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The Returns to Scarce Talent: Footedness and Player Remuneration in European Soccer

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Abstract

We investigate the salary returns to the ability to play football with both feet. The majority of footballers are predominantly right footed. Using two data sets, a cross-section of footballers in the five main European leagues and a panel of players in the German Bundesliga, we find robust evidence of a substantial salary premium for two-footed ability, even after controlling for available player performance measures. We assess how this premium varies across the salary distribution and by player position.

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1. Introduction

A number of empirical studies try to explain the observable variation in sports player salaries with differences in individual characteristics such as age, experience, number of league and international appearances, number of goals scored, and player position, as well as team characteristics including sporting and financial performance. They rely on rather "indirect" measures of ability and performance that only imperfectly reflect a player's value to the team.

In this paper we analyze the impact of two-footedness on earnings among professional soccer players. We might expect two-footedness to affect players' remuneration positively in two ways. First, two-footedness may directly affect player performance. Forwards, who are paid to score and make goals, may be better able to make space and strike at goal more accurately from various angles if they are able to use both feet. Midfielders and defenders may be better able to tackle, make passes accurately and fend off the opposition if they are adept at moving and intercepting the ball with both feet. In some positions, such as left back or right back in defence, being a predominantly one footed player could be an advantage. But in general, being adept with both feet can be seen to be an advantageous skill that might be rewarded in the labour market. We seek to explore whether this is indeed the case.

Second, two-footedness gives the team management the opportunity to use a player in various positions on the pitch and this utility may enhance wages over and above performance. Thus, two-footedness may be positively correlated with earnings, even after accounting for performance, although performance is likely to absorb some part of this premium.

In most labour markets, workers seek to acquire scarce skills which can enhance their earnings power but is two-footedness an innate ability or is it a skill that can be acquired by training and learning? There is clearly a fixed component to two-footedness, as a natural physical attribute, but it can be learned to some degree. Learning two-footedness can occur,

for example, post-injury if a player is constrained in using his previously strong foot. It is also taught in some countries and it is possible that there is player learning. In an article in the English football magazine *When Saturday Comes*, entitled 'One foot wonders', English Premier League coaches and youth academy directors were interviewed on this question. These interviews revealed that coaches in English football tended to accept one-footedness as a given attribute. However, some coaches pointed out that training methods used in England tended not to emphasise work done to improve performance with a player's weaker foot, noting that coaches in Brazil, Holland and Africa tended to be more inclined to address and rectify poor performance, especially in terms of passing and shooting, with a player's weaker foot. These observations by coaches suggest that two-footedness is mainly but not wholly an innate ability and is something that can be developed, to some extent, by training.

It appears that this is beginning to change. A soccer school was set up in the UK in 2004 claiming to be "the first and original soccer school that concentrates solely on improving the other foot" (http://www.theotherfootsoccerschool.com/about.htm) [1]. Nevertheless, this training of two-footedness is something that can only be properly developed at an early age in the formative years of a player's career and is difficult to instill in the established professional players that comprise our samples. Furthermore, a recent study of amateur and professional players found a "surprising absence of plasticity in foot use, given the importance of learning, experience and culture in models of handedness and footedness" (Carey et al., 2009).[2] Hence, we can treat footedness as a pre-determined specialist ability that is capable of generating a return to salary.

[1]Those who set up the school cite the inspiration of Tom Finney, a famous English forward in the 1950s, who played in all the forward positions for England having taught himself two-footedness (http://www.theotherfootsoccerschool.com/may08_article.pdf).

[2] http://www.cortexjournal.net/article/S0010-9452(08)00258-X/abstract

We analyse two data sets in order to determine the extent of any salary premium for a player's ability to use two feet in professional soccer. In our first data set, which is a large cross-section covering players from the top five European leagues, having controlled for demographics, player position, and national league it appears that two-footed players enjoy a pay premium of around 14 to 15% over right-footed players. Left-footed players also receive a pay premium in most of our estimates using this European cross-section, though it is considerably smaller than the premium for two-footedness in most model specifications.

Our second data set is panel data for players appearing in the German Bundesliga. We then create a panel from the careers of players in the 2005/06 Bundesliga cohort going back to 2002/03. We confirm a sizeable salary premium for two-footed players in these data, although there appears to be no premium for left-footed players relative to right-footed players.

