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Abstract

The financial valuation of a football clubs contain a significant gap between the book values and the market values. This gap is driven by the valuation of the intangible assets of a football club, mainly it's player contracts. In this thesis a model that could predict the market value of a player is built. If this model proves to be accurate in predicting the market value of a player, it could be used by accounting regulators to introduce a reevaluation option for the intangible assets of a football club. This study focusses on players from the Dutch Eredivisie, Portuguese Liga Portugal, Belgian Jupiler Pro League, Turkish Süper Lig and Scottish Premiership during the 2022/23 season. An ordinary least squares (OLS) regression will be performed. These results will then be tested against transfers that actually happened during the 2022/23 season.

The findings reveal that the market value of a player is significantly influenced by both the characteristics and the performance statistics of a player. For the characteristics, a significant relation between the market value and a player's age, position, footedness and league is found. For the performance statistics a significant relation is found for minutes played, goals scored, assists provided and the passing accuracy. After testing the predicted market value of a player against transfer fees that were actually paid, no significant differences were found. Therefore, such a model could be used by accounting regulators to allow for a reevaluation option for the intangible assets of a football club.

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1. Introduction

1.1 Research Problem and Motivation

The gap between the market value and the book value of many companies is growing. This shows that intangible assets such as human capital are becoming more important in determining a company's market value (Żarnik-żuławska, 2017). This can also be seen in the football industry, since the total assets of a football club often equal one-third to one-half of the market value of their total assets (Lozano & Gallego, 2011). Those football clubs are no longer just clubs, they have become companies. Some of these clubs earn billions in revenue, there even are European clubs that are on the stock exchange (Müller, Simons & Weinmann, 2017). Because of these high revenues, the transfer fees paid by football clubs are reaching an all-time high. Despite the revenues and transfer fees reaching all-time highs, many football clubs are in critical financial situations (Kanyinda, Bouteiller & Karyotis, 2019). The amount of clubs in critical financial situations can partially be explained by the current regulations on accounting for intangible assets. Since there is often a large gap between the market value and the net book value of a football club's intangible assets. This can result in football clubs being close to accounting bankruptcy, but they can still survive because there is a big hidden value in their intangible assets (Lozano & Gallego, 2011).

The gap between the book and market value of a football arises from the current accounting regulations. Under the International Financial Reporting Standards (IFRS) human resources are not disclosed as assets. In the football industry player contracts are accounted for as intangible assets, according to the International Accounting Standards (IAS) 38. Under this approach the true value of the human capital is not accurately reflected (Kučera, 2019). Since not all players of a football club meet the requirements to be capitalized, players from the youth academy or players for which no transfer fee was paid are not allowed to be capitalized. However, Kučera (2019) found that there is a relationship between the success of a football club and the professional contracts it holds. Therefore, a valuation model for human capital could provide a more accurate representation of a football clubs core assets. Since people cannot be owned by any organization, they cannot be listed as assets in the financial statements. To still give the shareholders relevant information on the human capital of a football club, the information on the fair value of their players could be represented in the notes of the financial statements.

If a player can be recognized under the current accounting regulations, a club should recognize the contract as an intangible asset and amortize these contracts over the length of this contract. However, Amir & Livne (2005) found that these amortization periods are often not in line with the periods in which the actual economic benefits are received. They found evidence that these benefits often don't last longer than two years, which is often shorter than the amortization periods. One of the reasons that these benefits last shorter than the amortization periods could be that players get transferred before the end of their contract (pavlovic, Milačić & Ljumović, 2014).

To decrease the gap between the market value and book value of a football club's intangible assets, multiple solutions have been researched. One of these possible solutions is wage capitalization. Since a club is compelled to pay these wages to a player during his contract and these values could be amortized with each payment (Oprean & Oprisor, 2014). However free agents tend to have a better negotiation position, since a club does not have to pay a transfer fee. This could result in an overvaluation for free agents. A different possible solution that is researched is to use the recruitment cost for a player's contract. These costs could be easily determined for academy players, based on personnel, facility costs etc. The main problem with this approach is that these costs are determined for the whole academy, not for a specific player. These costs would have to be distributed over the players that actually sign a professional contract. Since not every academy player signs a professional contract, this method might lead to the overvaluation of the academy players (Oprean & Oprisor, 2014).

1.2 Research Objectives

Under the current accounting regulations, the financial statements of football clubs are not comparable. Clubs with a development strategy tend to have a larger portion of their assets unaccounted for. Besides a substantial portion of assets which are unaccounted for in the financial statements, the values that are reported are also outdated. This is because the change in value over time are also not accounted for (Maroun, Van Zijl, Chesaina & Garnett, 2022). Therefore, it is important reevaluate the current accounting system for football clubs in relation to transfers. In this thesis the following research question will be studied:

Can the market values of football players be explained by a player's characteristics and performance statistics?

