The Determinants of Football Transfer Market Values: An Age of Financial Restraint

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ABSTRACT

This paper examines the effect of policy introduced by the English Premier League in 2010 aimed at increasing demand for 'home-grown' players on the transfer market value for professional football players. It examines the determinants of football transfer market values between 2009 and 2011 and in doing so attempts to provide possible explanations for the poor financial performance of the English football industry. By introducing new ability indicators of players, this paper finds that the policy had no significant effect on the transfer market value of 'home-grown' players after its introduction. Furthermore this paper contradicts past papers by concluding that the position of a player has no significance in transfer market value. Despite large criticism for short-sighted transfers by football clubs, football clubs seem to take into account the career-long statistics of a player when determining transfer values, providing evidence against the short-sightedness of football clubs as a potential reason for their poor financial performance.

1 Introduction

Sloane (1969) pioneered research in the labour market of professional football; he studied the concept of professional football teams being utility maximisers and not profit maximisers as standard microeconomic theory would suggest. His work catalysed the economic analysis of football in a way similar to studies of American sports, such as Rottenberg (1986). Garcia-del-Barro and Szymanski (2006) found that the actions of Spanish and English football teams supported Sloane's original theory and were more closely approximated by *win* maximization than by *profit* maximisation, both in the short term and the long term. Szymanski & Smith (1997) described the English Premier League (EPL) as 'an industrial cartel selling a highly popular product with only imperfect substitutes. Despite this, the majority of its member teams lose money and the industry has faced successive financial crises.' Franck (2010) found that the English Premier League has not managed to deliver a collective pre-tax profit in any single year since its formation in 1992. Furthermore, Conn (2009) showed that Premier League teams had accumulated liabilities amounting to £3.1 billion in their books as of June 2009. It is this juxtaposition that highlights the need to analyse the efficiency of the football labour market.

[1]I would like to thank Dr. Yuxin Li, my supervisor, who has dedicated much support and Assoc. Prof. Sue Bridgewater, both of the University of Warwick for their time, effort and suggestions and assistance in writing this paper. I would also like to thank Asst. Prof. Luca Flabbi of Georgetown University for his helpful suggestions in improving the future scope of my research. All errors are my own.

This study aims to find out how the market currently assesses player value and whether this is efficient and/or contributing to the financial difficulties faced by many teams today. The financial difficulties imply a labour market that seems not to conform to standard microeconomic theory. It seems that players are being paid *above* their marginal product, suggesting teams' costs are not minimised and in turn profits are not maximised. This paper also seeks to investigate the policy changes of the past few years and their influence on player transfers. The end model may be able to highlight errors of player value assessment and see whether policy aimed at correcting such errors has been effective.

2 Existing Literature

The largest costs for teams in the English Premier League – England's top tier football league – are wages spent on players and transfer fees paid to acquire such players (Battle et. al., 2011). For this reason the labour market for football has become a hot topic for sports economists. As Rosen and Sanderson (2001) explain, *'Professional sport is one of the few empirical cases where the marginal product of a player can be directly assessed.'* Sports are almost unique in affording the opportunity to measure specific work performance on a narrow set of jobs. Most of the work to date has used German data. However, as statistics have gradually been introduced into English football, empirical studies have emerged, some of the most influential are outlined below.

Carmichael, Forrest and Simmons (1999) used EPL football league data to model transfers with an OLS cross-sectional model after applying the Heckman two-step process for sample bias. They found age, games played previous season, goals scored in previous season, and international games played (caps) over entire career, to be significant in determining transfer fees. Their study, along with Speight and Thomas (1997), was unique in its use of English data. These papers' determinants come under some distinct categories. Proxies for experience in the labour market are measured by age, league and cup games played. Their primary proxy for ability is the number of goals scored in the previous season and international appearances, which gives a bias towards attacking players and without other variables fails to suitably assess non-attacking players whose ability is influenced less by goals scored in the previous seasons (goalkeepers being a prime example of this).

Dobson and Gerrard (1999) used a panel data set ranging from 1990 to 1996 and found many similar findings to Carmichael, however they used *career* goals scored as their proxy for ability. Whilst this is biased towards attacking players, it highlights the disagreement between researchers as to whether football teams value 'short-run' recent performance, that is how many goals scored in the *previous season*, or whether they value overall 'long-run' ability, for which the number of *career* goals scored is more suitable.

Since the 1995 'Bosman Ruling', which made the European football market more flexible for players to transfer between EU member states, there has been a 309% increase in employment totals of foreign players in the EPL (Dobson and Gerrard, 2011). In an attempt to curb the apparent bias towards foreign players, UEFA, the governing body of football in Europe, introduced policy changes in *2008* which the EPL enforced for all participating teams in *2010*, stipulating that no fewer than eight 'home-grown' players must be included in squads to participate in the EPL competition (UEFA 2010). The EPL's aim when changing policy in 2010 was to increase demand for 'home-grown' players in order to increase national teams' performance at international tournaments like the FIFA World Cup. This paper assesses whether this policy change has had an impact on the significance of 'home-grown' players in determining transfer values.

