League is £2.48 million and in the Championship £438,000, the efficiency scores can still be compared, because the Premier League clubs also receive higher revenues than Championship clubs. Clubs perform to their resources and because more money is needed to be competitive in the Premier League relative to the Championship, the comparison of the efficiency scores will show if the increasing costs between Championship clubs and Premier League clubs happens in an efficient way or not.

From Table 7 it can be concluded that Everton is the most efficient Premier League for 2008-2014 period with an efficiency score of on average 98.5%. Everton is also the most efficient club in every season covered in the sample period. They are followed by Tottenham Hotspur with an efficiency score of 97.8% and Liverpool and Chelsea which both have an efficiency score of 95.8%. A short note has to be made that Liverpool has one missing season of data as already mentioned in Section IV. Remarkably, the club with the most winning league titles and also the club with the most points awarded over the whole sample period, Manchester United, is only ninth efficient club with an average efficiency score of 93.7%. This is mainly caused by the sharp decline in efficiency scores for the 2012/2013 and 2013/2014 seasons compared to the seasons before. Although, they won the league title in the 2012/2013 season, their efficiency dropped by more than 5% compared to the season before when they ended on the second place with the same amount of points as in the 2012/2013 season. In the 2013/2014 season Manchester United awarded twenty-five points lower in the league which resulted in a more than 8% drop for the efficiency score of that season. This cause for this might be the managerial change of Sir Alex Ferguson by the former Everton manager David Moyes after twenty-six years (Elberse & Dye, 2012). Remarkably, David Moyes managed the most efficient club the six seasons before he became the manager of Manchester United. The most inefficient Premier League club over the period 2008-2014 is Derby County with an efficiency score of only 37.2%. They have only played for one season in the Premier League during the sample period where they awarded eleven points, the lowest number of points awarded by a club during a season.

Over the whole sample period clubs have been the most efficient in the 2008/2009 season (98.6%) and the least efficient in the 2013/2014 season (80.6%). From the 2008/2009 season the average efficiency scores decrease every season. This explains the significant negative eta (η) from the regression output in Table 5. The average club efficiency score for the clubs present in the Premier League over the sample period is 87.4%.

Club	2008	2009	2010	2011	2012	2013	2014	Overall
Everton	99.9%	99.8%	99.6%	99.2%	98.5%	97.3%	94.9%	98.5%
Tottenham Hotspur	99.8%	99.7%	99.4%	98.9%	97.9%	96.1%	92.9%	97.8%
Liverpool	99.7%	99.5%	N/A	98.1%	96.4%	93.4%	88.0%	95.8%
Chelsea	99.6%	99.2%	98.5%	97.2%	94.9%	90.6%	90.6%	95.8%
Arsenal	99.7%	99.4%	98.8%	97.7%	95.8%	92.3%	86.1%	95.7%
Manchester City	99.7%	99.3%	98.8%	97.7%	95.7%	92.2%	85.9%	95.6%
Stoke City		99.4%	98.8%	97.7%	95.8%	92.3%	86.1%	95.0%
Wigan Athletic	99.3%	98.7%	97.5%	95.4%	91.6%	84.9%		94.6%
Manchester United	99.5%	99.0%	98.2%	96.7%	93.8%	88.7%	80.1%	93.7%
Birmingham City	98.2%		93.8%	88.8%				93.6%
Newcastle United	99.5%	99.1%		96.7%	93.9%	88.8%	80.2%	93.0%
Hull City		99.0%	98.2%				80.0%	92.4%
Southampton						94.2%	89.5%	91.8%
West Ham United	99.3%	98.7%	97.6%	95.6%		85.2%	74.2%	91.8%
Portsmouth	91.7%	N/A	N/A					91.7%
Sunderland	99.2%	98.5%	97.2%	94.7%	90.3%	82.6%	69.9%	90.3%
Blackpool				90.2%				90.2%
Swansea City					94.9%	90.7%	83.4%	89.7%
Aston Villa	99.0%	98.2%	96.6%	93.7%	88.4%	79.4%	64.9%	88.6%
Bolton Wanderers	97.5%	95.3%	91.3%	84.2%	72.6%			88.2%
Fulham	99.0%	98.1%	96.4%	93.3%	87.8%	78.3%	63.3%	88.0%
Blackburn Rovers	97.4%	95.1%	91.0%	83.8%	72.0%			87.9%
West Bromwich Albion		98.5%		94.9%	90.7%	83.2%	70.9%	87.6%
Crystal Palace							86.7%	86.7%
Burnley			85.1%					85.1%
Norwich City					92.0%	85.6%	74.8%	84.2%
Wolverhampton			89.9%	82.0%	69.0%			80.3%
Reading	98.0%					62.4%		80.2%
Cardiff City							68.3%	68.3%
Queens Park Rangers					68.3%	48.9%		58.6%
Derby County	37.2%							37.2%
Middlesbrough	N/A	N/A						N/A
Average	95.4%	98.6%	95.9%	93.8%	89.0%	85.3%	80.5%	87.4%

Table 7: Technical Efficiency Score for the Premier League. The technical efficiency scores for each club that has participated at least one season in the Premier League during the sample period is given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2008 is the 2007/2008 season, 2009 is the 2008/2009 season, etc. In the final column the overall efficiency score of the club is given in the sample period. In the final row the average per season and the average overall efficiency score is given.

When Table 7 is compared with Table 8, it can be concluded that Championship clubs have on average higher efficiency scores over the sample period than Premier League clubs. The average efficiency score for a Championship club over the period 2008-2014 is 97.1%. A short note has to be

made with respect to scores that were not able to be calculated due to data limitations. Although, for the Premier League there were also missing data points, there were more data points missing for the Championship clubs, mostly clubs that ended on the bottom places in the league. Because those clubs do not award many points in the league, it is likely that with the availability of data for those clubs the average efficiency score would come out lower. Similar to the Premier League, the Championship clubs were on average the most efficient in the 2008/2009 season (99.4%). Also, after the 2008/2009 season the average efficiency score per season declines for the rest of the sample period with only a small jump in the 2011/2012 season compared to the season before. So the negative eta (η) from the regression output in Table 6 is explained by this finding.

Looking at the efficiency scores of the individual clubs, it is noticeable that for a total of seven times the efficiency score was rounded 100%. Burnley have achieved to accomplish this for two times and possibly because of this ultimate efficiency they promoted to the Premier League in the 2008/2009 season. Furthermore, in eighteen times of the cases the efficiency score was 99.9% for a club in a season, which means that those clubs perform closely to perfect efficiency. Finally, when the clubs that played in the Championship during the sample period, but with no efficiency scores are omitted, the least efficient club would be Colchester United with an efficiency score of 90.0%.

Club	2008	2009	2010	2011	2012	2013	2014	Overall
Burnley	100.0%	100.0%		99.8%	99.6%	99.1%	98.0%	99.4%
Derby County		100.0%	99.9%	99.8%	99.5%	98.9%	97.5%	99.2%
Watford	100.0%	99.9%	99.9%	99.7%	99.4%	98.6%	96.9%	99.2%
Cardiff City	99.9%	99.9%	99.7%	99.4%	98.7%	97.1%		99.1%
Leicester City	100.0%		99.9%	99.7%	99.4%	98.6%	96.8%	99.0%
Ipswich Town	100.0%	99.9%	99.8%	99.6%	99.1%	98.0%	95.6%	98.9%
Norwich City	99.7%	99.3%		96.7%				98.6%
West Bromwich Albion	99.5%		97.4%					98.4%
Reading		99.9%	99.8%	99.5%	98.8%		94.1%	98.4%
Hull City	99.9%			99.2%	98.3%	96.2%		98.4%
Southampton	99.9%	N/A			96.9%			98.4%
Peterborough United			99.7%		98.5%	96.6%		98.2%
Brighton & Hove Albion					99.3%	98.5%	96.7%	98.2%
Queens Park Rangers	99.9%	99.8%	99.7%	99.2%			91.6%	98.1%
Blackpool	99.9%	99.9%	99.7%		98.6%	96.9%	93.1%	98.0%
Sheffield Wednesday	99.9%	99.9%	99.7%			97.0%	93.5%	98.0%
Charlton Athletic	100.0%	99.9%				97.4%	94.4%	97.9%
Nottingham Forest		99.9%	99.7%	99.4%	98.6%	96.8%	93.0%	97.9%
Stoke City	97.7%							97.7%
Middlesbrough			N/A	N/A	99.1%	98.0%	95.6%	97.6%
Swansea City		N/A	98.5%	96.7%				97.6%
Plymouth Argyle	98.5%	96.6%	N/A					97.6%
Crystal Palace	N/A	N/A	N/A	99.0%	97.8%	95.0%		97.3%
Newcastle United			97.2%					97.2%
Leeds United				99.4%	98.6%	96.9%	93.1%	97.0%
Wolverhampton Wanderers	99.8%	99.7%				91.5%		97.0%
Barnsley	99.9%	99.8%	99.5%	98.9%	97.6%	94.6%	88.3%	96.9%
Scunthorpe United	99.4%		97.2%	93.9%				96.8%
Coventry City	99.6%	99.1%	98.1%	95.7%	90.7%			96.6%
West Ham United					96.1%			96.1%
Wigan Athletic							96.1%	96.1%
Sheffield United	99.2%	98.1%	95.8%	90.9%				96.0%
Millwall				99.1%	98.0%	95.6%	90.5%	95.8%
Preston North End	99.1%	98.0%	95.5%	90.2%				95.7%
Bournemouth							95.6%	95.6%
Huddersfield Town						97.0%	93.5%	95.2%
Bristol City	99.7%	99.3%	98.5%	96.6%	92.6%	84.1%		95.1%
Blackburn Rovers						96.5%	92.2%	94.4%
Birmingham City		99.7%			97.0%	93.4%	85.7%	93.9%
Bolton Wanderers						95.9%	91.1%	93.5%
Colchester United	90.0%							90.0%
Doncaster Rovers		N/A	N/A	N/A	N/A		N/A	N/A
Portsmouth				N/A	N/A			N/A
Yeovil Town							N/A	N/A
Average	99.2%	99.4%	98.8%	97.7%	97.8%	96.2%	93.8%	97.1%

Table 8: Technical Efficiency Score for the Championship. The technical efficiency scores for each club that has participated at least one season in the Championship during the sample period is given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2008 is the 2007/2008 season, 2009 is the 2008/2009 season, etc. In the final column the overall efficiency score of the club is given in the sample period. In the final row the average per season and the average overall efficiency score is given.