If this model proves to be useful for estimating the fair values of football players. Accounting regulation setters could use it, to enhance the current system of linear amortization

with no fair value adjustments. By applying a fair value system, it could also allow for the recognition of academy players and free agents, who are currently not accounted for (Maroun et al., 2022). Which will make the financial statements of football clubs more transparent and comparable. Resulting in better information for the stakeholders.

1.3 Research Methodology

To analyze the relationship between the characteristics and performance statistics of a player and his market value, an ordinary least squares regression will be performed. The data that will be used in this research is coming from transfermark.com and whoscored.com. Transfermarkt.com has information about a player's characteristics such as his age and height, and a crowdsourcing based estimate of a player's market value. Whoscored.com has data on the performance statistics of players, such as goals scored, the number of cards received and their passing accuracy.

The dataset will be made up of clubs from five European leagues, the Dutch Eredivisie, Portuguese Liga Portugal, Belgian Jupiler Pro League, Turkish Süper Lig and the Scottish Premiership. The data will be from the 2022/23 season since this is the most recent season that has complete data. Goalkeepers will be excluded from the sample since, most of the performance statistics do not apply to them. In this regression the market value will be the dependent variable. To verify the results of this model the results will be tested against transfers that happened during the 2022/23 season.

1.4 Thesis Outline

In the second chapter of this thesis the existing literature will be discussed. Based on the existing literature multiple hypotheses will be developed. In the third chapter the methodology of this research will be explained. This chapter will also give clarification on the variables that are used. The results of the data analysis will be described in the fourth chapter, these results will be discussed in the fifth chapter. In the sixth chapter a conclusion will be drawn and the limitations of this research will be explained. In this chapter there will also be recommendations for future research.

2. Literature review and Hypothesis development

2.1 Previous models

In previous studies there have been multiple attempts to build a model to estimate a player's market value. Felipe et al. (2020) used players from the top five leagues in Europe and estimated market values from transfermarkt.com to build their model. In their analysis they found that the age of a player, the position he plays in, the league he plays in and whether he plays in a European competition (Champions league or Europa league) or not, have a significant impact on the market value of a player.

Müller et al. (2017) have also build a model that estimates the market value of players in Europe's top five leagues. However, Müller et al. (2017) also looks at the performance statistics of a player. Their model is based on the crowdsourcing estimates of market values from transfermarkt.com. They found that their data driven model did not significantly deviate from actual transfer fees that were paid for certain players. Their model provided a better estimate for players in the low and medium price range, however the crowdsourcing estimates were better able to estimate the values of players in the high price category. This could be caused by the lack of popularity indicators such as a potential boost to tickets sales. The upside of this model is that the estimates are more transparent and reproducible. With a data driven model it is also possible to update the values more frequently, since it does not rely on the input of users. This reliance on input from users is the reason that market values are infrequently updated via a crowdsourcing project such as transfermarkt.com. However, they only tested their model on the top five leagues in Europe, meaning that this might not be applicable to all leagues.

2.2 Player characteristics

Lucifora & Simmons (2003) studied the salaries of players in the Italian Serie A and Serie B, they found that the salary of player tends to increase until he reaches 28. After this point the salaries trend downwards. Bryson, Frick & Simmons (2012) modelled the salaries of players in one of Europe's top five leagues. They found a similar for the effect of the age of a player on his salary, with the turning point being at 26 instead of 28. Both findings are explained by the fact young players are inexperienced, so as they gain more experience, they also tend to get a more important role within their team. But after a certain point 28 in Lucifora & Simmons (2003) and 26 in Bryson et al. (2012) this increase in experience and tactical knowledge gets offset by a decrease in a player's physical ability.

***H1**: The age of a player affects his market value.*

Another characteristic that can influence the market value of a player is his height. Since longer players have an increased probability winning aerial duels which can lead to scoring or preventing a goal. Fry, Galanos & Posso (2014) studied the goal scorers in the champions league between 1991 and 2011. They found that this increased chance in winning headers has a significant effect on the productivity of a player. Since players with a higher productivity are more valuable to a club, this might also increase his market value. Kologlu, Birinci, Kanalmaz & Ozyilmaz (2018) used a dataset with attackers from the English, Spanish, German and Italian top divisions, they found that height has a significant effect on a player's market value. Players with a height between 180 and 184 centimeters had the highest market value in this sample. This could be explained by the fact that longer players might be less agile and lack dribbling skills, whereas shorter players lack the ability to wins aerial duels.