2. Literature Review

Several empirical studies examine the remuneration of players in European soccer. These include Lehmann and Weigand (1999), Lehmann (2000), Huebl and Swieter (2002), Lucifora and Simmons (2003), Lehmann and Schulze (2008), Garcia-del-Barrio and Pujol (2007), Frick (2006, 2007) and Frick and Deutscher (2009). The model structure of these studies is quite similar. In standard Mincer-style, player salaries are influenced by age, (career) games played, (career) goals scored, international caps, player position, assists and tackles, "superstar status", and contract duration. While age and experience have a positive, yet decreasing effect, the influence of contract duration is strictly linear. Midfielders and forwards earn a premium relative to defenders. Higher productivity also has a positive and linear influence on wages.

Significant impacts of experience, performance and peer reputation on salary can also be found in studies of North American sports, see Hamilton (1997) on basketball, Kahn (1993) for baseball, Berri and Simmons (2009) and Simmons and Berri (2009) on American football and Idson and Kahane (2000) for hockey.

These papers show that the salaries of professional sports players are influenced systematically by factors such as age, experience and performance in very similar ways to those found in other occupations. Where sports teams differ is in the distribution of salaries which is even more highly skewed than in standard occupations. Also sports teams apply more stringent selection procedures into occupations. For example, poor performance by a player results in being dropped from the team squad and very quickly being discarded; there are high levels of mobility within the industry (between teams) and into and out of the industry, with shorter careers than in most occupations. The large skewness of the salary distribution and high degree of player mobility appear to apply to all team sports, including North American major leagues as well as European soccer.

Some literature exists relating physical attributes such as height to earnings and also relating subjective attributes such as beauty to salary. Of particular relevance to our study is the literature on handedness and earnings. According to Denny and O'Sullivan (2007), left-handed men earn about 5% more than right-handed men while left-handed women earn 4% less than right-handed women. Ruebeck, Harrington and Moffitt (2007) find that highly educated left-handed men earn significantly more than highly educated right-handed men. This effect is most pronounced among those receiving lower than average earnings for the highly educated group.

How, then, does footedness affect salary in soccer? We suggest three possible channels.

Direct effect on performance

Because two footed players can play the ball with either foot, they may score more goals if, for example, defenders find it harder to read their movements. This allows two footed players to throw defenders off balance, thus creating space for scoring opportunities. In midfield, two footed players may have a better range of passes and are more likely to complete a pass however they receive the ball. Coaches recognize this and give two footed players more appearances than one footed players. Defenders may also find two-footedness advantageous. For instance, they may be able to clear the ball away from goal more effectively than single-footed players whichever way the ball comes to them, and they may be able to get a tackle in on a striker whichever direction the striker takes.

Positional utility

Since two footed players are similarly skilled with either foot this means they can fill more positions on the team than one-footed players, i.e. a two footed midfield player can play left, centre or right midfield whereas a right-footed midfield player could only fill centre or right midfield and may perform poorly in left midfield, although there are occasions where coaches will play a right-footed player on the left wing, with instructions to cut inside and shoot.

Correlation of footedness with other attributes

Denny and O'Sullivan (2007) suggest that there may be a correlation between left handedness and IQ, so left handed people may be cleverer than otherwise similar right handed people. Analogously, if being two footed is correlated with IQ two-footed players may be better able to read the game and anticipate situations. Their physical dexterity may be associated with greater mental dexterity. For instance two footed players may have more time to think instinctively or set up attacks from midfield partly because they have more space and

time to do so due to being able to control a pass or ricochet more quickly and accurately than a one footed player can. Extending this point, and drawing on Denny and O'Sullivan (2007), if physical dexterity with feet is correlated with mental intelligence, two-footed players may have better bargaining skills in salary negotiations.

3. Hypotheses and Data

We test three hypotheses suggested by the above discussion. First, we test the proposition that there is a salary premium for two-footedness. Second, we hypothesize that much of this premium is accounted for by performance but some remains even after controlling for performance. Third we test the proposition that the salary premium for two-footedness is greater for forwards and midfielders than for defenders but the forwards' premium will fall more markedly once performance is accounted for. This is because the positional utility argument is stronger for midfielders.

Finally we consider whether the premium for two-footedness varies over the salary distribution.

We use two data sets to explore these hypotheses.

Data Set 1 (www.transfermarkt.de)

Our first data set is a large cross section with information on 3,127 players who at the beginning of the 2005/06 season were under contract by one of the first division teams in either England, France, Germany, Italy, or Spain (source: www.transfermarkt.de). Our analyses exclude the 339 goalkeepers, 297 players with missing information on preferred foot and 68 players with missing information on salary, age or height. This gives 2,264 observations with complete information on all relevant variables. Goalkeepers are excluded as footedness is not especially relevant for their performance and hence their salary.

A descriptive analysis of these data reveals that the majority of the players are right-footed (60%); 22% are left-footed players and only 18% of the players in the five leagues are equally strong with both feet. The classification of players is undertaken by external experts who assess players based on observation of matches.