Feess and Muehlheusser (2003) and Simmons (1997) showed that more flexible labour markets theoretically lead to a longer contract length, raising average transfer market values, but did not test this empirically with football data. Goddard and Wilson (2008), Preston and Szymanski (2000) and Reilly and Witt (1995) empirically tested the theory of flexible labour markets on *salaries* in the football market. Szymanski (2000) used balanced panel data from 1978-1995 on wage bills for 39 teams (some of which were not in the EPL) and deduced that, after controlling for the wage bill, 'home-grown' players proved *insignificant* in determining wages. However, the sample used by this paper included teams outside of the EPL which may have affected these results because the 1995 policy change affected the EPL more than other leagues. The dependant variable was wages and thus with a dependant variable of transfer market value, it may have seen different results regarding the significance of 'home-grown' players.

2.1 Contribution

Frick (2007) identifies that most of the statistics used in past papers are rather 'indirect' measures of a player's productivity that only imperfectly reflect a player's value to his team. The reason for this is the lack of statistics generated during football matches. However the recent developments in player tracking technology have allowed such statistics to be published. Variables such as the bias a player gives to using just one foot in a game (reflecting the degree of flexibility in productivity as used by Bryson, Frick and Simmons (2009) in football *salary* determinants), the disciplinary record of players, and proportion of games played at a professional level are now available. This paper introduces these new measures of player productivity into the model for determining transfer market fees.

There was also conflicting evidence between papers such as Dobson and Gerrard (1999), Speight and Thomas (1997) and Carmichael, Forrest and Simmons (1999) as to whether *career* goals or *previous season* goals matter for player transfers. This paper addresses this issue by implementing data that allows investigation of *both* career games played and goals scored as well as games played and goals scored for the previous season in the model. From this we can effectively establish which explains more variation in the transfer market values. However in order to overcome bias towards attacking players, more universal measures of ability will be used simultaneously. Furthermore the model over the period 2009-2011 will shed some light on whether 'home-grown' players have become more valuable due to policy alterations highlighted above.

That is to say, this paper will find out which 'direct' ability variables the market values, whether or not these variables are assessed short-term or long-term (entire career) and how the recent policy changes, which increased the required number of 'home-grown' players in the EPL, have influenced the fees paid for 'home-grown' players.

3 Model

3.1 Data Set

The data set used consists of all transfers (excluding free transfers) involving all English Premier League clubs between 2009 and 2011. This includes players being bought from other leagues across the world or leaving the EPL. This results in 307 players observed over each year to compile a balanced panel data set of 921 observations. The transfer market fees were acquired from transfermarkt.de (2011) and the player specific attributes were acquired from Scout7 (2011). The trasfermarkt.de data source is widely used by football econometricians (see Bryson, Frick and Simmons, 2009), however the use of Scout7, which *"is professional football's global leader in the provision of scouting, recruitment, player administration and management solutions" (Scout7, 2011),* is unique to this study and provides the more 'direct' ability indicators. Our dependent variable '*ln transferamount*' takes the natural logarithm of the transfer amounts paid for exclusive use of players in our data set to ensure that we have a normally distributed dependent variable. Our primary focus is on the dummy variable 'home-grown' which takes the value *one* if the player is classified as 'home-grown' under EPL guidelines[2] and *zero* otherwise. We control for the experience of a player, the ability of a player and the bargaining power of the buying and selling clubs. The variables used and their descriptive statistics are shown in tables A1 and A2 of the appendix.

The data set contains players which in a given year were not transferred and thus have no official transfer amount and no data for our dependent variable. To overcome this problem we control for censored sample observations using a Tobit model, which also corrects for sample selection bias. We run both a random effects Tobit model to control for unobserved heterogeneity and a standard Tobit model to compare and contrast the results. We also follow Bryson, Frick and Simmons (2009) and use *estimated* transfer market values (taken from *transfermarkt.de*) for the players who were not transferred. This allows us to utilise the dynamic information contained in the panel data set and compare our findings to the Tobit model to see if the censored sample affects our results. The decision over fixed or random effects for the *estimates* model is determined by the Hausman test, which tests whether the restrictions underlying the random effects model (that the unobserved heterogeneity of players is uncorrelated with the explanatory variables) are too strict or not.