***H2**: The height of a player has a positive effect on a player's market value.*

There are also differences in the market values for the different positions (goalkeepers, defenders, midfielders and attackers) in the Spanish Laliga. However, within those groups there are no significant differences (for example left backs and center backs) (He, Cachucho & Knobbe,2015). Felipe et al. (2020) performed a regression on players in the top five leagues in Europe, in their research they found that midfielders and attackers have a significantly higher market value than goalkeepers and defenders.

***H3**: The position a player plays in affects his market value.*

Since two-footed players are much rarer than left or right footed players and two-footed players are more flexible. The two-footed players earn higher wages than players that are one-footed (Bryson et al., 2012). Since clubs are willing to pay a wage premium for two-footed players to stay at their club. Clubs might also be willing to pay a higher transfer fee for a two-footed player. Herm, Callsen-Bracker & Kreis (2014) found a similar result for effect the footedness of a player on his market value in a sample with players from the German Bundesliga.

***H4**: The footedness of a player affects his market value.*

There are also differences between the different leagues a player can play in. So are some leagues considered more competitive than others. This could also influence a player's market value. If a player has proven to be able to perform in a tougher league, clubs might be willing to pay more for this player. Rodríguez, Hassan & Coad (2018) found that the market value of players in the English Premier league are significantly higher than the market values of players in the Spanish Laliga. Bell, Brooks & Brooks (2023) found comparable results for the effect for the league in which player is active on his market value. They found that the players in the English Premier League are significantly higher valued and have significantly higher salaries, than players in the other top five leagues in Europe.

***H5**: The league a player plays in has an effect on his market value.*

2.3 Performance indicators

Since teams tend to start their best players, the amount minutes played by a player could give an indication of the talent level of a player. Using a sample of players that transferred during the 2011-12 season in the English premier League Ruijg & Van Ophem (2014) found that there is a positive relationship between the minutes played by a player and the transfer fees paid for those players. Müller et al. (2017) built a model to estimate the market value of players in the top five leagues in Europe, they also found a significant positive relationship between the number of minutes played by a player and his market value.

***H6**: The number of minutes played positively affects a player's market value.*

Since a football game is won based on who scored the most goals, players that score more goals or give many assists will have a higher market value. Majewski (2016) found that the effects for goals scored and assists given on the market value is positive and significant for the 150 most valuable forwards. He also found that for attackers the variables of goals and assists show the strongest influence on the market value.

***H7**: The number of goals a player scores have a positive effect on his market value.*
***H8**: The amount of assists a player gives has a positive effect on his market value.*

The passing accuracy is another statistic that gives an indication of a players talent level. Herm et al. (2014) found that for players in the German Bundesliga, a higher passing accuracy has positive effect market value. Since if a player has a high passing accuracy it allows the team to keep possession, meaning that the team can build up to try and create chances, meanwhile the opposing team cannot score.

***H9**: The passing accuracy of a player has a positive effect on his market value.*

If a player receives a red card or if he receives multiple yellow cards, a player will be suspended for one or multiple games. These suspensions can have a negative effect on the performance of the team. Therefore, clubs will be more interested in players that receive less cards and they might be willing to pay more for those players (Patnaik, Praharaj, Prakash & Samdani, 2019). Lussier, Kim, Magnusen & Kim (2021) found that in the American Major League Soccer (MLS) players that receive many yellow and/or red cards have significantly lower wages. Since those wages are an indication of what the players are worth to the club, it might also give an indication of how much another club would be willing to pay for this player.

***H10**: The number of cards (Reds and yellows) negatively impacts a player's market value.*

3. Methodology.

3.1 Data collection

The dataset for this study consists of data from the 2022/23 season for clubs in the Dutch Eredivisie, Portuguese Liga Portugal, Belgian Jupiler Pro League, Turkish Süper Lig, and Scottish Premiership. This sample was chosen since the 2022/23 season is the most recent season of which all the data is available. The leagues were chosen since they are considered smaller leagues, but they are still big enough that the data is accurately available. So, by using these leagues it can be checked whether or not it is also possible to predict the market values of players outside of the top five leagues in Europe.

The data on player characteristics such as age, height and footedness are retrieved from transfermarkt.com. Transfermarkt.com also provides a crowdsourcing based estimate of a player's market value. The data for the performance statistics of a player, such as goals scored, passing accuracy and cards received is retrieved from whoscored.com.

Since the performance of a goalkeeper is measured differently from outfield players. Goalkeepers are excluded from the sample, since most of the performance statistics are not applicable to them.

3.2 Variables and measurements

In this study a player's market value is chosen as the dependent variable. For this market value the crowdsourcing estimates from transfermarkt.com are used. The market values will be measured in euros. As can be seen in Table 1, the average market value of player in this sample is €2,419,846.-. However, this variable seems to be right-skewed, therefore the logarithm of market value will be used as the dependent variable.