Data Set 2 Bundesliga panel

Our second data set has player salary recorded over several seasons by *Kicker* magazine. Here, we take the assessment of footedness from the first data set, isolating those players appearing in the German Bundesliga. We then create a panel from the careers of players in the 2005/06 Bundesliga cohort. This comprises 1,314 player-season observations over 2002/03 to 2006/07. These data comprise players active in 2005/06 whose footedness can be identified from the presence of the same players in the European cross-section data set. Hence, this panel is constructed from a particular cohort of players in the Bundesliga.

Both www.transfermarkt.de and *Kicker* offer market valuations of players assessed at the beginning of a season as a proxy for undisclosed salary, which remains private and confidential in Europe. We can be confident of the reliability of these proxies for several reasons. First, the correlation between salary figures produced from each source is high, at 0.75 (Torgler *et al.* 2006). Second, the *Kicker* source has assessed player valuations by a stable team of experts who have established consistent practice over a long period. Third, the team of experts at *Kicker* magazine have accessed a sub-sample of actual salaries from the Bundesliga and found a high correlation of 0.80 between these actual salaries and *Kicker* market valuations (Torgler and Schmidt, 2007; Frick, 2006). Fourth, both www.transfermarkt.de and *Kicker* have excellent coverage of players, ranging from high- and low-profile players and including every team in the five major European leagues (England, France, Germany, Italy and Spain) in the former and Germany in the latter.

We interpret the players' market values as published by *Kicker* as particularly reliable. Aggregating the individual market values across teams and dividing these by a constant factor of 1.5 results in the aggregated wage bill of each team in the Bundesliga as published in the annual reports of the German Football Association over the period 1996-2007.

[INSERT TABLES 1 AND 2]

Tables 1 and 2 show that two footed players and left footed players are minorities in both the European cross section and the Bundesliga panel. The Bundesliga appears to have a higher proportion of two footed midfield players than other leagues and this helps generate the greater share of two footed players overall in Germany.

Salaries are typically lower in Germany compared to other leagues, notably England and Spain (Frick, 2007). In the cross-section, two footed players are older, on average, and score more goals per game. Greater scoring power by two footed players might simply be a reflection of forwards being disproportionately two footed relative to players as a whole and Table 1 offers some suggestion that this might be the case for the European cross-section. Similarly, in the Bundesliga panel, two footed players also score more goals per game. But, in contrast to the European cross-section, Table 2 above shows that forwards in the Bundesliga are not disproportionately more likely to be two footed than players as a whole in that league.[3]

Table 3 indicates that there is a large raw salary premium for two-footedness over being right-footed or left-footed. It is apparent in both data sets.

[INSERT TABLE 3]

4. Estimation

Our most general model is:

[3] Probits for the correlates of two-footedness are available from the authors on request.

$$\ln(\text{Salary}) = \alpha_0 + \alpha_1 \text{ Age} + \alpha_2 \text{ Age}^2 + \alpha_3 \text{ Height} + \alpha_4 \text{ Height}^2 + \alpha_5 \text{ Left foot} + \alpha_6 \text{ Two foot} + \alpha_7 \text{ Midfield} + \alpha_8 \text{ Forward} + \alpha_9 \text{ League Dummies (or Club Dummies)} + \alpha_{10}\textbf{Attendance} + \boldsymbol{\alpha_{11}}\textbf{International Status} + \alpha_{12}\textbf{Nationality} + \alpha_{13}\textbf{ Performance} + \varepsilon$$

where, for the European cross-section, ln(Salary) is the log of annual salary (in €); age is player age in years plus its squared term; height is player height in centimetres plus its squared term; left foot and two foot are dummy variables where the reference category is right-footed; midfield and forward are dummies for players' positions, with defender as the reference category; there are five league dummies for England (the Premier League), France (Ligue 1), Germany (Bundesliga) and Italy (Serie A), with Spain (Primera Liga) as the reference category. **Attendance** is a vector of interaction terms between league dummies and average club home attendance from the previous season: these capture varying club market size effects on player salary across teams and leagues. **International status** is a vector of dummies (Eng04, Fr04 etc.) for current internationals defined according to whether the player appeared in the national team in any international fixture in 2004/05.[4] **Nationality** is a vector of nationality terms showing country of birth, as defined in www.11v11.co.uk. These are grouped as: England, France, Germany, Italy, Western Europe, Eastern Europe, North America, Africa and Asia with Spain as omitted category.