Comparing the average efficiency scores for the Premier League and the Championship in Table 9, it can be concluded that the average efficiency scores in the Championship is significantly higher than the average efficiency scores in the Premier League at the 1% level (P = 0.0000 and P = 0.0001). In Table 9 (left) the output for a t-test for mean comparison with unequal variances is shown for the mean on the average efficiency scores per club. It shows a significant alternative hypothesis of the difference being not equal to zero at the 1% level (P = 0.0001). Furthermore, the difference being greater than zero is also significant at the 1% level (P = 0.0001). In Table 9 (right) the output for a t-test for mean comparison with unequal variances is shown for the mean of all the efficiency scores during the sample period. The reason for a second t-test is that in the previous t-test clubs were treated equally, no matter whether the club played only for one season in a particular league or for seven seasons. The second t-test accounts for this by letting clubs that played for one season in the league only having one observation, while a club that played for seven seasons in the league has seven observations. Table 9 (right) shows that this change does not make a difference in the result. Also now the difference between the means is significantly not zero at the 1% level (P = 0.0000) and the difference is significantly greater than zero (P = 0.0000). So, the t-tests for mean comparison conclude that Championship clubs are significantly more efficient than Premier League clubs.

Variable	N	Mean	Std. Err.
TECH	41	0.9713	0.0036
TEPL	31	0.8735	0.0224
Difference		0.0978	0.0227

	P-value
Ha: Diff < 0	0.9999
Ha: Diff ≠ 0	0.0001
Ha: Diff > 0	0.0001

Variable	N	Mean	Std. Err.
TECH	149	0.9775	0.0024
TEPL	135	0.9103	0.0093
Difference		0.0672	0.0096

	P-value
Ha: Diff < 0	1.0000
Ha: Diff ≠ 0	0.0000
Ha: Diff > 0	0.0000

Table 9: T-tests for mean comparison with unequal variances. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between the Premier League (TEPL) and the Championship (TECH). In the left table the means of the average technical efficiency scores of the clubs are compared with the null-hypothesis of the difference being equal to zero. In the right table the individual observations of the technical efficiency scores are used to test the same null-hypothesis. The alternative hypotheses are that difference is smaller than zero, not equal to zero and greater than zero.

Robustness Check

As described in Section V the robustness check contains the ranking of the clubs instead of the number of points awarded as the dependent variable. This allows for a combination of the Premier League and the Championship, because the clubs are ranked from 1 to 44 with a score of 1 when a club ended on the most bottom place in the Championship and 44 when a club won the league title in the Premier League. In this paragraph the correlations and results related to the robustness check are outlined.

Table 10 shows the correlations of the variables for the whole dataset when the clubs in the Premier League and Championship are ranked based on their final league ranking. The ranking is strongly positive correlated with the wages & salaries, amortization of player registrations and other operating expenses. Also, the majority foreign ownership is positively correlated with the ranking, but because not all majority foreign owned clubs play in the Premier League the correlation coefficient is not as strong as for the variables of the operating expenses. Furthermore, the variables for the operating expenses mutually show stronger positive correlation coefficient than apart in the Premier League and Championship. This is due to a higher amount of observations for the calculation of these correlations. All correlation coefficients are significant at the 5% level which means that these correlations can be interpreted reliable.

Variable	Ranking	Wage	Amort	Other	Foreign
Ranking	1.000				
Wage	0.773	1.000			
Amort	0.732	0.932	1.000		
Other	0.629	0.841	0.763	1.000	
Foreign	0.209	0.396	0.385	0.392	1.000

Table 10: Correlation Table, Robustness Check. The correlation table shows the correlations between the variables *Ranking*, *Wage*, *Amort*, *Other* and *Foreign* for the robustness check from the 2007/2008 season to the 2013/2014 season.

From Table 11, the regression output for the Stochastic Cobb Douglas production frontier model, it can be seen that only the *Amort* coefficient is not significant at the 10% level (P = 0.890). The other coefficients are all significant at the 1% level (P = 0.000). This suggests that the final league ranking is also a good indicator for the producing factor of English football clubs. Because it is difficult to compare the two different measures for pitch performance it cannot be concluded which producing factor is the best. However, the three significant coefficients at the 1% level is a better result than the two regressions outputs, with number of points awarded as the producing factor, for the Premier League and Championship separately.

The *Wage* coefficient has a value of 0.948 which means that a one per-cent increase in wages & salaries results in a 0.948% increase in the final ranking. The prediction made in Section IV for the sign of the *Wage* coefficient holds at the 1% level (P= 0.000). The sign of the coefficient is similar to that of the *Wage* coefficient in the frontier models of the Premier League and Championship, but the effect of wages & salaries in on the number of points awarded is smaller than on the ranking. The reason for this is that the range for the number of points awarded is bigger than for the ranking. Also, it is easier to increase the number of points awarded than climb a position in the league table, because on average the difference between a league position is greater than one point.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-8.208	0.715	0.000	μ	0	-	σ^2	0.796
Wage	0.948	0.106	0.000	η	-0.982	0.000	γ	0.801
Amort	-0.008	0.059	0.890	Ln(σ^2)	-0.228	0.258	σ_U^2	0.638
Other	-0.300	0.057	0.000				σ_V^2	0.159

Table 11: Stochastic Cobb-Douglas Production Frontier Model output, Robustness Check. The regression output for all the clubs that participated at least on season in the Premier League and/or Championship between the 2007/2008 season and the 2013/2014 season with the final league ranking as the dependent variable. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

The *Amort* coefficient has a -0.008 which means that a one per-cent increase in amortization of player registrations results in a 0.008% decline in the final ranking. Rounded the effect of amortization of player registrations is equal to zero and because the coefficient is not significantly differ from zero at the 10% level (P = 0.890), the *Amort* coefficient does not add information to the frontier model. The *Other* coefficient does add information to the model with a significance at the 1% level (P=0.000). It has a value of -0.300 which means that a one per-cent increase in other operating expenses results in a 0.300% decline in the final ranking. Compared to Table 10, the correlation table, the negative sign is contradicting to the significantly and strongly positive correlation coefficient of 0.629 between the ranking and the other operating expenses.

From the other statistics in Table 11 there can be drawn several conclusions. First of all, the eta (η) has a value of -0.982 which is significant at the 1% level (P = 0.000). This means that the inefficiency of the clubs increases over time. The gamma (γ) has a value of 0.801 which means that on average 80.1% of the variance in the error term is due to inefficiency and 19.9% is due to stochastic shocks. This ratio is almost equal to the gamma of the frontier model for the Premier League, but the average variance of the inefficiency error term, $U_{i,t}$, is higher (0.638) compared to the Premier League (0.1295) and Championship (0.006). However, because the dependent variable for the current frontier model is different compared to the previous two, it cannot be concluded at this point which model provides, on average, higher efficiency scores.

This can be concluded from Table 12 where the technical efficiency scores for all the clubs that played in the Premier League and/or Championship between the 2007/2008 season and 2013/2014 season is shown. The average efficiency score of a club during this period is 85.5% where it was 87.4% for the Premier League in Table 7 and 97.1% for the Championship in Table 8. In the new frontier model, Burnley is also here the most efficient club, now not only compared to the other Championship clubs, but compared to all the clubs that played in the two highest football divisions in England during the sample period. They have an average efficiency score of 96.7% and are followed by Derby County

with an average efficiency score 96.6%. Remarkably, Derby County has an efficiency score in the 2007/2008 season of 100% where it has an efficiency score of 37.2% on the number of points awarded. Apparently, it was already a big achievement for Derby County to play in the Premier League in that season compared to their money spending and maybe they did expect to relegate, but was the number of points awarded not as high as they could possibly award to their money spending. After their relegation they did not lose their high efficiency score relative to the other clubs. The previous most efficient club from the Premier League, Everton, is also now one of the most efficient clubs with an efficiency score of 95.1%. Also the previous least efficient club in the Championship, Colchester United, is now the least efficient club, but an efficiency score of 18.3% is a big difference compared to the efficiency score of 90.0% in the previous frontier model. Furthermore, the four times Premier League winner during the sample period, Manchester United, also has a low efficiency ranking in the new frontier model. This is mainly caused by the efficiency score of 54.9% in the 2013/2014 season. So also the new frontier model shows that the efficiency score dropped to a dramatic level after the managerial change.