3.2 Results pooled OLS

Our final specification explaining the variation in transfer market fees paid for the exclusive use of players takes the following form:

$$\begin{aligned}\ln(transfer\ amount) = \alpha &+ \beta_1 age + \beta_2 age^2 + \beta_3 Appspl + \beta_4 Goalsperapps + \beta_5 AppsplperApps \\ &+ \beta_6 (AppsplperApps)^2 + \beta_7 Nopreviousclubs + \beta_8 Redandyellcardsperapps \\ &+ \delta_2 Homegrown * 2010 + \delta_3 Homegrown * 2011 + \delta_4 International \\ &+ \delta_5 champions\lg + \varepsilon\end{aligned}$$

The results for the above specification for the pooled OLS model are shown in the first column of table 1. Most of the coefficients are significant at the 5% level or more. This is most likely due to the lack of control for unobserved heterogeneity, but may also be due to a unit root in our dependant variable. Yet as table A3 shows, the Harris-Tzavalis panel data test for unit roots rejected the null hypothesis of a unit root at the 1% level. The coefficient on both '*home-grown*' dummy variables was insignificant at the 5% level, which when controlling for other factors provides evidence to suggest that the EPL policy change in 2010 has been *ineffective* thus far in increasing the demand for 'home-grown' players. The reasons for this are discussed later.

The primary coefficients controlling for the ability of a player are the '*goalsperapps*', '*redandyellcardsperapps*', '*international*', '*appsplperapps*' and '*appsplperappssq*'. The '*goalsperapps*' variable is a measure for how efficient a player is at scoring goals within a game. Higher ability players are those who have scored in a high proportion of the games in which they play. Given that goals are ultimately the desired outcome for football clubs, we expect a higher premium for players who score them efficiently compared to those who do not. Our results reconcile this with a positive coefficient. The model predicts that a 0.01 increase in the ratio, which would

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[2] A 'home-grown' player is defined as one who, irrespective of his nationality or age, has been registered with any club affiliated to the Football Association or the Welsh Football Association for a period, continuous or not, of three entire seasons or 36 months prior to his 21st birthday (or the end of the season during which he turns 21). (English Premier League, 2010).

Table 1 Regression Results

Variable	OLS	TOBIT RE	TOBIT	FE PANEL	FE PANEL LS
AGE	**0.4327** **	**3672173** ***	**3672175** ***	**1.6509** ***	**1.4859** ***
	(0.2135)	(1264802)	(1308299)	(0.2499)	(0.2410)
AGESQ	**-0.0118** ***	**-80224** ***	**-80224** ***	**-0.0343** ***	**-0.0290** ***
	(0.0041)	(25366)	(27189)	(0.0048)	(0.0045)
APPSPL	**0.0079** ***	**17069** **	**17069** **	**0.0063** **	**-**
	(0.0012)	(7714)	(8395)	(0.0028)	
GOALSPERAPPS	**1.4987** ***	5239610 *	5239612 *	-0.5492	**-0.7509** **
	(0.4032)	(2789921)	(3154954)	(0.4600)	(0.3414)
APPSPLPERAPPS	**4.1803** ***	7482396	7482405	**2.5600** **	1.4155
	(1.3189)	(7145856)	(6164655)	(1.2724)	(1.1764)
APPSPLPERAPPSSQ	**-2.7059** ***	-4601368	-4601374	-2.0470 *	-0.7983
	(0.9835)	(5704180)	(4983620)	(1.0725)	(0.9750)
NOPREVIOUSCLUBS	**-0.1286** **	-206397	-206397	0.1341	**0.1918** **
	(0.0507)	(356440)	(334248)	(0.0873)	(0.0868)
REDANDYELLCARDSPERAPPS	**2.7161** ***	551375	551374	-0.1613	-0.0072
	(0.7842)	(4709439)	(4075678)	(0.9437)	(0.8928)
HOMEGROWN2010	-0.3263	**-3390469** **	**-3390471** **	-0.0236	-0.0003
	(0.2138)	(1298742)	(1268934)	(0.0924)	(0.0919)
HOMEGROWN2011	-0.1825	636391	636391	0.1190	0.1881
	(0.1868)	(1182829)	(1038510)	(0.1303)	(0.1321)
CHAMPIONSLG	**0.7514** ***	**5492747** ***	**5492750** ***	**0.3545** **	**0.3563** ***
	(0.1177)	(810477)	(951459)	(0.1365)	(0.1359)
INTERNATIONAL	**0.6327** ***	-460451	-460452	**0.1534** **	-0.0588
	(0.1481)	(939357)	(774936)	(0.0745)	(0.0992)
CONST	**7.7500** ***	**-52200000** ***	**-52200000** ***	**-6.7376** **	-5.3347 *
	(2.5912)	(14900000)	(15700000)	(3.1957)	(3.1038)
APPSLS	**-**	**-**	**-**	**-**	**0.0147** ***
					(0.0032)
R-squared (Overall)	0.4549	-	-	0.3411	0.2561
Number of Obs	331	921	921	921	921

*=Significant at 10% level
**=Significant at 5% level
***=Significant at 1% level

Robust Standard Errors in Parentheses

OLS dependant variable: ln(*transferamount*)
Tobit RE & Tobit dependant variable: *transferamount*
FE Panel & FE Panel LS dependant variable: ln(*transferamount with estimates*)

approximately be brought about by an extra goal per match for a player, increases the transfer market value of a player by approximately 1.51% percent ceteris paribus (c.p), which is in line with previous findings.