Performance is a vector of player performance variables that includes numbers of starting appearances by players in 2003/04 and 2004/05 (App03 and App04 respectively); number of substitute appearances (Sub03 for appearances in 03/04 and Sub04 for 04/05); goals per game (including substitute appearances) in 2003/04 (Goal03pg) and 2004/05 (Goal04pg); a dummy for appearances in a Champions' League match in given season

[4] WEUR is a set of European countries not otherwise identified e.g Holland, Portugal; EEUR refers to eastern European countries e.g. Russia, Ukraine, SAM refers to Central and South American countries, NAM refers to North American countries, AFRICA to all African countries, ASIA to Middle East, Australia, New Zealand and Asia.

(Champion03, Champion04) and a dummy for appearances in a UEFA Cup match in given season (Uefa03, Uefa04).

The salary model for the Bundesliga is similar except that height is absent from the data; club attendance is denoted by log attendance; international dummies are only available for South America (intsam), Western Europe (intwest) which now includes those countries defined for the European cross-section plus England, France, Germany and Italy, Eastern Europe (inteast) and Germany (intger). Nationality dummies are recorded as Eastern European, Western European, Africa, Asia, South America and North America with Germany as omitted category. These nationality groupings are constructed to be consistent with codings for international status. In the performance measures, appearances refer to games appeared in previous season and comprises starts plus substitute appearances. Similarly, Champions League, UEFA cup and goals per game are each defined as records from the previous season. Season dummies are included in estimates using the Bundesliga panel. Since our focus is on effects of foot attributes we do not include player fixed effects but do include club fixed effects in our most general model.

Finally, the Bundesliga data contain an additional performance measure, subjective ratings of performance from *Kicker* magazine. A growing literature uses expert evaluations as useful product information that contains intangible and uncertain quality signals. For example, Elliott and Simmons (2008) show how review scores of film critics are correlated positively with UK film revenues. The use of match evaluations from *Kicker* improves our ability to test the sensitivity of the two-footed premium to fine controls for player performance (for an application to German football, see Franck and Nüesch (2008)). In Germany, a team of sports experts produces evaluations of player performances using discrete grades from 1.0 (excellent) to 6.0 (very bad). We take the seasonal average scores for each player, who must play at least 30 minutes in a given match, and deduct this score from 7 to aid interpretation.

We observe that defenders gain higher scores on average than forwards and to correct for any positional bias in ratings we divide each player's score by the positional average for each season.

Throughout we estimate OLS models for the whole sample and, in order to test the effects of two-footedness by player position, on split samples for defenders, midfielders and attackers.

Several studies of salary in professional team sports use quantile regression estimation since log salary measures tend to have even greater kurtosis values than standard occupations (Hamilton, 1997, Reilly and Witt, 2007, Berri and Simmons, 2009, Simmons and Berri, 2009, Vincent and Eastman, 2009). Of course, ordinary least squares is the best linear unbiased estimator provided that the error distribution is homoscedastic. Moreover, ordinary least squares parameters tend to a normal distribution around true values even if the individual residuals are not normally distributed. The particular advantage of quantile regression is that it facilitates examination of salary returns to characteristics at different points in the salary distribution (Koenker, 2005, Vincent and Eastman, 2009). Ordinary least squares constrains marginal effects of covariates to be the same at the mean and elsewhere. But in salary models, and more so in sports than in standard labour markets, the average salary is greater than the median due to excess kurtosis of the distribution. Marginal effects at the median are not necessarily the same as at the mean or anywhere else in the distribution. The presence of player outliers, superstars in European football, may well cause marginal effects of covariates, such as two-footedness, to differ through the distribution. However, we have no prior on the pattern of this variation. It does appear, though, from evidence on North American sports, that marginal effects of covariates on player salaries do differ in magnitude, sometimes substantially, over the salary distribution (Berri and Simmons, 2009, Simmons and Berri, 2009, Vincent and Eastman, 2009).

Presence of non-normality in the dependent variable is indicated by a large kurtosis value and in our case the D'Agostino (1990) test is performed by the sktest command in Stata 10.1. We can investigate the impacts of footedness at any quantile of the salary distribution, not just the conditional mean. Moreover, the quantile regression approach is semi-parametric in that it avoids assumptions about the parametric distribution of the regression error term, an especially suitable feature where the data are heteroskedastic as in our case. To ensure robustness of standard errors, we bootstrap with 200 replications.

5. Results

We build up our salary models beginning with a naïve specification containing just left foot and two-footed. We then proceed to add in sequence groups of variables to represent physical and demographic characteristics (age, height and nationality), job characteristics (position dummies), ability to pay (league dummies and club attendances) and performance covariates (appearances, goals, European games, international status). The final, most general specification adds in club dummies for club-level unobserved fixed effects. This leads to some of the club characteristics in previous specifications dropping out. The results of this exercise for the European cross-section are shown in Table 4. All estimates are carried out with the 2,264 observations appropriate to the most general specification. Reported t-statistics shown in parentheses are computed with robust standard errors.