The variables that are used to predict a player's market value, can be split in two groups, a player's characteristics and his performance statistics.

The variables that are used for the player characteristics are: age, height, position, footedness and league. The age of a player will be measured in years. To check for a non-linear relationship, the squared term of a player's age will also be used. The height of a player will be measured in centimeters. On average a player in this sample is 25.38 years old and has a height of 181.49 centimeters (Table 1).

The position of a player is a categorial variable split in to three categories: defenders, midfielders and attackers. For this variable, attacker will be the reference category. In this sample 649 (31.2%) players are defenders, 769 (37.31%) are midfielders and 643 (31.49%) are attackers (Table 2). The footedness of a player will also be accounted for via a categorial variable. This variable will be split up by two-footed, left-footed and right-footed. For this variable two-footed will be the reference category. In this sample 42 (2.1%) of players are two-footed, 530 (26.55%) are left-footed and 1424 (71.34%) are right-footed (Table 3). Finally, the league in which a player is active will be split up in to five different categories: Eredivisie, Liga Portugal, Scottish Premiership, Jupiler Pro League or Süper Lig. For this variable, the Eredivisie will be used as the reference category. 425 (20.62%) of the players in this sample play in the Eredivisie, 386 (18.73%) play in the Jupiler Pro League, 427 (20.73%) in the Liga

Portugal, 288 (13.97%) in the Scottish Premiership and the other 535 (25.96%) play in the Süper Lig (Table 4).

For the performance statistics of a player, minutes played, goals, assists, passing accuracy, yellow cards and red cards will be used. Minutes played will be measured by the number of minutes a player was on the field during the past season. The average amount of minutes played by a player in this sample was 1289.67 minutes (Table 1). For goals, the amount of goals a player scored during the past season will be measured. Assists are measured as the amount of assists a player provided during the past season. On average a player in this sample scored 2.02 goals and gave 1.40 assists (Table 1). Passing accuracy is the percentage of passes completed by a player during the past season. The average player in this sample has an passing accuracy of 77.35% (Table 1). Finally yellow and red cards will be measured by the amount of cards a player received during the past season. On average a player received 2.67 yellow cards and 0.14 red cards (Table 1).

3.3 Research design

In this study the predictability of a player's market value will be researched using a quantitative approach. Multiple ordinary least squares (OLS) regression will be performed to check whether there is a relationship between characteristics and performance statistics of football player and his market value. The OLS regression method is chosen because it allows for the estimation of the linear relationship between the dependent variable (market value) and multiple independent variables (player characteristics and performance statistics).

Using OLS also gives an estimation of the coefficients which indicates the direction and the strength of the relationship between the dependent and independent variable. It also provides statistical measures to assess the goodness of fit of the model and the significance of individual variables.

Three different models will be estimated, in the first model the player's age, the squared term of the age, the player's Height and his position will be taken into account.

$$\text{Log\_}Market\_value_i = \beta_0 + \beta_1 Age_i + \beta_2 Age\text{^}2_i + \beta_3 Height_i + \beta_4 Defender_i + \beta_5 Midfielder_i$$

Where β_0 is the intercept and β_1 $till$ β_5 are the coefficients of the independent variable. ε_i is the error term.

In the second model the footedness of a player and the league in which a player is active will be added.

$$log\_Market\_value_i = \beta_0 + \beta_1 Age_i + \beta_2 Age\text{^}2_i + \beta_3 Height_i + \beta_4 Defender_i + \beta_5 Midfielder_i + \beta_6 Left\ Footed + \beta_7 Right\ Footed_i + \beta_8 Jupiler\ Pro\ League_i + \beta_9 Liga\ Portugal_i + \beta_{10} Scottish\ Premiership + \beta_{11} Süper\ Lig_i$$

Where β_0 is the intercept and $\beta_1\ till\ \beta_{11}$ are the coefficients of the independent variable. ε_i is the error term.

In the third and final model, the performance statistics of a player will also be included. These are the number of minutes played, the number of goals scored, the amount of assists provided, the passing accuracy and the amount of yellow and red cards received. To see how to performance of a player on the field impacts his market value.

$$\log\_Market\_value_i = \beta_0 + \beta_1 Age_i + \beta_2 Age\text{^}2_i + \beta_3 Height_i + \beta_4 Defender_i + \beta_5 Midfielder_i + \beta_6 Left\ Footed + \beta_7 Right\ Footed_i + \beta_8 Jupiler\ Pro\ League_i + \beta_9 Liga\ Portugal_i + \beta_{10} Scottish\ Premiership + \beta_{11} Süper\ Lig_i + \beta_{12}\ Minutes\ Played_i + \beta_{13} Goals_i + \beta_{14} Assists_i + \beta_{15} Passing\ Accuracy_i + \beta_{16} Yellows_i + \beta_{17} Reds_i + \varepsilon_i$$

Where β_0 is the intercept and $\beta_1\ till\ \beta_{16}$ are the coefficients of the independent variable. ε_i is the error term.