Club	2008	2009	2010	2011	2012	2013	2014	Overall	Charlton Athletic	99.9%	99.7%				87.7%	71.7%	89.8%
Burnley	100.0%	99.9%	99.7%	99.2%	97.8%	94.3%	86.0%	96.7%	Blackpool	99.8%	99.6%	98.9%	97.0%	92.3%	81.1%	58.8%	89.7%
Derby County	100.0%	99.9%	99.7%	99.1%	97.7%	94.1%	85.6%	96.6%	Nottingham Forest		99.6%	99.1%	97.5%	93.5%	83.9%	64.0%	89.6%
Watford	99.9%	99.9%	99.6%	99.0%	97.4%	93.4%	83.8%	96.2%	Bolton Wanderers	99.8%	99.6%	98.8%	96.9%	92.0%	80.5%	57.5%	89.3%
Everton	99.9%	99.8%	99.5%	98.7%	96.7%	91.5%	79.7%	95.1%	Blackburn Rovers	99.8%	99.6%	98.8%	96.9%	91.9%	80.2%	57.0%	89.2%
Wigan Athletic	99.9%	99.8%	99.5%	98.7%	96.6%	91.3%	79.3%	95.0%	Manchester United	99.8%	99.5%	98.7%	96.7%	91.4%	79.0%	54.9%	88.6%
Hull City	99.9%	99.8%	99.5%	98.7%	96.5%	91.0%	78.7%	94.9%	Manchester City	99.8%	99.5%	98.7%	96.5%	91.0%	78.0%	53.0%	88.1%
Ipswich Town	99.9%	99.8%	99.5%	98.6%	96.3%	90.6%	77.8%	94.7%	Middlesbrough	N/A	N/A	N/A	N/A	96.0%	89.8%	76.0%	87.3%
Tottenham Hotspur	99.9%	99.8%	99.4%	98.4%	95.8%	89.5%	75.3%	94.0%	Leeds United				97.9%	94.5%	86.2%	68.5%	86.8%
Cardiff City	99.9%	99.8%	99.4%	98.4%	95.8%	89.3%	74.9%	93.9%	Queens Park Rangers	99.8%	99.4%	98.4%	95.9%	89.4%	74.5%	47.0%	86.3%
Stoke City	99.9%	99.8%	99.4%	98.3%	95.7%	89.1%	74.5%	93.8%	Birmingham City	99.7%	99.1%	97.7%	94.1%	85.1%	65.2%	33.1%	82.0%
West Ham United	99.9%	99.8%	99.4%	98.3%	95.6%	88.8%	73.8%	93.6%	Portsmouth	79.7%	N/A	N/A	N/A	N/A			79.7%
Aston Villa	99.9%	99.7%	99.3%	98.2%	95.4%	88.4%	73.0%	93.4%	Plymouth Argyle	86.8%	69.9%	N/A					78.4%
Newcastle United	99.9%	99.7%	99.3%	98.2%	95.3%	88.0%	72.3%	93.3%	Barnsley	99.6%	98.9%	97.0%	92.2%	80.5%	56.4%	22.4%	78.1%
Fulham	99.9%	99.7%	99.3%	98.1%	95.0%	87.5%	71.3%	93.0%	Peterborough United			96.7%		79.2%	55.2%		77.0%
Norwich City	99.9%	99.8%		98.3%	95.7%	89.1%	74.5%	92.9%	Bournemouth							76.5%	76.5%
Leicester City	99.9%		99.4%	98.3%	95.6%	89.0%	74.3%	92.7%	Millwall				95.6%	88.8%	73.3%	45.0%	75.7%
Sunderland	99.9%	99.7%	99.3%	98.0%	94.8%	87.0%	70.2%	92.7%	Wolverhampton	98.9%	97.2%	92.7%	81.6%	58.5%	24.7%		75.6%
Reading	99.9%	99.7%	99.2%	97.8%	94.4%	85.9%	67.9%	92.1%	Coventry City	97.6%	93.7%	84.1%	63.3%	30.6%			73.9%
Southampton	99.9%	N/A			96.7%	91.5%	79.7%	91.9%	Preston North End	94.5%	86.0%	67.1%	35.7%				70.8%
Crystal Palace	N/A	N/A	N/A	98.7%	96.7%	91.6%	79.8%	91.7%	Huddersfield Town						80.5%	57.5%	69.0%
Swansea City		N/A	99.4%	98.4%	95.8%	89.3%	75.0%	91.6%	Sheffield United	93.9%	84.6%	64.2%	31.7%				68.6%
Brighton & Hove Albion					97.4%	93.4%	83.9%	91.6%	Bristol City	98.3%	95.4%	88.2%	71.6%	41.2%	9.7%		67.4%
West Bromwich Albion	99.9%	99.7%	99.1%	97.7%	93.9%	84.8%	65.8%	91.5%	Scunthorpe United	91.8%		54.5%	20.5%				55.6%
Arsenal	99.9%	99.7%	99.1%	97.6%	93.9%	84.7%	65.6%	91.5%	Colchester United	18.3%							18.3%
Liverpool	99.9%	99.7%	N/A	97.9%	94.5%	86.3%	68.8%	91.2%	Doncaster Rovers		N/A	N/A	N/A	N/A		N/A	N/A
Chelsea	99.9%	99.6%	99.0%	97.3%	92.9%	82.4%	61.2%	90.3%	Yeovil Town							N/A	N/A
Sheffield Wednesday	99.9%	99.7%	99.1%			84.9%	66.0%	89.9%	Average	96.6%	97.8%	95.3%	90.8%	90.1%	81.6%	68.1%	85.5%

Table 12: Technical Efficiency Scores, Robustness Check. The technical efficiency score for each club that participated at least one season in the Premier League and/or the Championship during the sample period is given in percentage s of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2008 is the 2007/2008 season, 2009 is the 2008/2009 season, etc. In the final column the overall efficiency score of the clubs is given in the sample period. In the final row the average per season and the average of the overall scores of the clubs are given.

Overall, the 2008/2009 season is also in the new frontier model the season where the clubs were on average the most efficient. Moreover, the average efficiency score per season drops after the 2008/2009 season. The significant negative eta (η) is explained by this finding, which is similar to the results of the efficiency scores related to the frontier model of the Premier League. Furthermore, the average efficiency score in the 2013/2014 season (68.1%) differs extremely from the average efficiency scores for the other seasons. This could be caused by the increase in revenue due to the new broadcasting deal that began in the 2013/2014 season. Finally, Bristol City had an efficiency score of 9.7% in the 2012/2013 season which is the lowest efficiency score achieved by a club in a season.

To see whether there is also now a significant difference in the average efficiency scores between Premier League clubs and Championship clubs, another two t-test for mean comparison with unequal variances is conducted. The outputs for these tests are shown in Table 13 where Table 13 (left) shows the t-test for the means on the average efficiency scores of the clubs. The alternative hypothesis of the difference being not equal to zero is significant at the 5% level (P = 0.014). Furthermore, the difference being smaller than zero is significant at the 1% level (P = 0.007) which means that Premier League clubs are now significantly more efficient than Championship clubs. This is the opposite for what was found with the efficiency scores related to the number of points awarded. The second t-test in Table 13 (right) concludes the same with the significant alternative hypothesis of the difference being not equal to zero at the 5% level (P = 0.001). The difference being smaller than zero is significant at the 1% level (P = 0.0005). It means that Premier League clubs are significantly more efficient than Championship clubs in terms of the final league ranking. This is not surprising, because the Premier League clubs are higher ranked than Championship clubs. Also during the season clubs are limited in the final league ranking which make a bad performing Premier League club have a higher ranking than a good performing Championship club. The model cannot recognize this limitation so that could be the explanation why Premier League clubs are more efficient than Premier League clubs.

Variable	N	Mean	Std. Err.
TECH	41	0.8364	0.0247
TEPL	31	0.9062	0.0117
Difference		-0.0697	0.0274

	P-value
Ha: Diff < 0	0.0068
Ha: Diff ≠ 0	0.0136
Ha: Diff > 0	0.9932

Variable	N	Mean	Std. Err.
TECH	152	0.8535	0.0166
TEPL	135	0.9170	0.0094
Difference		-0.0635	0.0191

	P-value
Ha: Diff < 0	0.0005
Ha: Diff ≠ 0	0.0010
Ha: Diff > 0	0.9995

Table 13: T-tests for mean comparison with unequal variances, Robustness Check. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores for the Premier League (TEPL) and the Championship (TECH) in the robustness check. In the left table the means of the average technical efficiency scores of the clubs are compared with the null-hypothesis of the difference being equal to zero. In the right table the individual observations of the technical efficiency scores are used to test the same null-hypothesis. The alternative hypotheses are that difference is smaller than zero, not equal to zero and greater than zero.

Before and after Financial Fair Play

In the following subparagraphs the whole sample will be separated into two subsets. The first subset is from the 2007-2008 season up to and including the 2009/2010 season and the second subset from the 2010/2011 season up to and including the 2013/2014 season. This allows to compare the period before and after the approval/introduction of Financial Fair Play by the UEFA. For both subsets a new frontier model will be conducted, new efficiency scores will be calculated, and a mean comparison t-test will be conducted to see in which subset the clubs were more efficient. This is done for both the number of points awarded and the final league ranking as the dependent variable. The results are presented in Table 14 up to and including Table 23

Premier League

First, the subset 2007/2008 up to and including 2009/2010 is tested for the Premier League with the number of points awarded as the dependent variable. The output for the Stochastic Cobb-Douglas Production Frontier Model for the Premier League is shown in Table 14. It shows that the *Wage* coefficient is significant at the 1% level (P = 0.000), similar to what was found in the full sample period regression output in Table 5.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-5.979	1.160	0.000	μ	0	-	σ^2	0.175
Wage	0.672	0.136	0.000	η	-0.290	0.007	γ	0.928
Amort	-0.066	0.090	0.462	Ln(σ^2)	-1.741	0.000	σ_U^2	0.163
Other	-0.045	0.061	0.461				σ_V^2	0.013

Table 14: Stochastic Cobb-Douglas Production Frontier Model output for the Premier League, 2007/2008 season up to and including 2009/2010 season. The regression output for the Premier League with the number of points awarded as the production factor for the first subset period. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

The *Wage* coefficient has a value of 0.672 which means that a one per-cent increase in the wages & salaries results in a 0.672% increase in the number of points awarded. Compared to Table 5, the coefficient is higher in the subset, which means that the effect of wages & salaries on the number of points was bigger in the period from the 2007/2008 season up to and including the 2009/2010 season. It could already suggest that the expenditure before the approval/introduction of Financial Fair Play was more efficient in terms of the translation into number of points awarded than after the approval/introduction. The *Amort* and *Other* coefficient are both not significant and have values almost equal to zero. Therefore, these coefficients are treated as not been contributing any additional

information to the frontier model. The eta (η) has a negative value of -0.29 and is significant at the 1% level (P = 0.007) which indicates that the efficiency scores is on average downward sloping. The gamma (γ) has a value of 0.928 which means that on average 92.8% of the variance in the error term is due to inefficiency and 7.2% is due to stochastic shocks. This number is higher than for the gamma of the full sample regression (0.828). Also the average variance of the inefficiency error term, $U_{i,t}$ is higher in the first subset regression (0.163) than in the full sample regression (0.129). This indicates that the efficiency score spread is higher in the first subset period.

The efficiency scores for the first subset of the Premier League are shown in Table 15. Similar to previous results, Everton is the most efficient club in the Premier League. This time with an efficiency score of 96.8% and followed by Liverpool with an efficiency score of 94.0%. Derby County is also this time, when the number of points awarded is the production factor, the least efficient club. Now with an efficiency score of 29.5%.