[INSERT TABLE 4]

As Table 4 shows, each insertion of another group of variables adds explanatory power. Throughout, we derive percentage impacts of changes in dummy variable from coefficients as $\exp(\beta) - 1$, where β is an estimated coefficient (Halvorsen and Palmquist, 1980). On this basis the salary premium for being a two-footed player relative to being right-footed begins at

82.2% and is still high at 51.3% with the addition of demographic, job and ability-to-pay variables. The two-footed premium falls dramatically with the introduction of performance controls to 16.4%. It falls further to 15.4% with the addition of club fixed effects. There is a raw premium of 14.8% for left-footedness relative to being right-footed. Unlike the two-footed premium it moves up and down with the addition of controls. The premium for left-footedness is significant in the final general specification with club fixed effects and at 14.0% it is almost as high as the two-footed premium. The left-footed premium is statistically significantly lower than the two-footed premium in all specifications until the introduction of performance controls, when the two-footed premium and left-footed premium are not statistically significantly different from one another. One reason why the premium for two-footedness declines faster than the premium for left-footedness is that the left-footedness premium may be driven primarily by its utility value to team managers, rather than through performance, whereas the two-footed premium is a combination of the two.

[INSERT TABLE 5]

Table 5 presents the coefficients for the control variables in the club fixed effects model presented in the last row of Table 4. The signs and significance of the control variables in the OLS estimates are much as to be expected with magnitudes that appear plausible. Salary is maximized at an age level of 26, which is slightly below estimates of 27 or 28 reported elsewhere in salary studies of European football (Lucifora and Simmons, 2003; Frick, 2007). Height is not significant, which is not surprising as the variation in this variable is rather small. Forwards gain a salary premium over midfielders who in turn gain a premium over equivalent defenders, a ranking noted by Frick (2007). An extra appearance last season delivers a greater increment to salary than an extra appearance in the season prior to that, suggesting that the impact of appearances on salary declines as time recedes. Also plausible is the result that an extra substitute appearance has a lower impact on salary than an extra starting

appearance. Goals per game in the last season have a positive effect on salary giving an extra boost to forwards' pay over and above their positional premium. Appearing in a Champions' League game in the previous season generates a salary increase which is greater than a Champions' League appearance in the season before that. UEFA Cup appearances also deliver salary increments, but to a lesser extent than Champions' League appearances. Again, this is a plausible reflection of the greater prestige and status afforded to the Champions' League as opposed to the UEFA Cup.

Not reported in Table 5 are estimates of club attendance, nationality and international status coefficients. Among the attendance effects, which we take as a proxy for market size or ability to pay, the largest marginal effect, of 0.018, is to be found in Spain (which also has the greatest variation in attendance), followed by Italy (0.013) and England (0.011). Club attendance had no significant impact on salary in France or Germany.

Nationality and international status effects deliver some interesting results in the OLS estimates. Other things equal, England non-internationals receive a 68.9% penalty relative to similar Spanish non-internationals but England internationals manage to more than offset this with a large 204% premium. Similarly, relative to Spanish non-internationals, German non-internationals also receive a salary penalty of 48.7% that is outweighed for German internationals by a 98.6% salary premium. Italian and French internationals each receive salary premia of more than 60% with no salary penalty for compatriate non-internationals. Western European and South American players receive salary premia relative to Spanish non-internationals, of 31.9% and 49.8% respectively. Overall, the performance of our control variables appears credible and also conforms to results from earlier studies.[5]

The estimated footedness premia are identical across the five European leagues (the respective interaction terms – not reported here – are statistically insignificant). We interpret

[5] Interactions between nationality and two-footedness were not jointly significant.

this as evidence that due to the liberalization of the national player markets induced by the Bosman-ruling in late 1995 we can now think in terms of a European salary model for players.

The Huber robust regression results in Table 5 show similar impacts of footedness on earnings as OLS. The only main differences concern lack of significance of some of the season 03/04 performance variables, such as goals per game, Champions League and UEFA cup appearances. The lack of significance of these variables from two seasons back simply reinforces the importance of performance earned in the recent past for current salary. Player contracts are of a rolling variety with periodic renegotiations sometimes long before an existing contract is due to expire. Such renegotiations are more likely to occur, with consequent higher salary, when players have shown enhanced performance, if only to retain the player in face of competing offers from rival clubs.