After these models are estimated, the model will be tested against the transfer fees that were actually paid during the 2022/23 season in these five leagues. This will be done to check whether there a statistically significant differences between the predicted market values of a player and the transfer fee paid by football clubs. To evaluate this a two-sided t-test will be performed.

3.4 Assumptions of OLS

The first assumption of OLS is that there is a linear relationship between the dependent variable and the independent variables. This was checked via scatterplots. These scatterplots generally showed a linear relationship between the logarithm of a player's market value and the player characteristics and performance statistics. Meaning that this assumption holds for this sample.

Another assumption of OLS is that the residuals should follow a normal distribution. This was checked via a histogram on the residuals. This histogram showed a normal distribution of the residuals, indicating that this is assumption holds for this sample.

The third assumption of OLS is that there should be no or little multicollinearity. To test for this assumption, pairwise correlations were assessed in a correlation matrix. This matrix showed low correlations between variables none of these pairwise correlations had a value higher than 0.8, indicating no multicollinearity issues.

The final assumption of OLS is that there should be homoscedasticity. To test for this assumption the Breusch-Pagan/Cook-Weisberg test was used. The test statistic chi^2 = 0.40 with a p-value of 0.528. since this p-value is greater than 0.05, the null hypothesis that there is a constant variance in the error terms cannot be rejected. Therefore, the assumption of homoscedasticity is satisfied for the regression model.

4. Results

In this chapter the findings from the multiple OLS regression are presented. Three different models will be analyzed. The dependent variable will be the logarithm of a player's market value for all three of the models. The results are summarized in Table 5.

Table 5 regression results

Dependent variable log of market value

	MODEL 1	MODEL 2	MODEL 3
AGE	0.868***	0.901***	0.508***
	(0.066)	(0.066)	(0.054)
AGE^2	-0.017***	-0.017***	-0.011***
	(0.001)	(0.001)	(0.001)
HEIGHT	-0.001	-0.002	0.004
	(0.004)	(0.005)	(0.004)
DEFENDER	-0.304***	-0.314***	-0.084
	(0.074)	(0.073)	(0.070)
MIDFIELDER	-0.208***	-0.206***	-0.110*
	(0.076)	(0.074)	(0.065)
LEFT-FOOTED		-0.447**	-0.336**
		(0.210)	(0.166)
RIGHT-FOOTED		-0.444**	-0.323**
		(0.204)	(0.161)
JUPILER PRO LEAGUE		0.188**	0.408***
		(0.094)	(0.074)
LIGA PORTUGAL		-0.151*	0.039
		(0.0908)	(0.073)
SCOTTISH PREMIERSHIP		-0.790***	-0.381***
		(0.106)	(0.085)
SÜPER LIG		0.458***	-0.051
		(0.087)	(0.071)
MINUTES PLAYED			0.0003***
			(0.000)
GOALS			0.092***
			(0.009)
ASSISTS			0.133***
			(0.014)
PASSING ACCURACY			0.031***
			(0.002)
YELLOW CARDS			-0.012
			(0.013)
RED CARDS			-0.011
			(0.062)
INTERCEPT	3.250***	3.445***	4.696***
	(1.232)	(1.234)	(1.061)

Notes: *= p<0.1 **P<0.05 ***P<0.01; standard errors are in parentheses. The Number of observations is 1968 for the first model 1941 for the second model and 1813 for the third model.

4.1 Model 1

In the first model that was estimated the basic characteristics of a player: age, age squared, height, and position, with attackers as the reference category, are included (Table 5).

For this set of variables, a significant regression model was found, F (5, 1962) = 42.93, p < 0.001. This model has an R squared of 0.099, indicating that 9.86% of the variance in a player's market value can be explained by this model.

The results show that age is a significant predictor for the market value of a player, with a beta of 0.868 (SE = 0.066, t = 13.06, p <0.001). Indicating that for every year a player gets older, his market value goes up by 86.8%, assuming that all the other factors stay the same. Age squared also showed a significant effect on a player's market value (B = -0.017, SE = 0.001, t = -13.45, p < 0.001). Showing that the age of player increases his market value at a diminishing rate. For the height of a player no significant effect on his market value has been found (B = -0.001, SE = 0.005, t = -0.30, p = 0.765).