Club	2008	2009	2010	Overall					
Everton	97.7%	96.9%	95.9%	96.8%	Reading	77.1%			77.1%
Liverpool	94.8%	93.1%	N/A	94.0%	Manchester City	81.1%	75.6%	68.9%	75.2%
Birmingham City	94.2%		90.0%	92.1%	Chelsea	80.4%	74.7%	67.8%	74.3%
Tottenham Hotspur	93.7%	91.8%	89.2%	91.6%	Wigan Athletic	80.1%	74.3%	67.3%	73.9%
Manchester United	93.2%	91.1%	88.3%	90.9%	Sunderland	79.8%	74.0%	66.9%	73.6%
Aston Villa	92.7%	90.4%	87.5%	90.2%	West Bromwich Albion		72.8%		72.8%
Stoke City		91.2%	88.5%	89.9%	Bolton Wanderers	78.9%	72.8%	65.5%	72.4%
Portsmouth	88.8%	N/A	N/A	88.8%	West Ham United	76.2%	69.5%	61.6%	69.1%
Arsenal	91.4%	88.7%	85.2%	88.4%	Hull City		68.6%	60.5%	64.6%
Wolverhampton			86.7%	86.7%	Newcastle United	60.1%	50.6%		55.3%
Blackburn Rovers	88.7%	85.2%	80.9%	84.9%	Derby County	29.5%			29.5%
Fulham	87.9%	84.2%	79.5%	83.9%	Middlesbrough	N/A	N/A		N/A
Burnley			79.4%	79.4%	Average	82.4%	80.3%	78.3%	79.0%

Table 15: Technical Efficiency Scores for the Premier League, first subset period. The technical efficiency scores for each club that participated at least one season in the Premier League between the 2007/2008 season and the 2009/2010 season are given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2008 is the 2007/2008 season, 2009 is the 2008/2009 season, and 2010 is the 2009/2010 season. In the final column the overall efficiency score of a club is given in the first subset. In the final row the average per season is given and the average of the overall efficiency scores of the clubs.

Furthermore, Manchester United was one of the most efficient clubs in the first subset period. So, their overall inefficiency in the full sample period cannot provisionally be attributed to Sir Alex Ferguson. Finally, looking at the averages per season and the overall average, it can be concluded that the efficiency scores is on average downward sloping, just like the eta (η) from the regression output in Table 14 already indicated. Also the average overall efficiency score is the lowest so far with 79.0%. This number is important for the mean comparison with the second subset period.

Second, the subset 2010/2011 up to and including 2013/2014 is tested for the Premier League with the number of points awarded as the dependent variable. Table 16 shows the regression output for the Stochastic Cobb-Douglas Production Frontier Model for the Premier League. The constant is significant at the 1% level (P = 0.000) and has a value of -4.178 which means that a club at least awards $e^{-4.178}$ (= 0.015) points. The *Wage* coefficient is also significant at the 1% level (P = 0.000) and has a value of 0.607 which means that a one per-cent increase in wages & salaries results in a 0.607% increase in the number of points awarded. Compared to the first subset regression output for the Premier League in Table 14 the *Wage* coefficient is lower in the second subset period which proves that the effect of wages & salaries on the number of points awarded is higher for the first subset period. Furthermore, the *Amort* coefficient is significant at the 5% level (P = 0.032) which is the first time so far in this thesis that the amortization of player registrations is significant in a frontier model. The value of the coefficient is -0.118 which means that a one per-cent increase in amortization of player registrations results in a 0.118% decrease in number of points awarded. So, for the second subset period it has been proven that a higher amount of transfer fees paid significantly leads to a less number of points awarded which is a small rebuttal for those clubs that try to reach the top in English football by spending much money on transfer fees. The *Other* coefficient is also in the second subset period not significant which means that the coefficient does not differ significantly from zero.

Looking at the other statistics in Table 16 it can be concluded that also in the second subset period the efficiency scores are on average downward sloping, because the value of eta (η) is negative with a value of -0.791 and significant at the 1% level (0.004). This number is much lower than the eta (η) from the regression output of the first subset period (-0.29) which indicates that in the second subset period there is more dispersion in the efficiency scores over time compared to the first subset period. Furthermore, the gamma (γ) has a value of 0.857 which means that on average 85.7% of the variance in the error term is due to inefficiency and 14.3% is due to stochastic shocks. This number is higher than for the gamma of the full sample regression (0.828), but lower than the gamma of the first subset period regression (0.928). Also the average variance of the inefficiency error term, $U_{i,t}$ is lower in the second subset regression (0.103) than in the first subset period regression (0.163), but also lower than the full sample period regression (0.129). This indicates that the efficiency score spread is lowest in the second subset period.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-4.178	0.929	0.000	μ	0	-	σ^2	0.120
Wage	0.607	0.111	0.000	η	-0.791	0.004	γ	0.857
Amort	-0.118	0.055	0.032	Ln(σ^2)	-2.122	0.000	σ_U^2	0.103
Other	-0.047	0.065	0.474				σ_V^2	0.017

Table 16: Stochastic Cobb-Douglas Production Frontier Model output for the Premier League, 2010/2011 season up to and including 2013/2014 season. The regression output for the Premier League with the number of points awarded as the production factor for the second subset period. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

Table 17 shows the technical efficiency scores for the Premier League clubs in the second subset period. Again, Everton is the most efficient club in the Premier League with an average efficiency score of 98.4%. Tottenham Hotspur is also the second most efficient club, now with an efficiency score of 98.0%. The two most inefficient clubs are Queens Park Rangers (59.3%) and Reading (58.2%) which is far below the overall average of 86.0%. On the other side, this 86.0% overall average efficiency score is higher than the 79.0% in the first subset period. For the average per season it can be concluded that there is more dispersion in the second subset period compared to the first subset period, but that three out of four seasons in the second subset period had a higher average efficiency score than the highest average efficiency score in a season in the first subset period.

Club	2011	2012	2013	2014	Overall	Sunderland	97.1%	93.7%	86.8%	73.3%	87.7%
Everton	99.6%	99.2%	98.3%	96.3%	98.4%	Crystal Palace				87.4%	87.4%
Tottenham Hotspur	99.6%	99.0%	97.9%	95.4%	98.0%	Birmingham City	85.8%				85.8%
Liverpool	99.3%	98.4%	96.6%	92.7%	96.8%	Aston Villa	96.5%	92.4%	84.0%	68.3%	85.3%
Arsenal	99.1%	97.9%	95.5%	90.5%	95.8%	Norwich City		93.9%	87.2%	74.1%	85.1%
Manchester City	99.0%	97.9%	95.5%	90.4%	95.7%	Fulham	95.8%	90.9%	81.1%	63.1%	82.7%
Chelsea	99.0%	97.8%	95.2%	89.8%	95.4%	Hull City				82.6%	82.6%
Southampton			96.6%	92.7%	94.6%	Bolton Wanderers	88.4%	76.5%			82.4%
Stoke City	98.7%	97.2%	94.1%	87.6%	94.4%	West Bromwich Albion	95.6%	90.7%	80.6%	62.3%	82.3%
Newcastle United	98.2%	96.0%	91.5%	82.4%	92.0%	Wolverhampton	83.4%	67.1%			75.2%
Wigan Athletic	96.8%	93.2%	85.7%		91.9%	Blackburn Rovers	83.0%	66.5%			74.7%
Manchester United	98.1%	95.8%	91.1%	81.6%	91.7%	Cardiff City				67.2%	67.2%
Swansea City		96.0%	91.4%	82.1%	89.8%	Queens Park Rangers		71.2%	47.4%		59.3%
Blackpool	88.6%				88.6%	Reading			58.2%		58.2%
West Ham United	97.6%		88.9%	77.3%	87.9%	Average	95.0%	90.6%	87.2%	81.9%	86.0%

Table 17: Technical Efficiency Scores for the Premier League, second subset period. The technical efficiency scores for each club that participated at least one season in the Premier League between the 2010/2011 season and the 2013/2014 season are given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2010 is the 2010/2011 season, 2011 is the 2011/2012 season, etc. In the final column the overall efficiency score of a club is given in the second subset. In the final row the average per season is given and the average of the overall efficiency scores of the clubs.

Next, the efficiency means are compared to test in which subset period the Premier League clubs were significantly the most efficient. The output for these test are shown in Table 18. The tests show that average efficiency score in the second subset period is significantly higher than in the first subset period. Table 18 (left) compares the means of the overall efficiency scores and the alternative hypothesis for the difference being not equal to zero is significant at the 10% level (P = 0.062). The difference being greater than zero is significant at the 5% level (P = 0.0309). In Table 18 (right) all the individual efficiency scores are used to conduct a mean comparison t-test. Here, the alternative hypothesis for the difference being not equal to zero is significant at the 1% level (P = 0.000) and the difference being greater than zero is also significant at the 1% level (P = 0.000).

Variable	N	Mean	Std. Err.
TEPL2	28	0.8596	0.0202
TEPL1	24	0.7897	0.0302
Difference		0.0699	0.0364

	P-value
Ha: Diff < 0	0.9691
Ha: Diff ≠ 0	0.0618
Ha: Diff > 0	0.0309

Variable	N	Mean	Std. Err.
TEPL2	80	0.9191	0.0109
TEPL1	55	0.8039	0.0176
Difference		0.1152	0.0207

	P-value
Ha: Diff < 0	1.0000
Ha: Diff ≠ 0	0.0000
Ha: Diff > 0	0.0000

Table 18: T-tests for mean comparison with unequal variances, subsets Premier League. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between the first (TEPL1) and second (TEPL2) subset in the Premier League. In the left table the means of the average technical efficiency scores of the clubs are compared with the null-hypothesis of the difference being equal to zero. In the right table the individual observations of the technical efficiency scores are used to test the same null-hypothesis. The alternative hypotheses are that difference is smaller than zero, not equal to zero and greater than zero.

Championship

In this subparagraph the full sample for the Championship is divided into the two subset periods as described above and the results are presented in the same order as for the Premier League. So first, the regression output for the first subset period will be analysed. This regression output can be found in Table 19. The *Wage* coefficient is significant at the 1% level (P = 0.000) and has a value of 0.442 which means that a one per-cent increase in wages & salaries results in a 0.442% increase in number of points awarded. This number is lower compared to the same coefficient value for the Premier League in the first subset period in Table 14 (0.672) which means that for the same period the Championship club could less translate the wages & salaries in number of points awarded. The *Amort* coefficient is not significant at the 10% level (P = 0.367), so this coefficient should not be treated as having additional power in the frontier model. The *Other* coefficient is significant at the 5% level (0.017) and has a value of -0.114 which means that a one per-cent increase in other operating expenses results in a 0.114% decline in the number of points awarded. This is almost equal to the value for the same coefficient in the full sample period regression output in Table 6 (0.088).