The '*redandyellcardsperapps*' variable seems to initially have the incorrect sign. Red and yellow cards are given to players who foul an opponent. Players who receive numerous cards within a season are suspended from taking part in future games. We would therefore expect that players with poor disciplinary records command *lower* transfer fees because they are not eligible to play as many games in a season as a player who receives no cards. Our results show a positive coefficient however. The reconciliation of these results is that the variable may proxy for defensive ability. This is because cards are often given for mistimed tackles by players and defensive players are more valuable to a team if they attempt more tackles. The variable '*redandyellcardsperapps*' therefore *could* be controlling for the variation of higher ability defensive players who attempt more tackles, but in doing so accumulate more cards for the unsuccessful tackles. If this is the case then we would expect a positive coefficient as we see in the data. This is a rather strong assumption though and the variable has little direct inference properties because many cards are not solely given for mistimed tackles. However table A4 shows that attacking players on average have a much lower mean for this variable than defensive players such as midfielders and defenders, supporting the hypothesis that this variable may proxy for defensive ability.

'*Appsplperapps*' and '*appsplperappsq*' represent the proportion of total games played in a professional league. Games that did not qualify as professional league games included reserve games and youth (age specific) games. '*Appsplperapps*' is therefore a proxy for ability whereby players of higher ability are expected to play a higher proportion of total games in a professional league during their career. These players are likely to command a higher transfer fee as their productivity is higher. Our results do indicate a positive coefficient on this variable, reconciling the above. The variable takes on a quadratic form because too high a proportion may indicate that a player has played very few youth games. This could indicate that at a younger age the player was not deemed to be of high enough ability to participate in these games and thus has less consistency of ability over their entire career. The negative sign on the '*Appsplperappssq*' coefficient supports this theory, but caution must be taken as the assumption that the reason for the negative coefficient is because of too few youth games, could be too strong across the entire sample. The data suggests that the optimal proportion of professional games to total games played is approximately 0.77 or 77%.

Variables that measured experience in the labour market included '*appspl*', '*age*' and '*agesq*'. All of these variables showed the expected signs whereby the more experience a player has the higher on average, ceteris paribus, is their transfer fee. This occurs up to a point after which a player's athletic ability may dwindle with age and thus the transfer fee falls as with traditional labour economic theory.

Finally two variables which capture the macro effects of negotiation between clubs are '*nopreviousclubs*' and '*championslg*'. '*Nopreviousclubs*' measures the number of clubs the player has played for before the recorded transfer. The higher this number the more times the player has been transferred in their career. As Hylan et. al (1996), cited by Carmichael, Forrest and Simmons (1999) argued, repeated transfers can be very disruptive to career development and personal life, negatively affecting player performance. The data supports this with a negative sign being attached to this particular variable. 'C*hampionslg*' is a dummy variable that equals *one* if either the selling or the buying club has participated in the UEFA Champions League (Europe's largest club football tournament) in any of the past three years. On average, clubs who have participated in this competition have higher purchasing power, often due to the large amounts in television revenue they receive for taking part in the competition. As such we would expect two things; firstly, that a club selling to a 'richer' club can demand a higher fee and extract more consumer surplus for themselves; and secondly, that players being brought from a Champions League club may be of higher ability and command higher fees. The results support both theories with a significant positive coefficient.

Of interest from these results is that position dummies equalling *one* if a player was in a specific position and *zero* otherwise, proved to be insignificant, contrary to previous studies. This may indicate omitted relevant variable bias in previous studies from the exclusion of ability indicators for more defensive players such as '*redandyellcardsperapps*' or the proportion of games played at a high level professionally '*appsplperapps*'. Furthermore direct measures such as the height or weight of a player, their preferred kicking foot, or the division in which they play in were insignificant, so are omitted from the main results tables (table A7).

3.2 Results Tobit

As explained above, the pooled OLS regression (dependant variable ln(*transferamount*)) omits players who were not transferred and have a transfer market value of zero. This may lead to selection bias stemming from the hypothesis that on average those players who are transferred are of higher ability. The Tobit model uses truncated distributions to estimate λ – the inverted mills ratio, which scales the OLS estimators to obtain an unbiased estimator of variable coefficients (Verbeek, 2004 see A6). The Tobit estimation method is preferred to the Heckman two-stage process because it overcomes the incorrect standard errors in the second stage of the Heckman process (Greene, 2003). We therefore ran a regression using this technique with the dependant variable being '*transferamount*' rather than the logarithmic transformation. The results are shown in column 2 of table 1.