The last variable that was used in this model is the position of a player. Defenders (B = -0.304, SE = 0.074, t = -4.12, p < 0.001) and midfielders (B = -0.208, SE = 0.076, t = -2.75, p = 0.006) are both significant and negative. This indicates that if all the other variables stay the same the market value for a defender is 30.4% lower than those of an attacker, for midfielders this is 20.8%.

4.2 Model 2

In the second model the other characteristics are added. These characteristics are the footedness of a player, with two-footed as the reference category and the league in which this player is active, with the Eredivisie as reference category (Table 5).

For this set of variables, a significant regression model was found, F (11, 1929) = 30.50, p < 0.001. This model has an R squared of 0.148, indicating that 14.82% of the variance in a player's market value can be explained by this model. This model shows, an improvement in explanatory power with the inclusion of the footedness of a player and the league in which a player is active, in comparison to the previous model.

The effect of age (B = 0.900, SE = 0.066, t = 13.73, p < 0.001) and age squared (B = -0.017, SE = 0.001, t = -14.01, p < 0.001) remained significant and similar in magnitude in this model. The effect of a player's height (B = -0.002, SE = 0.005, t = -0.40, p = 0.691) remained insignificant. The effect of a players positions also remained significant and similar in magnitude for defenders (B = -0.314, SE = 0.073, t = -4.31, p < 0.001) and midfielders (B = -0.206, SE = 0.074, t = -2.78, p = 0.006).

The results of this model also show that the footedness of a player has a significant effect on his market value. Both left-footed (B = -0.447, SE = 0.210, t = -2.12, p = 0.034) and right-footed (B = -0.444, SE = 0.204, t = -2.17, p = 0.030) have a negative effect on a player's market value. This indicates that if all the other variables stay the same, the market value of a left-footed player is 44.7% lower than those of two-footed players, for right footed-players this 44.4%.

The final variable of this model is the league in which a player is active. Playing in the Jupiler Pro League (B = 0.188, SE = 0.094, t = 2.00, p = 0.046) has a significant and positive effect on a player's market value. Meaning that if all other variables are equal, players in the Jupiler Pro League have a market value that is 18.8% higher than those of players in the Eredivisie. For players in the Scottish Premiership (B = -0.790, SE = 0.106, t = -7.45, p < 0.001) and Süper Lig (B = -0.458, SE = 0.087, t = -5.23, p < 0.001) this effect is also significant, however for these leagues the effect on a player's market value is negative. The players in the Scottish Premiership have market values that are 79% lower than those of players in the Eredivisie, players in the Süper Lig have market value that are 45.8% lower than those of players in the Eredivisie. Lastly for players in the Liga Portugal (B = -0.151, SE = 0.091, t = -1.66, p = 0.097) no significant differences were found in comparison to the Eredivisie at a 5% significance level.

4.3 Model 3

In the final model the performance statistics will also be added. These statistics are: minutes played, goals scored, assists, passing accuracy, yellow cards, and red cards (Table 5).

For this set of variables a significant regression model was found, F (17, 1795) = 85.49, p < 0.001. This model has an R squared of 0.447, indicating that 44.74% of the variance in a player's market value can be explained by this model. This model shows an improvement in explanatory power with the inclusion of performance statistics in comparison to the other two models.

In this model the effect of age (B = 0.508, SE = 0.055, t = 9.31, p < 0.001) and age squared (B = -0.011, SE = 0.001, t = -10.84, p < 0.001) remain significant. The effect of a player's height (B = 0.004, SE = 0.004, t = 1.13, p = .258) remains insignificant. The effect of a player's position is no longer significant for both defenders (B = -0.084, SE = 0.070, t = -1.21,

p = 0.227) and midfielders (B = -0.110, SE = 0.065, t = -1.70, p = 0.090) at a 5% significance level.

The effect of the footedness of a player remains significant for both left-footed (B = -0.336, SE = 0.166, t = -2.03, p = 0.043) and right-footed (B = -0.323, SE = 0.161, t = -2.01, p = 0.044) players, in comparison to two-footed players. For players in the Jupiler Pro League (B = 0.408, SE = 0.074, t = 5.50, p < 0.001) the effect became more significant than in the previous model, now being significant at a 1% significance level. However, the effect of playing in the Süper Lig (B = -0.051, SE = 0.071, t = -0.72, p = 0.473) is no longer significant at a 5% significance level. The effect for playing in the Scottish premiership (B = -0.381, SE = 0.085, t = -4.49, p < 0.001) remains significant and the effect of playing in the Liga Portugal (B = 0.039, SE = 0.073, t = 0.54, p = 0.590) remained insignificant.