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-0.523	0.803	0.515	μ	0	-	σ^2	0.051
Wage	0.442	0.094	0.000	η	-0.432	0.118	γ	0.686
Amort	-0.047	0.052	0.367	Ln(σ^2)	-2.983	0.000	σ_U^2	0.035
Other	-0.114	0.048	0.017				σ_V^2	0.016

Table 19: Stochastic Cobb-Douglas Production Frontier Model output for the Championship, first subset period. The regression output for the Championship with the number of points awarded as the production factor for the first subset period. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

Furthermore, the eta (η) has a negative value of -0.432, but is not significant at the 10% level (P = 0.118). Also, the gamma (γ) has a value of 0.686 which means that on average 68.6% of the variance in the error term is due to inefficiency and 31.4% is due to stochastic shocks. This number is higher than for the gamma of the full sample period regression (0.607). Also the average variance of the inefficiency error term, $U_{i,t}$ is higher in the first subset regression (0.035) than in the full sample period regression (0.007). This indicates that the efficiency score spread is higher in the first subset period.

In Table 20 the technical efficiency scores are shown for the first subset period of the Championship clubs. Surprisingly, Wolverhampton Wanderers is the most efficient Championship club in the first subset period with an efficiency score of 96.4%. This is so surprising, because Wolverhampton Wanderers were the 26th efficient club in the full sample period (Table 8). The most efficient club then, Burnley, is only the 6th efficient club now with an efficiency score 94.3%. Again, Colchester United is the least efficient club with an efficiency score of 71.3% now. The negative eta (η) is explained by the downward sloping average efficiency score per season. The overall efficiency scores for the clubs have an average of 89.0% which is way lower than the overall average of 97.1% for the full sample period in Table 8.

Club	2008	2009	2010	Overall					
Wolverhampton Wanderers	97.1%	95.6%		96.4%	Watford	93.4%	90.1%	85.2%	89.5%
West Bromwich Albion	97.2%		93.5%	95.3%	Barnsley	92.6%	88.8%	83.4%	88.3%
Stoke City	95.2%			95.2%	Reading		90.2%	85.4%	87.8%
Bristol City	96.8%	95.1%	92.6%	94.8%	Ipswich Town	92.2%	88.2%	82.6%	87.7%
Cardiff City	96.7%	95.0%	92.4%	94.7%	Queens Park Rangers	92.0%	88.0%	82.3%	87.4%
Burnley	95.5%	93.2%		94.3%	Coventry City	91.7%	87.6%	81.6%	87.0%
Sheffield United	96.1%	94.1%	91.2%	93.8%	Swansea City		N/A	86.5%	86.5%
Plymouth Argyle	94.9%	92.3%	N/A	93.6%	Southampton	82.2%	N/A		82.2%
Blackpool	96.0%	94.0%	90.9%	93.6%	Derby County		83.8%	76.3%	80.0%
Leicester City	96.1%		91.0%	93.5%	Charlton Athletic	82.2%	74.0%		78.1%
Newcastle United			93.2%	93.2%	Norwich City	81.9%	73.7%		77.8%
Scunthorpe United	95.7%		90.2%	93.0%	Peterborough United			76.3%	76.3%
Nottingham Forest		94.4%	91.6%	93.0%	Colchester United	71.3%			71.3%
Hull City	92.9%			92.9%	Crystal Palace	N/A	N/A	N/A	N/A
Birmingham City		91.6%		91.6%	Middlesbrough			N/A	N/A
Preston North End	94.5%	91.8%	87.7%	91.3%	Doncaster Rovers		N/A	N/A	N/A
Sheffield Wednesday	93.5%	90.2%	85.4%	89.7%	Average	92.1%	89.6%	87.0%	89.0%

Table 20: Technical Efficiency Scores for the Championship, first subset period. The technical efficiency scores for each club that participated at least one season in the Championship between the 2007/2008 season and the 2009/2010 season are given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2008 is the 2007/2008 season, 2009 is the 2008/2009 season, and 2010 is the 2009/2010 season. In the final column the overall efficiency score of a club is given.

Second, the subset 2010/2011 up to and including the 2013/2014 season is tested. The results for the regression output can be found in Table 21. The *Wage* coefficient is significant at the 1% level (P = 0.000) and has a value of 0.346 which means that a one per-cent increase results in a 0.346% increase in the number of points awarded. The *Amort* and *Other* coefficient are both not significant at the 10% level (P = 0.269 and P = 0.542), so these variable do not have additional power in the frontier model. In this frontier model only one coefficient is significant which could be problematic for further calculations with the efficiency scores. However, because the wages & salaries cover a large fraction of the data in the Championship (59.3%) the efficiency scores might already come close to the actual efficiency of the clubs.

	Coef.	Std. Err.	P-value		Coef.	P-value		Coef.
Constant	-0.532	0.736	0.470	μ	0	-	σ^2	0.666
Wage	0.346	0.079	0.000	η	-0.617	0.003	γ	0.740
Amort	-0.039	0.035	0.269	Ln(σ^2)	-2.709	0.000	σ_U^2	0.049
Other	-0.026	0.043	0.542				σ_V^2	0.017

Table 21: Stochastic Cobb-Douglas Production Frontier Model output for the Championship, second subset period. The regression output for the Championship with the number of points awarded as the production factor for the second subset period. The distribution of the inefficiency term is a time varying decay model. Mu is constrained to zero in the model, because it is assumed that $U_{i,t}$ is half-normal distributed. *Coef.* is the coefficient of a specific variable in the left column. *Std. Err.* is the standard error of the coefficient, *P-value* is the probability of the coefficient being equal to zero. σ^2 is the variance of the whole error term. σ_U^2 and σ_V^2 are the variance of the inefficiency term and the term for the stochastic shocks. *Gamma* is the ratio of σ_U^2 to σ^2.

For the efficiency scores of the second subset period in the Championship, which are shown in Table 22, there can be drawn several conclusions. First of all, Burnley is most efficient club in the second subset period with an efficiency score of 97.8% and they are followed by Derby County (97.2%) and Watford (96.8%). These three clubs were also the three most efficient clubs in the full sample period (Table 8) and in the robustness check for the full sample period (Table 12). Secondly, Sheffield United is now the most inefficient club with an efficiency score of 71.3%. Moreover, Wolverhampton Wanderers, the most efficient club in the first subset period, is now almost the most inefficient club. They are just one place above Sheffield United with an efficiency score of 73.2%. Finally, the average overall efficiency score is 88.7% which is just a fraction smaller than the average overall efficiency score from the first subset period (89.0%).

Club	2011	2012	2013	2014	Overall						
Burnley	99.3%	98.7%	97.6%	95.7%	97.8%	Charlton Athletic			92.2%	86.2%	89.2%
Derby County	99.1%	98.3%	96.9%	94.5%	97.2%	Leeds United	96.3%	93.2%	87.9%	78.9%	89.1%
Watford	98.9%	98.1%	96.5%	93.6%	96.8%	Queens Park Rangers	96.7%			80.9%	88.8%
Leicester City	98.8%	97.8%	95.9%	92.6%	96.3%	Millwall	96.0%	92.8%	87.1%	77.6%	88.4%
Cardiff City	98.2%	96.6%	93.9%		96.2%	Huddersfield Town			91.1%	84.2%	87.7%
Brighton & Hove Albion		97.6%	95.6%	92.1%	95.1%	Sheffield Wednesday			91.0%	84.1%	87.5%
Ipswich Town	98.3%	96.9%	94.3%	89.8%	94.8%	Barnsley	95.4%	91.6%	85.0%	74.2%	86.5%
Hull City	97.2%	94.9%	90.9%		94.3%	Scunthorpe United	84.9%				84.9%
Peterborough United		95.9%	92.7%		94.3%	Blackburn Rovers			87.6%	78.5%	83.0%
Norwich City	94.1%				94.1%	Bolton Wanderers			86.1%	75.9%	81.0%
Reading	97.8%	95.9%		86.9%	93.5%	Coventry City	86.0%	75.8%			80.9%
Swansea City	93.3%				93.3%	Birmingham City		88.4%	79.7%	65.8%	78.0%
Southampton		93.1%			93.1%	Bristol City	87.9%	78.7%	64.4%		77.0%
Middlesbrough	N/A	96.3%	93.2%	87.9%	92.5%	Preston North End	74.7%				74.7%
Crystal Palace	95.9%	92.6%	86.9%		91.8%	Wolverhampton Wanderers			73.2%		73.2%
West Ham United		90.9%			90.9%	Sheffield United	71.3%				71.3%
Nottingham Forest	96.9%	94.3%	89.7%	82.0%	90.7%	Doncaster Rovers	N/A	N/A		N/A	N/A
Blackpool		95.3%	91.5%	85.0%	90.6%	Yeovil Town				N/A	N/A
Bournemouth				89.8%	89.8%	Portsmouth	N/A	N/A			N/A
Wigan Athletic				89.3%	89.3%	Average	93.2%	93.4%	89.2%	84.8%	88.7%

Table 22: Technical Efficiency Scores for the Championship for the period 2010/2011 up to and including 2013/2014. The technical efficiency scores for each club that participated at least one season in the Championship between the 2010/2011 season and the 2013/2014 season are given in percentages of efficiency, rounded at one decimal. The higher the percentage, the higher the efficiency. Clubs with a N/A have not enough data to calculate an efficiency score which causes a not available efficiency score for those clubs. The efficiency scores are given per season where 2011 is the 2010/2011 season, 2012 is the 2011/2012 season, etc. In the final column the overall efficiency score of a club is given in the second subset. In the final row the average per season is given and the average of the overall efficiency scores of the clubs.

In Table 23 the outputs for the mean comparison t-tests are shown, where the t-test in Table 23 (left) compares the means for the average overall efficiency scores and Table 23 (right) the means for the individual efficiency scores. From both tables in can be concluded that the difference in efficiency scores between the first and the second subset period does not significantly differ from zero. The alternative hypothesis in Table 23 (left) for the difference being not equal to zero is not significant at the 10% level (P = 0.869) and the same applies for the alternative hypothesis in Table 23 (right) (P = 0.718).