In our cross-section, the *p*-value for the test statistic of the null hypothesis that kurtosis does not depart from the value associated with a normal distribution is 0.012 and hence our log salary data depart from normality, a result that is similar to those found in some studies of North American sports (e.g. Berri and Simmons, 2009 on NFL). We therefore report quantile regression estimates in Table 6. Along with Frick and Deutscher (2009), our study is one of just two to utilize quantile regression to estimate a salary model in European team sports.

[INSERT TABLE 6]

The estimates did not converge with club fixed effects so we simply retain league dummies: our model specification is thus as per the specification used for the penultimate

model reported in Table 4. In the median quantile regression estimates, the control variables have coefficients and significance much in line with OLS.[6]

The impacts of footedness on salary are found to vary somewhat over the distribution. We find a significant premium for two-footedness at 5% or better at 0.1, 0.75 and 0.9 quantiles, with the largest premia found at the top and bottom of the salary distribution. A significant premium for left-footedness is found at 0.1 and 0.5 quantiles. At the median an F-test for coefficient equality (lincom in Stata) shows that the hypothesis of equality of returns from two-footedness and left-footedness cannot be rejected at 1% level. Hence, at the median, there is no salary advantage to being two-footed over being left-footed. This can be interpreted to mean that both attributes are indicators of scarce ability, recalling that the large majority of players is predominantly right footed. But at higher quantiles, 0.75 and 0.9, we find that the left footed premium is not significantly different from zero whereas the two footed premium is significant, with large magnitudes of 20 to 22 percent. We note that Germany has higher proportions of both two-footed and left-footed player compared to other leagues (compare Tables 1 and 2). The short supply of left-footed and two-footed players apparent in most European leagues is not present in Germany. The prevalence of left-footed players in the Bundesliga means that the opportunity for players to extract a salary premium for this attribute is absent.

[INSERT TABLE 7]

Frick (2007) shows that, in the Bundesliga at least, there is a stable ranking of salary by position with forwards earning more than midfielders, on average, who then earn more than defenders. This prompts us to ask how the premium for foot dexterity varies by position. Ta-

[6] The only substantial differences concern the nationality and international dummies. We find that the only nationality dummy to be significant at the median quantile is South America with a positive premium. International players from England, Italy, Germany, Spain and France all receive, in descending order of magnitude, substantial salary premia relative to Spanish non-internationals.

ble 7 shows the premia for two-footed and left-foot characteristics in our European cross-section, by position. We present two models for each player position: the first conditions on demographics and ability to pay, as per Table 4 row 4, whereas the second model also conditions on player performance, as per Table 4 row 5. Without controls for performance, the results indicate a significant salary premium for two-footedness for defenders, midfielders and forwards, with midfielders having the largest premium and defenders the smallest. There is no evidence of a significant premium for left-footedness. When controls for performance are added the two-footed premium falls substantially and only remains statistically significant in the case of midfielders. Conditioning on performance also results in a significant salary premium for left-footed midfielders relative to right-footed midfielders, although the premium is not as large as the two-footed premium. These findings are consistent with the conjecture that two-footedness is of greater use as an attribute for midfielders who require a wider range of skills such as controlling the ball, turning away from opponents while retaining possession, moving into different positions to receive the ball, passing the ball and shooting. It might be argued that forwards must also have the most of the aforementioned skills but our results tend to suggest that the salaries of forwards are determined more by what they achieve, essentially goals scored, than their footedness attributes.

Hence, our additional estimations show first, that a two-footedness premium is more evident and larger at the top and bottom of the salary distribution and second, that it is concentrated on midfield positions where two-footedness could be a strong factor affecting unobserved player performance.

Bundesliga panel

To establish whether we can generalize from our findings to other data sources we turn to the Bundesliga panel, as a means of external validation. This has a smaller number of play-

ers identified by footedness measures taken from the European cross-section with these players tracked through their careers.

Table 8 presents models that are similar to those for the European cross-section presented in Table 4. As with the European cross-section we see that adding groups of variables leads to consecutive reductions in two footed premium, so that in the most general specification there is a premium of 13%, significant at the 1% level. This club fixed effects model is estimated on a sub-sample with positive appearances only. If we focus on the full sample models in rows 4 and 5, these show us how the two-footed premium responds to performance controls. The two-footed premium is 20% controlling for demographics, position and ability to pay, but falls to 8.1% when performance controls are added and is not statistically significant. One key difference between the two samples is that the left-footed premium is statistically insignificant in all specifications using the Bundesliga panel.