For the performance statistics of a player, the number of minutes played (B = 0.0003, SE = 0.00004, t = 6.99, p < 0.001) shows a significant positive effect on a player's market value. Meaning that if a player plays one more minute and all the other factors remain the same, his market value increases with 0.03%. The amount of goals scored (B = 0.092, SE = 0.009, t = 10.00, p < 0.001) and assists provided (B = 0.133, SE = 0.014, t = 9.34, p < 0.001) also show a significant and positive relationship with the market value of a player. Showing that the market value of a player increases with 9.2% if he scores one more goal and with 13.3% if he provides one more assist, assuming all the other factors remain the same. The passing accuracy (B = 0.031, SE = 0.002, t = 12.28, p < 0.001) of a player also shows a positive and significant effect on his market value. Indicating that players that are more precise in their passing have a higher market value. Lastly no significant effect was found for the amount of yellow (B = -0.012, SE = 0.013, t = -0.95, p = 0.342) or red cards (B = -0.011, SE = 0.062, t = -0.18, p = 0.857) a player received.

4.4 Robustness

To test the robustness of this model it will be tested against transfer fees that were actually paid during the 2022/23 season. To do this test only transfers with a transfer fee between clubs within the five leagues of this study are used.

After performing a paired two-sided t-test to compare the transfer fees that were paid and the transfer fees that are expected based on the model. It is found that actual transfer fees had a mean of 4019153 (SD = 4555335) and the expected transfer fees had a mean of 5156030 (SD = 3010000). The paired t-test revealed a mean difference of -1136878 (t = -0.2854, df = 58), with corresponding p-values of 0.388 for the hypothesis that the mean difference is smaller than 0, 0.776 for the hypothesis that the mean difference is not equal to 0, and 0.612 for the hypothesis that the mean difference is greater than 0.

These results indicate that there is no statistically significant difference between actual transfer fees and the predicted transfer fees based on the model at a 5% significance level. Therefore, the null hypothesis that the mean difference between the two variables is zero cannot be rejected. These results suggest that this model is useful for predicting the actual transfer values of football players, indicating that it could be used to develop regulations for the reevaluation of human capital.

5. Discussion

The regression analysis shows that both the player characteristics and his performance statistics have a significant effect on his market value. For the age of a player a non-linear effect is found, this effect is significant in all three of the models. This was expected since Lucifora & Simmons (2003) and Bryson et al. (2012) found that the salary of a player tends to increase at start of his career, growth would later slow down and after a certain age the wages would go down. However, in contrast to some previous studies such as Fry et al., (2014) and Kologlu et al. (2018) no significant relationship between a player's height and his market value have been found. Similarly to the findings of He et al. (2015) and Felipe et al. (2020) the position in which a player plays also has a significant effect on the market value of a player. The footedness of player has a significant effect on a player's market value, this is in line with the findings of Herm et al. (2014) and Bryson et al. (2012). There also seems to be a relationship between the league a player is active in, which was also found by Rodríguez et al. (2018) Bell et al. (2023). However, this effect is less significant when the performance statistics are added to the model. This could be explained by the fact that the leagues in this sample are relatively similar in strength.

The amount of goals scored and assists provided also shows a significant effect on a player's market value, these findings are similar to those of Majewski (2016). The results for the number of minutes played are in line with the findings of Ruijg & Van Ophem (2014) and Müller et al. (2017). Similar to the findings of Herm et al. (2014) the passing accuracy of a player also has a significant effect on a player's market value. In contrast to the findings of Patnaik et al. (2019) and Lussier et al. (2021), there was no significant relationship found between the amount of cards received, yellow or red, and the market value of a player.

After testing this model on transfer fees that were actually paid, it was found that there are no significant differences between the predictions and the actual values. Therefore, this model could accurately predict the current market value of a player. So, this model could be used by accounting regulation setters, to introduce a reevaluation option for the human capital of a football club. Which could help to increase the transparency and comparability of the financial statements of different football clubs.

6. Conclusion

In this thesis the relationship between the characteristics and performance statistics of a football player and his market value is studied. In this research players from five different European leagues from the 2022/23 season were used, these leagues are the Dutch Eredivisie, Portuguese Primeira Liga, Belgian Jupiler Pro League, Turkish Süper Lig, and Scottish Premiership. On these players an ordinary least squares (OLS) regression analysis was performed. For the player characteristics age, height, position, footedness and the league in which he is active were used. For the performance statistics minutes played, goals scored, assists provided, passing accuracy and the amount of cards received were used.

6.1 Findings

For the age of a player a significant positive relationship was found, however this positive relationship has a diminishing rate. For the height of a player no significant relationship has been found.

The position of a player affects his market value, in this model it is found that defenders and midfielders have significantly lower market values in comparison with attackers. If a player is left- or right-footed their market value is significantly lower than players that are two-footed.