Variable	N	Mean	Std. Err.
TECH2	36	0.8871	0.0119
TECH1	30	0.8899	0.0120
Difference		-0.0028	0.0169

	P-value
Ha: Diff < 0	0.4344
Ha: Diff ≠ 0	0.8689
Ha: Diff > 0	0.5656

Variable	N	Mean	Std. Err.
TECH2	89	0.9008	0.0085
TECH1	63	0.8966	0.0080
Difference		0.0042	0.0116

	P-value
Ha: Diff < 0	0.6409
Ha: Diff ≠ 0	0.7182
Ha: Diff > 0	0.3591

Table 23: T-tests for mean comparison with unequal variances, subsets Championship. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between the first (TECH1) and second (TECH2) subset in the Championship. In the left table the means of the average technical efficiency scores of the clubs are compared with the null-hypothesis of the difference being equal to zero. In the right table the individual observations of the technical efficiency scores are used to test the same null-hypothesis. The alternative hypotheses are that difference is smaller than zero, not equal to zero and greater than zero.

Practices

In this paragraph the most efficient and the most inefficient clubs are examined. The most common features for those clubs are highlighted which will be used to develop an advice for the most inefficient clubs to become more efficient. This is not done by stating that the inefficient clubs should award more points with the same resources, but how the inefficient clubs could change their financials to become more efficient.

In the Premier League, Everton, Liverpool and Tottenham Hotspur were overall the most efficient clubs in the sample period. However, looking at their financials throughout the sample period there cannot be found any similarity between these clubs in terms of the amount spend on the operating activities. For instance, Everton spends less on wages & salaries, amortization of player registrations, and other operating expenses than the average Premier League club while Liverpool spends above average on these operating expenses. Liverpool even spends between two and three times more the amount spend by Everton. Tottenham Hotspur spends almost the same amount on operating expenses as the average Premier League club. Looking at the ratio for the different operating expenses it can be concluded that all these three clubs spend slightly less than 75% of their total operating expenses on wages & salaries and amortization of player registrations. This is the same ratio as for the average Premier League club described in Section IV. Furthermore, these clubs have in common that they are competing for the same rankings in the league table which is just below the top teams and between the fourth and eighth place on average.

In the Championship, Burnley, Derby County and Watford were overall the most efficient clubs in the sample period. For these three clubs there can be found more similarities than for the most efficient Premier League clubs. First of all the average total operating expenses in the sample period lies between the £23 million and £27 million per season. Also the ratios between the different operating expenses are almost equal between these clubs. Between the 55% and 60% is spend on wages & salaries, around the 10% is spend on amortization of player registrations, and between the 25% and 35% is spend on other

operating activities. Remarkably, Derby County and Watford spend less on operating activities throughout the sample period. Because these two clubs did not perform any worse by this, the high efficiency can be explained.

The most inefficient clubs in the Premier League were Derby County, Queens Park Rangers and Cardiff City. For the first club it can be stated that the spend a too less amount on the operating activities to be competitive in the league. For Queens Park Rangers and Cardiff City the opposite is true. These two clubs spend a too high amount on the wages & salaries and amortization of player registrations relative to their performance on the pitch. The amount spend by both clubs is even slightly higher than the amount spend by Everton which is the most efficient club. So these two clubs have the resources to pay wages & salaries and transfer fees to be competitive with the other clubs, but probably too high wages and transfer fees are paid to and for players relative to their quality or the money is not spend in a way that would be the best for the team. In this case Queens Park Rangers and Cardiff City should better look at how they are going to invest their money on the players. So quality has to be more important than quantity for these clubs and other inefficient clubs. For the Championship the most inefficient club is Colchester United and also for them it is the case that they spend the same amount of money on operating activities than the most efficient clubs in the Championship. So, also for Colchester United the same applies as for Queens Park Rangers and Cardiff City, but actually for every inefficient club.

Foreign Ownership

The final step is testing whether there is a significant difference in efficiency between clubs with a majority foreign ownership and a non-majority ownership. In this paragraph the results from the tests will be described. These tests are similar to the t-test for mean comparison in the previous paragraphs. The only difference is that now the means of the efficiency scores are compared for clubs with and without a majority foreign ownership. The results for these t-tests can be found in Table 24 up to and including Table 27 In these tests the alternative hypothesis of the difference being smaller than zero is the most interesting, because as described before it lies in the most interest of this thesis whether the majority foreign owned clubs are less efficient than majority non-foreign owned clubs.

Table 24 (left) shows the t-test for the efficiency scores means of the Premier League clubs over the full sample period. The alternative hypothesis for the difference being smaller than zero is not significant at the 10% level (P = 0.174). This means that there is no significant difference between the means of the efficiency scores of the majority foreign owned clubs and majority non-foreign owned clubs. The same test is also conducted for the two subset periods of the Premier League. The output for the first subset period can be found in Table 25 (left), the output for the second subset can be found in Table 25 (right). It can be concluded from both tables that there is still no significant difference at the

10% level (P = 0.681 and P = 0.369) between the efficiency scores means for majority foreign owned Premier League clubs and majority non-foreign owned Premier League clubs.

Table 24 (right) shows the t-test results for the efficiency scores means of the Championship clubs over the full sample period. Also for the Championship the difference between the means is not significantly smaller than zero (P = 0.168). Furthermore, the distinction in subsets also does not prove that there is a significant difference between the efficiency scores means for majority foreign owned Championship clubs and majority non-foreign owned Championship clubs. For the first subset period (Table 26 left) the difference is not significantly smaller than zero with P = 0.157 and for the second subset period (Table 26 right) the difference is not significantly smaller than zero with P = 0.751.

Variable	N	Mean	Std. Err.
Foreign1	69	0.9018	0.0150
Foreign0	66	0.9191	0.0107
Difference		-0.0173	0.0184

	P-value
Ha: Diff < 0	0.1741
Ha: Diff ≠ 0	0.3481
Ha: Diff > 0	0.8259

Variable	N	Mean	Std. Err.
Foreign1	51	0.9718	0.0041
Foreign0	101	0.9767	0.0030
Difference		-0.0049	0.0051

	P-value
Ha: Diff < 0	0.1681
Ha: Diff ≠ 0	0.3361
Ha: Diff > 0	0.8319

Table 24: T-tests for mean comparison with unequal variances, ownership Premier League (left) and Championship (right), full sample period. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between majority foreign owned clubs (Foreign1) and majority non-foreign clubs (Foreign0) in the Premier League (left) and Championship (right). In these t-tests all individual observations on the technical efficiency scores are used with the null-hypothesis of the difference being equal to zero. The alternative hypotheses are that the difference is smaller than zero, not equal to zero, and greater than zero.

Variable	N	Mean	Std. Err.
Foreign1	28	0.8122	0.0252
Foreign0	27	0.7954	0.0249
Difference		0.0168	0.0354

	P-value
Ha: Diff < 0	0.6809
Ha: Diff ≠ 0	0.6383
Ha: Diff > 0	0.3191

Variable	N	Mean	Std. Err.
Foreign1	41	0.8822	0.0190
Foreign0	39	0.8907	0.168
Difference		-0.0085	0.0253

	P-value
Ha: Diff < 0	0.3688
Ha: Diff ≠ 0	0.7376
Ha: Diff > 0	0.6312

Table 25: T-tests for mean comparison with unequal variances, ownership Premier League first subset period (left) and second subset period (right). In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between majority foreign owned clubs (Foreign1) and majority non-foreign clubs (Foreign0) in the Premier League for the first subset period (left) and second subset period (right). In these t-tests all individual observations on the technical efficiency scores are used with the null-hypothesis of the difference being equal to zero. The alternative hypotheses are that the difference is smaller than zero, not equal to zero, and greater than zero.

Variable	N	Mean	Std. Err.
Foreign1	11	0.8768	0.0212
Foreign0	52	0.9007	0.0085
Difference		-0.0239	0.0229

	P-value
Ha: Diff < 0	0.1567
Ha: Diff ≠ 0	0.3134
Ha: Diff > 0	0.8433

Variable	N	Mean	Std. Err.
Foreign1	40	0.9071	0.0118
Foreign0	49	0.8956	0.0120
Difference		0.0115	0.0169

	P-value
Ha: Diff < 0	0.7513
Ha: Diff ≠ 0	0.4975
Ha: Diff > 0	0.2487

Table 26: T-tests for mean comparison with unequal variances, ownership Championship first subset period (left) and second subset period (right). In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between majority foreign owned clubs (Foreign1) and majority non-foreign clubs (Foreign0) in the Championship for the first subset period (left) and second subset period (right). In these t-tests all individual observations on the technical efficiency scores are used with the null-hypothesis of the difference being equal to zero. The alternative hypotheses are that the difference is smaller than zero, not equal to zero, and greater than zero.

Finally it has been tested whether there is a significant difference in the efficiency scores means between all the majority foreign owned clubs and majority non-foreign owned clubs. This is done by using the efficiency scores from the robustness check. The results for the mean comparison t-test can be found in Table 27. It shows that also for the efficiency scores from the robustness check the difference is not significantly smaller than zero (P = 0.418).

Variable	N	Mean	Std. Err.
Foreign1	120	0.8810	0.0131
Foreign0	167	0.8851	0.0144
Difference		-0.0041	0.0194

	P-value
Ha: Diff < 0	0.4176
Ha: Diff ≠ 0	0.8352
Ha: Diff > 0	0.5824

Table 27: T-tests for mean comparison with unequal variances, ownership Premier League and Championship, Robustness check. In these tables the results for the t-tests for mean comparison with unequal variances are shown to test whether there is a significant difference in the technical efficiency scores between majority foreign owned clubs (Foreign1) and majority non-foreign clubs (Foreign0) in the Premier League and Championship. In these t-tests all individual observations on the technical efficiency scores are used with the null-hypothesis of the difference being equal to zero. The alternative hypotheses are that the difference is smaller than zero, not equal to zero, and greater than zero.

Because there is not found any significant difference in efficiency scores between majority foreign owned clubs and majority non-foreign owned clubs, the question arises whether the clubs that became majority foreign owned were already significantly efficient. If so, this could explain why foreign investors want to take a majority stock ownership in a football club. During the sample period ten clubs saw their ownership changing from a majority non-foreign ownership to a majority foreign ownership

and only one club, West Ham United, saw the reverse thing happen. Because this change in ownership was not in the same year for these clubs, each club is tested apart. This is done by comparing the efficiency score prior to the season of the change in ownership to the average of all clubs in that season. A z-test shows whether the efficiency score was significantly different from the average of all the other clubs that season. The ten clubs with a change from majority non-foreign to majority foreign ownership all differ significantly at the 10% level to the average. Only Arsenal and Nottingham Forest do not differ at the 5% level. For West Ham United the efficiency score was not significantly different from the average. Therefore, it can be suggested that foreign investors buy stocks and take a majority ownership in a football club when the club is significantly efficient above average. However, there are not enough observations to conclude this in general. For domestic investors in England and Wales there cannot be drawn any conclusions. Not only because there is only one observation, but also because the non-significance suggests that there might be a lot of other reasons why domestic investors take a majority ownership in a football club.