Many of the variables that were significant in the pooled OLS regression became statistically insignificant from zero when we controlled for unobserved heterogeneity and selection bias in our data. Our primary variable of interest '*home-grown2010'* became statistically significant at the 5% level. The sign of the coefficient suggests that in the year of the policy change, a home-grown player would on average be 12% *less* likely to be transferred c.p. (see table A8 for probit model on probability of being transferred). The expected value of a 'home-grown' player regardless of whether transferred or not, is approximately £923,510 less than an equivalent foreign player c.p. This difference between 'home-grown' players and foreign players is only statistically different from zero in 2010, shown by the *insignificant* coefficient on '*home-grown2011*'. This provides evidence to suggest that the EPL policy change had an effect on the value of 'home-grown' players, but not in the direction that it intended to and only in the immediate short-run.

A possible explanation for this may lie in the fact that the EPL gave teams warning about the change in policy. Whilst the policy (acting as an import quota of foreign players) may have actually raised the demand for 'home-grown' players, the teams being warned may have led to a counteracting increase in the supply of 'home-grown' players, which would have prevented the price rise we would expect to see. Equally the reason could be simply that the policy was not strong enough to reverse previous bias towards foreign players found by authors such as Goddard and Wilson (2008). In particular there were many 'loop-holes' in the rules, such as players receiving three years training in either the English or Welsh Football Association prior to the age of twenty-one could be counted as 'home-grown', regardless of nationality. Furthermore EPL teams were able to have as many foreign players *in addition* to their 25 squad quota, providing they were no older than 21 at the end of the season. Any of these possible explanations reconcile our findings that the policy has been ineffective in achieving its aim, and any effect had disappeared by 2011.

We see that experience through the variables '*appspl*', '*age*' and '*agesq*' remain significant with the correct signs as predicted by theory. The '*championsleague*' variable also remains statistically significant at the 5% level with the correct sign. However many of the other ability indicators have become statistically insignificant and this could be a result of controlling for unobserved heterogeneity, although a Likelihood ratio test between the standard tobit model and random effects tobit had a p-value of 1.0. This is evidence to suggest that there is not enough variation between individuals to exploit in the data set and the two models become synonymous. The standard Tobit model is reported in the third column (table 1), with coefficients almost identical to the random effects Tobit model. This is a surprising result because it suggests that players do not have a given ability from birth that remains over time. This is in stark contrast to the current view of the football industry which believes certain players to be of superior ability from the very beginning of their career (Diem, 2011). The most likely reason for this is that the sample only consists of players who have at some point in time played in the EPL, the top tier of English football. Thus within the sample there may not be enough variation *between* individuals to exploit in the data.

3.2 Results Fixed Effects Model

Given that our results for the policy change were very different between the pooled OLS and Tobit models, we compared the results to hypothetical estimates taken from *transfermarkt.de* for the transfer market value of those players that were not transferred. This follows closely Bryson, Frick and Simmons (2009) who also used *estimations* of transfer market values for those players not transferred. They also used *transfermarkt.de* for their estimations on the grounds that this source covers an enormous range of players and employs experts who work on such estimations. A Hausman test between random and fixed effects rejected the null hypothesis that the explanatory variables are not correlated with unobserved heterogeneity values at the 1% level (table A5). Thus we used a fixed effects regression (which removes unobserved heterogeneity through differencing), which is unsurprising given the result of the Likelihood ratio test for the Tobit models. The results from this regression are shown in column 4 of table 1. They are most similar to the Tobit regression, suggesting that this particular model is more robust than the original pooled OLS model.

Of key importance is that the '*homegrown2010*' variable has now become statistically insignificant. On its own this sheds little light on the effectiveness of the policy introduced in 2010, however when combined with the Tobit results, which suggested that the sign of the coefficient was the wrong way, we have further evidence suggesting that the policy has been *ineffective*. The insignificance of the '*homegrown2011*' variable further supports this conclusion from our results. The other variables that are significant have the same signs on each coefficient as the Tobit results. The exception to this is the proxy for ability over entire career – '*appsplperapps*'. This has become significant again in the fixed effects model, with correct signs as the theory above would predict. The '*international*' dummy also becomes statistically significant at the 5% level. These results should be taken with caution precisely because they are only estimates of transfer values, but they do provide evidence that suggests there is a weak relationship between transfer value and the proportion of games played in a professional league, suggesting that we may have found a new ability indicator absent from previous studies.

The final column in our results table shows the explanatory power of the regression when short-run variables are used to control for ability rather than long-term variables. The overall R-squared clearly falls and this was also seen when the two types of ability indicators were compared for the pooled OLS method. Furthermore in the short-run model the coefficient on '*nopreviousclubs*' turned positive, which contradicted our previous 3 models' results and findings from previous studies. Alongside this the coefficient on '*goalsperapps*' becomes significant, but negative, which is difficult to justify that a player who is more efficient at scoring demands a *lower* transfer fee (we also found similar results when short-run indicators for goals scored etc were tested). For these reasons the career-long variables models are preferred. One potential explanation for the poor financial performance of football clubs is a short-sighted view of transfers; football clubs may buy players with a very short outlook of their impact upon the team's performance, neglecting the long-run implications of such decisions. Our results refute this claim as we see that long-run indicators explain more of the variation within transfer fees. This provides evidence that clubs take long-run indicators into consideration and not simply short-run equivalent indicators.