Significant differences have also been found between different leagues, Players active in the Jupiler pro league had a significantly higher market value than players active in the Eredivisie. Whereas player in the Scottish Premiership had significantly lower market values than players in the Eredivisie. For players in the Liga Portugal and the Süper Lig, no significant differences were found in comparison with the Eredivisie.

For the performance statistics of a player a positive and significant relationship was found between the number of minutes played by a player and his market value. The amount of goals scored and assists provided also showed a positive and significant effect on a player's market value. If a player has a higher passing accuracy, it tends to have a positive effect on his market value. Lastly no significant relationship has been found between the amount of cards a player receives and his market value.

This model was checked against actual transfers for during the 2022/23 season. The estimates of the model showed no significant differences with the actual transfer fees that were paid. Therefore, it could be assumed that the model gives an accurate prediction of a player's market value.

6.2 Implications

Under the current accounting regulations, the intangible assets of a football clubs do not show their true value. Therefore, a reevaluation method based on market values could be useful. This way the intangible assets of a football club will be more accurately reflected in their financial statements. Resulting in more transparency and a better comparability of the financial statements between different football clubs. Giving better information to the stakeholder of these football clubs.

6.3 Contribution

This research contributes to the existing literature by estimating a model to predict the market value of player. This has also been done by Felipe et al. (2020) and Müller et al. (2017), however those two studies only looked at the top five leagues in Europe (the top divisions of England, Spain, Germany, Italy and France). Therefore, this study contributes to the literature by focusing on five smaller leagues in Europe, showing that such a model is also applicable in smaller leagues. In practice, this model could help accounting regulators to add a reevaluation option to the intangible assets of a football club. It could also help football clubs to have a better understanding of the market value of its players or the players it wants to sign.

6.4 Limitations

This study also has its limitations. First of all, the model relied on crowdsourced estimates of a player's market value, which may not always perfectly reflect the true market value of a player. Since those values could be biased by fans of a certain club or nation giving a player an higher estimated market value or fans of rival club giving a lower estimated market value. For lesser-known leagues it could also be that there are too few reliable estimates to provide an accurate market value. Another limitation of this study is that goalkeepers are excluded from the sample. Since if accounting regulators want to apply a reevaluation method for the intangible assets of a club, it needs to be applicable to all its players, not just the outfield players. Lastly, this study does not account for the popularity of a player, which could influence a player's market value. Since more popular players could attract more sponsors and have a higher marketing potential.

6.5 Future Research

Future research for this topic could include, applying such model on goalkeepers to find what factors influence their market value. It could also be beneficial to examine this model on more leagues to further test the robustness of this model. Finally future research could look into other factors that might have an influence on a player's market value such as how popular a player is, which could result in a higher attendance in the stadium and potentially more sponsor deals. Another factor that could be looked in to is how injury prone a player is, since Drawer and Fuller (2002) found that if a club has some important players injured, this will likely cause them to have less success in the competitions resulting in lower revenues. Therefore, injury prone players might have a lower market value than players that are less likely to get injured.

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8. Appendix

Table 1 Descriptive statistics of the continuous variables

VARIABLE	MEASUREMENT	MEAN	ST. DEV.	MIN	MAX
AGE	Years	25,38088	4,545242	16	41
HEIGHT	Centimteres	181,4886	6,4977576	160	201
GOALS	Total this season	2,015798	3,389963	0	29
ASSISTS	Total this season	1,397051	2,064633	0	17
PASSING ACCURACY	Percentage	77,35208	10,16385	0	100
YELLOW CARDS	Total this season	2,672986	2,443667	0	13
RED CARDS	Total this season	0,1400737	0,3832232	0	3
MINUTES PLAYED	Total this season	1289,672	899,4264	1	3420
MARKET VALUE	Euro's	2419846	4980427	25000	6500000

Table 2 Player Positions

VARIABLE	CATEGORY	FREQUENCY	PERCENT	CUMMULATIVE
POSITION	Defender	649	31,20	31,2
	Midfielder	769	37,31	68,51
	Attacker	643	31,49	100

Table 3 Footedness of a player

VARIABLE	CATEGORY	FREQUENCY	PERCENT	CUMMULATIVE
FOOTEDNESS	Two-footed	42	2,10	2,10
	Left-footed	530	26,55	28,66
	Right-footed	1424	71,34	100

Table 4 Current league of a player

VARIABLE	CATEGORY	FREQUENCY	PERCENT	CUMMULATIVE
	Eredivisie	425	20,62	20,62
	Jupiler Pro League	386	18,73	39,35
LEAGUE	Liga Portugal	427	20,73	60,07
	Scottish Premiership	288	13,97	74,04
	Süper Lig	535	25,96	100