[INSERT TABLE 9]

The OLS estimates are put into some doubt as, in the case of the Bundesliga panel, the p-value for the D'Agostino test on log salary is 0.022, showing a statistically significant departure from normality of the dependent variable. This suggests the need to use quantile regression and estimates, again with bootstrapped standard errors, are shown in Table 9. We find that the salary premium in the Bundesliga for two-footedness is significant at 10 per cent or better across all quantiles except 0.1, where it is statistically non-significant. At the median the premium for two-footedness is estimated at 13.7%, which turns out to be the same as for the median in the European cross-section, though the former is estimated with greater precision. Thus, the quantile regression results from the Bundesliga panel corroborate those from the European cross-section.[7]

[7] One key difference in impacts of control variables between Bundesliga panel and European cross-section is the absence of salary premia for midfield and forward players. Although log salary deviates significantly from nor-

We test the sensitivity of the Bundesliga results to the addition of the *Kicker* subjective performance rating, incorporating variables for the individual's score relative to the average for the position he plays in (forward, midfield or defence). These scores are not available for all players, so the sample size for estimation falls to 1,156. Although these three variables are themselves strongly positive and statistically significant, they have only a marginal effect on the size of the two footed premium. For instance, the premium of 8.3% estimated for two-footedness in the penultimate model in Table 9 becomes 7.1% (significant at a 9% confidence interval). Quantile regression estimates indicate that the two-footed premium is confined to those in the top quartile of the salary distribution once the performance ratings are added to the performance controls.

Given our evidence that two footed players in the Bundesliga appear to earn a statistically significant salary premium, much of which is related to player performance, it is natural to ask whether variations in team members through footedness can affect team performance. Are there opportunities for teams to exploit labour market inefficiencies by raising the share of two-footed players in a team? To answer this question, we constructed a team-level data set from the Bundesliga panel with team payroll and team points over the period 2003/04 to 2006/07. This restriction reduces the number of teams qualifying for our sample from 72 to 57. We also obtained the share of total appearances accounted for by two-footed players for teams which had sufficient coverage of players, taken to be a minimum of 10. Following Simmons and Forrest (2004), we then performed an OLS regression of points on relative average payroll, scaled by average for a given season, and its square. If we add the relative share of appearances by two-footed players to this regression and find it significant then this

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mality in the Bundesliga, we note that nevertheless the player salary distribution is more compressed in Germany relative to other countries. This relative compression may explain the lack of premia for particular positions.

is evidence that two-footed players are underpaid in the Bundesliga player market.[8] If Bundesliga players are paid a competitive salary, appropriate to their position, experience and performance then the coefficient on two-footed appearance share should be insignificant. The results of a pooled OLS regression, with t-statistics in parentheses, are shown below[9]:

$$\underset{\text{(4.83)}}{Points = 35.85\,Relative\ average\ payroll} \underset{\text{(3.11)}}{- 6.31\,Relative\ average\ payroll^2} + \underset{\text{(0.31)}}{2.31\,Two\text{-}footed\ appearance\ share}$$

$n = 57$, $R^2 = 0.55$

A similar model was constructed for the European cross-section, with 98 teams covering the five major leagues. The results are:

$$\underset{\text{(5.67)}}{Points = 25.96\,Relative\ average\ payroll} \underset{\text{(3.11)}}{- 3.14\,Relative\ average\ payroll^2} + \underset{\text{(0.91)}}{9.13\,Two\text{-}footed\ appearance\ share}$$

$n = 98$, $R^2 = 0.67$

These results confirm the finding of efficient pricing of two-footedness across European leagues. From both data sets, it is indeed the case that the two-footed appearance variable has an insignificant coefficient, and in the dimension of footedness at least, opportunities to increase performance by raising the appearance share of two footed players appear to be absent. This is not surprising given the increased degree of player mobility across football leagues that was made possible by the Bosman ruling of 1995 (see Frick, 2009 for an analysis of the impact of the Bosman ruling on player mobility). One interpretation of our result is that players appropriate the rents from their scarce footedness skill. However, player bargaining power is such that they are able to move between clubs even if there is a points premium attached to a team that raises its share of two-footed players.

5. Summary and Implications

[8] Frick and Simmons (2008) found evidence that head coaches were underpaid in the Bundesliga but also argued that over- or under-payment of players would be less likely.

[9] Inclusion of a variable denoting the appearance share of left-footed players delivered insignificant coefficients in each data set.

We have presented substantial evidence in favour of a premium for two-footedness, over and above controls for demographics, player position in team, club ability to pay and player performance. Our OLS results from both data sets show a robust premium for two-footedness, albeit one that declines when performance variables are added. Even with performance variables included, the two footedness premium is substantial, at 15.4% in the European cross-section and 13.2% in the Bundesliga panel.