4 Concluding Remarks

4.1 Further Research and Issues

The methodology of contrasting the three models highlights that our results are driven by the sample collected and data available. The sample was chosen for its representative nature regarding the EPL in order to assess EPL policy. However many transfers occur for no fee, 'free transfers'. This paper omitted such transfers because there is often very little data for ability indicators for these players, who are often much younger than the population average. This does suggest that the sample is biased and further research should target these players, finding data for their ability indicators. To overcome this issue we compare all three models and can clearly see that certain variables are robust to changes in the model and whether or not we use estimates or true transfer market values. In particular the results for the variable of interest '*homegrown2011*' provided the same conclusion for all models: that the policy was not effective in fulfilling its original aim.

The models here fail to fully capture the complexity of the transfer market primarily because of a lack of suitable data from the football industry. Further research should concentrate on finding more 'direct' measures of ability, alongside the proxies used here. Given the continuing increase in statistics generated in football matches, this data should start to become available for research. In particular, ability indicators for goalkeepers, such as the number of games played without conceding a single goal and for midfielders, the proportion of games in which they provide an 'assist' for a goal, should be included. Further control for the market and bargaining power of clubs should be considered, in particular the number of years left in a contract and the timing of the transfer. Transfers can either take place in the summer or winter transfer windows and the results may differ between these two markets. The financial situation of football clubs should also be accounted for in more detail than in the above models to fully account for the bargaining power of clubs when making a transfer.

4.2 Implications & Concluding remarks

The main aim of this paper was to model the variation in transfer market fees and in doing so assess the effectiveness of policy introduced by the EPL in 2010. The data set allowed us to use not just aggregated appearance and goal figures, but those that were in professional (non-youth) leagues that haven't been available to previous studies. The paper also provides evidence to suggest that football clubs are *not* short-sighted in their transfer market spending and that career-long variables more fully explain the variation in transfer fees. In controlling for the ability of players through a new variable '*applsplperapps*', we can more fully assess the policy introduced. However more 'direct' measures of ability are still yet to be included and as such this paper may suffer from omitted relevant variable bias. Nevertheless our results provide evidence to suggest that the EPL policy change had either no impact on the transfer fee paid for 'home-grown' players or had an adverse effect on the fee that they command. One plausible explanation for these results is that the EPL warning clubs about the changes in advance may have increased the supply of 'home-grown' players, thus reducing the upward pressure on the price of 'home-grown' players after the policy was introduced. Alternatively the policy may not have been strong enough to fully change the way that football clubs assess 'home-grown' players' values, because of its various loop-holes, some of which were noted in section 3.2. Despite authorities' attempts to curb the bias towards foreign players, EPL teams if anything still seem to have a bias towards foreign players, but at least can combat critics claims that they are short-sighted in transfer decisions. Perhaps 2011 marks the start of the much needed Age of Financial restraint.

5 Appendix

Table A1 Variable Definitions

AGE	The age in years of a player at the time of transfer
AGESQ	The age in years of a player squared at the time of transfer
APPSPL	Number of appearances in a fully professional (non-youth) league for entire career of player
APPS	Number of appearances including youth leagues for entire career of player
APPSLS	Number of appearances in a fully professional (non-youth) league for previous season up to point of transfer of player
GOALSPERAPPS	Number of goals scored in a fully professional league divided by number of appearances in professional leagues for entire career of player
APPSPLPERAPPS	Number of appearances in a professional league over number of appearances in total.
APPSPLPERAPPSSQ	Number of appearances in a professional league over number of appearances in total squared
NOPREVIOUSCLUBS	Number of previous clubs the player has been transferred to before the time of most recent transfer
REDANDYELLCARDSPERAPPS	Sum of red cards and yellow cards received over the total number of appearances for entire career.
HOMEGROWN2010	Dummy variable taking the value one if a player is classified as 'home-grown' under EPL rules and the year of transfer is 2010, zero otherwise
HOMEGROWN2011	Dummy variable taking the value one if a player is classified as 'home-grown' under EPL rules and the year of transfer is 2011, zero otherwise
CHAMPIONSLG	Dummy variable taking the value one if purchasing club or selling club has qualified for group stage of Champions League in any of past three years, zero otherwise
INTERNATIONAL	Dummy variable taking the value one if a player has one or more international appearances for their country over entire career of player, zero otherwise