To see whether the eleven clubs are more or less significant than the other clubs, the average efficiency score after the change in ownership is compared to the average of the whole sample. This is also done by conducting a z-test. For the clubs that changed from a non-foreign to a foreign ownership Arsenal, Cardiff City, Charlton Athletic, Hull City, Southampton and Watford are significantly more efficient than the other clubs after becoming majority foreign owned. But also West Ham United is significantly more efficient than the other clubs after becoming majority non-foreign owned. The remaining four clubs had no significant difference in efficiency scores compared to the total average. This might suggest that only the change in ownership itself is enough to be relative more efficient. However, this can only be concluded if more observations were available.

Section VII Conclusion

In this section the thesis is concluded. This contains the testing of the hypotheses from Section V, based on the findings from the results in Section VI. After the hypotheses testing the research question from Section I is answered. Furthermore, some recommendations for the clubs will be stated out, but also the limitations in this thesis and recommendations for further research will be described.

Hypotheses Testing

The hypotheses in this paragraph originate from Section V where the hypotheses are developed and explained with the reasoning behind it. In this paragraph those hypotheses are tested with the help of the results described in Section VI.

The first hypothesis is as follows:

"The relation between pitch performance and financial performance is significantly positive"

In all the regression outputs the *Wage* coefficient has a positive sign and is significant at the 1% level. However, the *Amort* coefficient is only significant in the regression output for the second subset period for the Premier League and there the coefficient has a negative value (Table 16). Also the *Other* coefficient is not significant in all the regressions and in the regressions where it is significant, it has a negative sign. This means that there is no significantly positive relationship between pitch performance and financial performance and therefore the first hypothesis is rejected.

The second hypothesis is as follows:

"English Championship clubs are more efficient than clubs in the English Premier League."

In the t-tests for the mean comparison between the technical efficiency scores for the Championship clubs and Premier League clubs (Table 9) the Championship clubs are significantly more efficient than the Premier League clubs. However, in the robustness check (Table 13) where the number of points awarded as the dependent variable is replaced by the ranking, the Premier League clubs are significantly more efficient than Championship clubs. This means that a point awarded in the Premier League has not the same value as for a point awarded in the Championship. Therefore, the robustness check has additional power in comparing the efficiency scores over the regular method. Because the robustness checks concludes that Premier League clubs are more efficient than Championship clubs the second hypothesis is rejected.

The third hypothesis is as follows:

"English Premier League and Championship clubs are less inefficient after the approval/introduction of Financial Fair Play by the UEFA."

From the t-tests for the mean comparison between the technical efficiency scores for the first subset period and the second subset period in the Premier League (Table 18) it can be concluded that Premier League clubs were significantly more efficient in the second subset period. However, from the t-tests for Championship clubs (Table 23) it can be concluded that there is no significant difference

between the first and second subset period. This means that not both the Premier League and Championship clubs are less inefficient after the approval/introduction of Financial Fair Play by the UEFA and therefore the third hypothesis is rejected.

The fourth hypothesis is as follows:

"Clubs with a majority foreign ownership are more inefficient than clubs with a majority non-foreign ownership."

For testing this hypothesis there has to been looked at the t-test outputs in Table 24 up to and including Table 27. It can be concluded that in none of the mean comparison tests there is a significant difference in efficiency scores between majority foreign owned clubs and majority non-foreign owned clubs, both for the Premier League as for the Championship. Therefore, the fourth hypothesis is rejected.

With the results for the hypotheses testing the research question can be answered. The research question is as follows:

"Are clubs with a foreign owner and more success in the English Premier League and Championship significantly more inefficient in terms of pitch performance related to their costs expenditure compared to clubs with a non-foreign owner?"

The answer to this question is "No", because clubs with a foreign owner do not significantly differ in efficiency compared with clubs with a non-foreign owner and it is not significantly proven that Premier League clubs are more efficient than Championship clubs and vice versa. This means that the more inefficiency of foreign owners in the banking industry (Lensink, Meesters, & Naaborg, 2008) is not applicable for the two highest divisions of English professional football for the period 2007/2008 up to and including 2013/2014. Therefore, it can also not been stated that the majority foreign owned clubs spend too much on wages & salaries, transfer fees or other operating activities. Although the relation between wages & salaries and pitch performance is strong, what irrefutable proves that clubs that increase wages & salaries award more points in the league, the amortization of player registrations and other operating expenses do not prove to significantly influence the pitch performance. It is a premature conclusion, but the not (always) significant relationship between the amortization of players registrations and other operating expenses with the pitch performance shows that the management of a club, and therefore also the owner, cannot influence the pitch performance through operating expenses other than wages & salaries. So, it can be questioned what the actual effect of a foreign owner is in relation to the goals new owners of football clubs try to achieve by buying the shares of a club. The final test suggested that this could be because the management of the club is already significantly more efficient than the other clubs. According to the other results in this thesis the only possibility to realize those goals is by contributing to the money available for wages & salaries. However, because there is a strong correlation between the wages & salaries and the amortization of player registrations, which is mostly driven by the transfer fees, the frontier models in this thesis contributes the fluctuation in pitch

performance to the wages & salaries, whereas there is also a need for high money resources to be spend on transfer fees to contract the best players for the club. Or in other words, to let the other competitors in the league not become stronger.

Therefore, clubs should not only focus on investing the additional money from the broadcasting rights into the wages & salaries for new and existing players. This means that the owners are still able to influence the pitch performance of the club by investing extra money in the club, but according to the results of this thesis, the clubs do not become significantly more inefficient. On the other side, the clubs' management is influenced by the approval/introduction of Financial Fair Play by the UEFA in the 2010/2011 season. Clubs have become relative more efficient compared to the three seasons before the approval/introduction of Financial Fair Play. If the UEFA is able to keep to rules for financial regulation more strict for the clubs and for the owners, possible mismanagement can be prevented in the football industry, or in particular England. The fact that Championship clubs have not improved their efficiency after the approval/introduction of Financial Fair Play could be that those club in a lesser extent feel the consequences of a fining. For instance, in the form of an exclusion for UEFA tournaments, because the only way to qualify for those tournaments is through the Premier League or by winning the national cup. Therefore, the status quo in the form of efficiency by the Championship clubs can be explained by a less incentive for those clubs to increase the efficiency, because they are harmed less by the consequences of inefficiency than Premier League. Another explanation can be that the Premier League is too lucrative for the Championship clubs which causes a primary focus on promoting to the Premier League instead of efficiently operating a football club. As long as the clubs will not become in trouble it will not be seen as a major problem, but when the times comes that one or multiple clubs have financial problems it could already been too late to save those clubs or maybe the entire football industry.

Limitations & Recommendations for Further Research

In this paragraph the major limitations of this thesis are outlined. If possible, recommendations for further research will be included for the specific limitation. As described in Section IV there was some data limitation in the form of missing financial statements for seven clubs. One possible way this could be solved is by contacting the club itself or the Companies House to ask if they can provide financial information for the missing years of the clubs. Another possibility is to restructure the dataset and only focus on a selected group of clubs, for instance only the best performing clubs or only the clubs that played continuously in the same league for a certain period. However, this could lead to a too small dataset which will make it difficult to draw reliable conclusions.

Another limitation is that there is too little information on the actual distribution of the shares of a club. From the annual reports is was often difficult to conclude who was the actual owner and for which period. Most of information that could not been found in the annual reports had to be retrieved from the notes in the financial statements to conclude who owned the club and when the ownership

changed. There is no obvious solution for this problem, because there is a reason why clubs do not openly provide the information on who owns the club. Private information is difficult to check so as long as the information on the ownership will not be made public it will be difficult for further research to determine who is the actual owner of the club and for what period.

The final limitation is that the phenomenon of majority foreign ownership has not been researched broad yet. There are only a smaller number of findings to make assumptions on in relation with football and ownership. The solution for this is to increase the research on this type of ownership for football clubs, because it will most likely be the future for football clubs.

References

Afriat, S. N. (1972). Efficiency Estimation of Production Functions. *International Economic Review, Vol. 13, No. 3*, 568-598.

Aigner, D., Lovell, C. K., & Schmidt, P. (1977). FORMULATION AND ESTIMATION OF STOCHASTIC FRONTIER PRODUCTION FUNCTION MODELS*. *Journal of Econometrics 6*, 21-37.

Aitken, B., Harrison, A., & Lipsey, R. E. (1996). Wages and foreign ownership A comparative study of Mexico, Venezuela, and the United States. *Journal of International Economics 40*, 345-371.

Arsenal Holdings plc. (2013, September 23). *Arsenal Holdings plc Statement of Accounts and Annual Report 2012/13.* Retrieved from Arsenal: http://www.arsenal.com/assets/_files/documents/sep_13/gun__1380277138_Arsenal_Holdings_plc_-_Annual_.pdf

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science 30*, 1078–1092.

Barros, C. P., & Garcia-del-Barrio, P. (2008). Efficiency Measurement of the English Football Premier League with a Random Frontier Model. *Economic Modelling 25*, 994-1002.

Barros, C. P., & Leach, S. (2006a). Analyzing the Performance of the English F.A. Premier League With an Econometric Frontier Model. *Journal of Sport Economics Vol. 7 No.3*, 391-407.

Barros, C. P., & Leach, S. (2006b). Performance evaluation of the English Premier Football League with data envelopment analysis. *Applied Economics 38*, 1449-1458.

Barros, C. P., & Leach, S. (2007). Technical efficiency in the English Football Association Premier League with a stochastic cost frontier. *Applied Economics Letters 14*, 731-741.

BBC. (2015, February 10). *Premier League in record £5.14bn TV rights deal.* Retrieved December 24, 2015, from BBC News: http://www.bbc.com/news/business-31379128

BBC. (2016, February 2). *Premier League transfer spending hits £1bn this season*. Retrieved March 5, 2016, from BBC: http://www.bbc.com/news/business-35460408

Brooks, C. (2014). *Introductory Econometrics for Finance.* Cambridge: Cambridge University Press.