Table A2 Summary Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
AGE	921	24.595	3.952	15	35
AGESQ	921	620.517	196.832	225	1225
APPSPL	921	154.411	126.697	0	2212
APPS	921	166.123	101.066	0	509
APPSLS	921	23.569	11.779	0	50
GOALSPERAPPS	921	0.129	0.133	0	0.857
APPSPLPERAPPS	921	0.865	0.405	0	1
APPSPLPERAPPSSQ	921	0.784	0.306	0	1
NOPREVIOUSCLUBS	921	2.147	1.301	0	7
REDANDYELLCARDSPERAPPS	921	0.118	0.092	0	1
HOMEGROWN	921	0.394	0.489	0	1
HOMEGROWN	921	0.394	0.489	0	1
CHAMPIONSLGNEW	921	0.325	0.468	0	1
INTERNATIONAL	921	0.632	0.483	0	1

*Table A3 Harris-Tzavalis unit-root test**

H_0: Panels contain unit roots		
Variable	Z-Statistic	P-Value
Transferamount (no constant)	-32.9059	0.0000
Transferamount (with constant)	-13.1565	0.000

*The Harris-Tzavalis test holds T fixed and assumes N tends to infinity more quickly than T. This is the most representative panel unit-root test for football transfer data where our T=3, and N is much larger. The test assumes a common autoregressive parameter between panels, but clearly provides evidence of no unit-roots. The variable tested is not the logarithmic transformation as this produces an unbalanced panel data set, which cannot be tested using the Harris-Tzavalis methodology.

Table A4 Redandyellcardsperapps by position

Variable: Redandyellcardsperapps	FWD	DEF	MID	GK
Mean	0.0931	0.1360	0.1353	0.0417
Standard Deviation	0.0930	0.0968	0.0798	0.0340

*Table A5 Hausman Test**

H_0: Difference in coefficients is not systematic	
$\chi^2_{(12)}$	87.67
P-value	0.000

*The Hausman test was carried out between the fixed and random effects specification of column 2 in table 1, but with normal standard errors. Here we reject the null hypothesis and thus the fixed effects coefficients are consistent and efficient.

A6 Tobit model

Because almost two-thirds of our data set were not transferred and thus had no dependent variable, OLS estimation using this creates sample selection bias. Tobit estimation accounts for these values using a latent variable model whereby underlying the observed data we may find negative transfer amounts. Teams may well find that because of limited places in a squad, they would actually be willing to pay for a player to not be in their squad and fill this space with a player of higher ability. Because a player has weekly wages that often far outweigh transfer fees over the course of a year, it is plausible that teams could pay to *not* have a player in their squad and avoid these costs so that the net effect would be a cost reduction for the team, but in essence a negative transfer market value. By using Tobit estimation we can account for this underlying behaviour as shown overleaf.

Underlying latent variable $y_i^* = x_i'\beta + \varepsilon_i$

Observed variables $y_i = \begin{cases} y_i^* \ if \ y_i^* > 0 \\ 0 \ if \ y_i^* \leq 0 \end{cases}$, all negative values of y_i^* are mapped to zero.

$$Log\ L = \sum_{y_i=0} \log P\{y_i = 0|x_i\} + \sum_{y_i>0} \log\left[f\left(y_i|y_i > 0, x_i\right). P\{y_i > 0|x_i\}\right]$$

$$= \sum_{y_i=0} \log P\{y_i = 0|x_i\} + \sum_{y_i>0} \log\left[f\left(y_i|x_i\right)\right].$$

$$= \sum_{y_i=0} \log\left[1 - \Phi\left(\frac{x_i'\beta}{\sigma}\right)\right] + \sum_{y_i>0} \log\left[\frac{1}{\sigma}\phi\left(\frac{y_i - x_i'\beta}{\sigma}\right)\right].$$

$$= \sum_{i=1}^{n}(1 - D_i).\log\left[1 - \Phi\left(\frac{x_i'\beta}{\sigma}\right)\right] + \sum_{i=1}^{n} D_i.\left\{\log\phi\left(\frac{y_i - x_i'\beta}{\sigma}\right) - \log\sigma\right\}, \quad D_i = \begin{cases} 1 \ if \ y_i > 0 \\ 0 \ if \ y_i = 0 \end{cases}$$

FOCs

$$\frac{\partial Log\ L}{\partial\beta} : \sum_{i=1}^{n}\left\{D_i\left[\frac{1}{\hat{\sigma}^2}\left(y_i - x_i'\hat{\beta}\right)x_i\right] - (1 - D_i)\hat{\lambda}_{0i}\frac{x_i}{\hat{\sigma}}\right\} = 0, \quad \hat{\lambda}_{0i} = \frac{\phi\left(\frac{x_i'\hat{\beta}}{\hat{\sigma}}\right)}{\left[1 - \Phi\left(\frac{x_i'\hat{\beta}}{\hat{\sigma}}\right)\right]}$$

$$: \frac{1}{\hat{\sigma}}\sum_{i=1}^{n}\hat{\varepsilon}_i^G x_i = 0, \quad Generalised\ \mathrm{Re}siduals : \hat{\varepsilon}_i^G = D_i\frac{y_i - x_i'\hat{\beta}}{\hat{\sigma}} - (1 - D_i)\hat{\lambda}_{0i}.$$

i.e for $\mathrm{D}_i = 1$, the generalised residual is the scaled residual : $\hat{\varepsilon}_i^G = \frac{\hat{\varepsilon}_i}{\hat{\sigma}} = \frac{y_i - x_i'\hat{\beta}}{\hat{\sigma}}$

and for $\mathrm{D}_i = 0$, it is $\frac{-\phi\left(\frac{x_i'\hat{\beta}}{\hat{\sigma}}\right)}{\left[1 - \Phi\left(\frac{x_i'\hat{\beta}}{\hat{\sigma}}\right)\right]} = -\hat{\lambda}_{0i}$

source : *Verbeek* (2004)

As the above shows, by using the Tobit model and maximum-likelihood estimation, the residuals account for the fact that many of our observations are censored at 0 because they were not actually transferred and therefore no official transfer market value was attached to the player. This is the most efficient and unbiased way of obtaining coefficient estimates for our data.

It has been noted that there may be a case for dual censoring in this case as the Tobit model fails to address whether a player was not transferred because he has a negative underlying transfer value or whether the owning club simply wished not to sell him as he may be of high ability. Whilst this is an issue, a brief examination of the data shows that very few of these players who were not transferred were likely to be of high ability based on reputation, and perhaps this is reflected by the fact that at some point in the sample period they were transferred and not kept by their original team. Furthermore our fixed effects estimates account for this problem and show very similar results suggesting that the Tobit model is not far from modelling the correct latent variable model. Never the less in future research this should be accounted for to ensure robustness.

*Table A7 Intermediate results**

Regression Results

Variable	OLS
AGE	**0.44001** **
	(0.21445)
AGESQ	**-0.01186** ***
	(0.00412)
APPSPL	**0.00789** ***
	(0.00128)
GOALSPERAPPS	**1.80329** ***
	(0.65227)
APPSPLPERAPPS	**4.11657** ***
	(1.30792)
APPSPLPERAPPSSQ	**-2.74732** ***
	(0.96757)
NOPREVIOUSCLUBS	**-0.13090** **
	(0.05192)
REDANDYELLCARDSPERAPPS	**2.56110** ***
	(0.89402)
HOMEGROWN2010	-0.31656
	(0.22188)
HOMEGROWN2011	-0.17173
	(0.18959)
CHAMPIONSLG	**0.73009** ***
	(0.11991)
INTERNATIONAL	**0.63265** ***
	(0.14842)
CONST	6.05693 *
	(3.21144)
EITHERFOOT	0.30902 *
	(0.16126)
HEIGHT	0.01501
	(0.01180)
WEIGHT	-0.01318
	(0.01059)
FORWARD	-0.17442
	(0.34635)
MIDFIELDER	-0.03361
	(0.32213)
DEFENDER	-0.06285
	(0.30556)
DIVISION1	-0.12243
	(0.11586)
R-squared (Overall)	0.4658
Number of Obs	331

* =Significant at 10% level
**=Significant at 5% level
***=Significant at 1% level
Robust Standard Errors in Parentheses

*Here the last 7 variables are insignificant but are either more direct indicators of ability or have been found to be significant in previous studies. 'EITHERFOOT'(whether a player can use both feet equally well) though significant in this specification at the 10% level became insignificant at any reasonable level in Tobit or Fixed effects specifications so was omitted from the main results table.

Table A8 Probit model predicting probability of being transferred taken from Tobit estimation (1st stage)

Variable	*Tobit Model marginal effects*
AGE	**0.1410** ***
	(0.0485)
AGESQ	**-0.0031** ***
	(0.0010)
APPSPL	**0.0007** **
	(0.0003)
GOALSPERAPPS	**0.2011** *
	(0.1073)
APPSPLPERAPPS	0.2872
	(0.2738)
APPSPLPERAPPSSQ	-0.1766
	(0.2187)
NOPREVIOUSCLUBS	-0.0079
	(0.0137)
REDANDYELLCARDSPERAPPS	0.0212
	(0.1808)
HOMEGROWN2010	-0.1206
	(0.0420)
HOMEGROWN2011	0.0247
	(0.0464)
CHAMPIONSLG	**0.2132** ***
	(0.0312)
INTERNATIONAL	-0.0177
	(0.0362)

*=Significant at 10% level
**=Significant at 5% level
***=Significant at 1% level
Robust Standard Errors in Parentheses

The above shows the probability of being transferred and in relation to the other results in this paper has very similar results. Whilst a few of the variables are insignificant at a reasonable significance level, most show the same trend as all three models in the main results table. For increased meaning this regression should include one variable that determines the probability of being transferred but does not determine the size or value of the transfer. In reality these sorts of variables are difficult to find but the above still gives a flavour of how inter-related the probability of being transferred is and for how much.

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