Brown, A. (2007). 'Not For Sale'? The Destruction and Reformation of Football Communities in the Glazer Takeover of Manchester United. *Soccer & Society, 8:4*, 614-635.

Budzinski, O. (2014). The Competition Economics of Financial Fair Play. *Ilmenau Economics Discussion Papers, Vol. 19, No. 85*, 1-28.

Carmichael, F., McHale, I., & Thomas, D. (2011). Maintaining market position: team performance, revenue and wage expenditure in the English premier league. *Bulletin of Economic Research*, 464-497.

Chan, K. H., Lin, K. Z., & Mo, P. L. (2003). An Empirical Study on the Impact of Culture on Audit-Detected Accounting Errors. *A Journal of Practice & Theory, Vol. 22, No. 2*, 281-295.

Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research 2*, 429-444.

CNN. (2015, January 12). *Middle East millions fueling European football.* Retrieved December 24, 2015, from CNN: http://edition.cnn.com/2015/01/12/football/qatar-uae-sponsor-football-europe/

Coelli, T. J., Rao, D. P., O'Donnell, C. J., & Battese, G. E. (2005). *An Introduction to Efficiency and Productivity Analysis.* New York: Springer.

Companies House. (2016). *About us*. Retrieved April 16, 2016, from GOV.UK: https://www.gov.uk/government/organisations/companies-house/about

Daily Mail. (2015, October 8). *Premier League set for £3bn windfall from global TV rights as rival broadcasters slug it out to screen England-based superstars.* Retrieved December 24, 2015, from Daily Mail: http://www.dailymail.co.uk/sport/football/article-3264606/Premier-League-set-3bn-windfall-global-TV-rights-rival-broadcasters-slug-screen-England-based-superstars.html

Elberse, A., & Dye, T. (2012). Sir Alex Ferguson: Managing Manchester United. *Harvard Business School Case 513-051*, 1-25.

Farrell, M. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society. Series A (General), Vol. 120, No. 3*, 253-290.

Franck, E. (2010). Private Firm, Public Corporation or Member's Association Governance Structures in European Football. *International Journal of Sport Finance 5*, 108-127.

Gerrard, B. (2010). Analysing Sporting Efficiency Using Standardised Win Cost: Evidence from the FA Premier League, 1995 – 2007. *International Journal of Sports Science & Coaching Volume 5 Number 1*, 13-35.

GOV.UK. (2016). *Leasehold property*. Retrieved March 17, 2016, from GOV.UK: https://www.gov.uk/leasehold-property/overview

Greene, W. (2003). *Econometric Analysis (5th ed.).* Upper Saddle River: NJ: Prentice Hall.

Haas, D. J. (2003a). Technical Efficiency in the Major League Soccer. *Journal of Sport Economics, Vol. 4 No. 3*, 203-215.

Haas, D. J. (2003b). Efficiency of English Football Teams: A Data Envelopment Analysis Approach. *Managerial and Decision Economics, Vol. 24, No. 5*, 403-410.

Hamil, S., & Walters, G. (2010). Financial performance in English professional football: 'an inconvenient truth'. *Soccer & Society, Vol. 11, No. 4*, 354-372.

Hofler, R. A., & Payne, J. E. (1997). Measuring efficiency in the National Basketball Association. *Economics Letters 55*, 293-299.

Independent. (2010, February 27). *The debt league: How much do clubs owe?* Retrieved February 20, 2016, from Independent: http://www.independent.co.uk/sport/football/premier-league/the-debt-league-how-much-do-clubs-owe-1912244.html

Lang, M., Grossmann, M., & Theiler, P. (2011). The Sugar Daddy Game: How Wealthy Investors Change Competition in Professional Team Sports. *Journal of Institutional and Theoretical Economics, Volume 167, Number 4*, 557-577.

Leach, S., & Szymanski, S. (2015). Making Money Out of Football. *Scottish Journal of Political Economy, 62(1)*, 25-50.

Lensink, R., Meesters, A., & Naaborg, I. (2008). Bank efficiency and foreign ownership: Do good institutions matter? *Journal of Banking & Finance 32*, 834-844.

Monsenego, J. (2012). *Taxation of Foreign Business Income within the European Internal Market.* Amsterdam: IBFD.

Moore, D. S., McCabe, G. P., Alwan, L. C., Craig, B. A., & Duckworth, W. M. (2011). *The Practice of Statistics for Business and Economics.* New York: W.H. Freeman and Company.

Müller, C. J., Lammert, J., & Hovemann, G. (2012). The Financial Fair Play Regulations of UEFA: An Adequate Concept to Ensure the Long-Term Viability and Sustainability of European Club Football? *International Journal of Sport Finance 7.2*, 117-140.

Norris, J. (2014, April 24). *Why footballers are worth every penny*. Retrieved March 3, 2016, from Crunch: https://www.crunch.co.uk/blog/small-business-advice/2014/04/24/footballers-paid-average-wage/

OECD. (2016). *Tax*. Retrieved March 16, 2016, from OECD Data: https://data.oecd.org/tax/social-security-contributions.htm

Palepu, K. G., Healy, P. M., & Peek, E. (2013). *Business Analysis and Valuation IFRS Edition.* Andover: Cengage Learning EMEA.

Raab, R., & Lichty, R. (2002). Identifying sub-areas that comprise a greater metropolitan area: the criterion of county relative efficiency. *Journal of Regional Science 42*, 579-594.

Richmond, J. (1974). Estimating the Efficiency of Production. *International Economic Review Vol. 15, No. 2*, 515-521.

Rohde, M., & Breuer, C. (2016). The Financial Impact of (Foreign) Private Investors on Team Investments and Profits in Professional Football: Empirical Evidence from the Premier League. *Applied Economics and Finance Vol. 3, No. 2*, 243-256.

Rowland, C. (2014, July 8). *FFP and The Amortisation of Suarez*. Retrieved March 16, 2016, from The Tomkins Times: https://tomkinstimes.com/2014/07/ffp-and-the-amortisation-of-suarez/

Samagaio, A., Couto, E., & Caiado, J. (2009). Sporting, financial and stock market performance in English football: an empirical analysis of structural relationships. *Centre for Applied Mathematics and Economics Working Papers*.

Sass, M. (2016). Glory Hunters, Sugar Daddies, and Long-Term Competitive Balance Under UEFA Financial Fair Play. *Journal of Sport Economics, Vol 17(2)*, 148-158.

Sloane, P. J. (1971). The economics of professional football: The football club as a utility maximizer. *Scottish Journal of Political Economy 17, 2*, 121-146.

Storm, R. K., & Nielsen, K. (2012). Soft budget constraints in professional football. European Sport Management. *European Sport Management Quarterly, 12(2)*, 183-201.

Sydsæter, K., Hammond, P., & Strøm, A. (2012). *Essential Mathematics for Economic Analysis.* Harlow: Pearson Education Limited.

Szymanski, S. (2014). Fair Is Foul: A Critical Analysis of UEFA Financial Fair Play. *International Journal of Sport Finance, 9*, 218-229.

The Football League. (2015, October 13). *Regulations*. Retrieved March 15, 2016, from The Football League: http://www.football-league.co.uk/global/regulations.aspx

The Guardian. (2010, February 5). *What's gone wrong at Portsmouth? Ten reasons for the demise of a club.* Retrieved December 24, 2015, from The Guardian: http://www.theguardian.com/football/2010/feb/05/portsmouth-balram-chainrai-sacha-gaydamak

The Guardian. (2015, April 14). *Twenty-eight English clubs are now owned overseas, increasing the risk of tax avoidance.* Retrieved December 24, 2015, from The Guardian: http://www.theguardian.com/football/2015/apr/14/english-football-clubs-owned-abroad-tax-avoidance

The Premier League. (2015, July 1). *History of the Premier League*. Retrieved from The Premier League: http://www.premierleague.com/en-gb/history/premier-league/

The Premier League. (2015). *Premier League Handbook Season 2015/16.* Retrieved March 15, 2016, from The Premier League: http://www.premierleague.com/content/dam/premierleague/site-content/News/publications/handbooks/premier-league-handbook-2015-16.pdf

The Telegraph. (2014, November 14). *Average Premier League salary rockets to £2.3m as clubs' TV windfall goes straight into players' pockets*. Retrieved March 3, 2016, from The Telegraph: http://www.telegraph.co.uk/sport/football/competitions/premier-league/11231076/Average-Premier-League-salary-rockets-to-2.3m-as-clubs-TV-windfall-goes-straight-into-players-pockets.html

Timmer, C. P. (1971). Using a probabilistic frontier production function to measure technical efficiency. *Journal of Political Economy 79*, 776-794.

Total Sportek. (2015, February 11). *Premier League TV Rights Money Distribution (2016-19).* Retrieved December 24, 2015, from Total Sportek: http://www.totalsportek.com/money/premier-league-tv-rights-money-distribution/

Tottenham Hotspur Limited. (2013, June 30). *Annual Report and Financial Statements*. Retrieved from Company House: https://s3-eu-west-1.amazonaws.com/document-api-images-prod/docs/enZRrnna89OmNwKxKUlTOTRqZUgi2cN61Eu3HRBPvR4/application-pdf?AWSAccessKeyId=ASIAJ6JQSRD5HSWWNR6A&Expires=1458209344&Signature=J9mbpvHE0Za%2FWjvQnx6sKDyvCXQ%3D&x-amz-security-token=AQoDYXdzEIf

Transfermarkt. (2016). *Luis Suárez*. Retrieved March 16, 2016, from Transfermarkt: http://www.transfermarkt.co.uk/luis-suarez/profil/spieler/44352

UEFA. (2015, December 11). *UEFA rankings for club competitions.* Retrieved December 24, 2015, from UEFA: http://www.uefa.com/memberassociations/uefarankings/country/

University of Queensland. (2008, October 29). Efficiency and Productivity Measurement: Stochastic Frontier Analysis. Australia. Retrieved January 3, 2016

Wilson, R., Plumley, D., & Ramchandani, G. (2013). The relationship between ownership structure and club performance in the English Premier League. *Sport, Business and Management: An International Journal, Vol. 3 Iss 1*, 19-36.

Zak, T. A., Huang, C. J., & Siegfried, J. J. (1979). Production Efficiency: The Case of Professional Basketball. *The Journal of Business, Vol. 52, No. 3*, 379-392.