The premia for two-footedness and left-footedness, relative to the most common case of right-footedness, are found to vary across the salary distribution in the European cross-section, being higher at the top and bottom of the salary distribution compared to the median. In contrast, this premium is quite flat across the salary distribution in Bundesliga panel and is absent for left-footedness. Controlling for performance in the European cross-section the premia for two-footedness is only significant for midfield players, a finding that is consistent with the proposition that two-footedness is particularly valuable for utility players.

Finally, although we find evidence of salary premia for two-footed players in both our data sets, we do not find that utilising more two-footed players adds significantly to team performance. Hence, the observed salary premia do not carry over to mis-pricing of players in the market for footballers in Europe.

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Table 1: Distribution of Left- and Right-Footed Players in European Cross Section

Preferred Foot	Defender	Midfielder	Forward	All Players
Right	61.5	56.6	62.6	59.7
Left	29.9	22.1	11.4	22.4
Left/Right	8.6	21.3	26.0	17.9
Total	795	935	534	2,264

Table 2: Distribution of Left- and Right-Footed Players in Bundesliga Panel

Preferred Foot	Defender	Midfielder	Forward	All Players
Right	55.3	49.5	51.3	51.3
Left	33.5	19.2	23.8	23.8
Left/Right	11.2	31.3	24.9	24.9
Total	161	198	107	466

Table 3: Descriptive statistics for log salary: Mean (standard deviation)

Category	European cross-section	Bundesliga panel
Two-footed	14.64 (1.54)	14.23 (1.03)
Left-footed	14.18 (1.30)	14.06 (0.90)
Right-footed	14.04 (1.33)	14.01 (0.91)

Table 4: Footedness effects for alternative model specifications with European cross-section

Specification	Two foot	Left foot	R^2
Naïve	0.600 (7.09)	0.138 (2.03)	0.026
+ Demographics	0.562 (7.73)	0.081 (1.34)	0.265
+ Job	0.515 (7.06)	0.121 (2.00)	0.274
+ Ability to pay	0.414 (6.22)	0.098 (1.74)	0.380
+ Performance	0.155 (2.82)	0.110 (2.28)	0.576
Club fixed effects	0.143 (2.56)	0.131 (2.67)	0.605

Note: Control variables are as follows. Demographics: age, age squared, full set of nationality dummies. Job: midfield, forward. Ability to pay: attendance variables by country. Performance: appearances, substitute appearances, goals per game, Champions' League appearance dummies, international status dummies. Reference categories are defender, Spanish league, Spanish nationality and Spanish international.

Table 5: OLS and Robust Regression Results for European Cross-Section

Variable	**OLS**	**Robust regression**
Two foot	0.143 (2.56)***	0.138 (2.52)**
Left foot	0.131 (2.67)***	0.120 (2.50)**
Age	0.836 (14.44)***	0.857 (16.64)***
Age^2	-0.016 (14.82)***	-0.016 (16.60)***
Height	-18.73 (1.13)	-18.85 (1.29)
$Height^2$	5.40 (1.19)	5.453 (1.36)
Midfield	0.159 (3.20)***	0.165 (3.41)***
Forward	0.265 (3.71)***	0.272 (4.28)***
App03	0.010 (4.44)***	0.010 (3.57)***
App04	0.029 (11.14)***	0.028 (9.43)***
Sub03	0.000 (0.08)	-0.002 (0.66)
Sub04	0.017 (2.87)***	0.014 (2.08)**
Goal03pg	0.119 (0.54)	0.071 (0.28)
Goal04pg	1.258 (5.37)***	1.249 (4.76)***
Champion03	0.180 (2.79)***	0.145 (1.73)*
Champion04	0.356 (4.66)***	0.337 (3.76)***
UEFA03	0.118 (2.11)**	0.114 (1.58)
UEFA04	0.223 (2.59)***	0.263 (2.73)***
	Also includes club attendance, nationality dummies, international status dummies and club fixed effects	Also includes club attendance, nationality dummies, international status dummies and club dummies

Table 6: Quantile regression results for European cross-section

Quantile	**0.1**	**0.25**	**0.5**	**0.75**	**0.9**
Two foot	0.229 (2.55)**	0.102 (1.37)	0.128 (1.75)*	0.182 (2.42)**	0.202 (2.82)***
Left foot	0.154 (2.08)**	0.096 (1.38)	0.148 (2.77)***	0.045 (0.81)	0.011 (0.16)
Age	1.059 (9.66)***	0.985 (11.28)***	0.794 (10.25)***	0.643 (10.25)***	0.534 (6.87)***
Age^2	-0.020 (9.52)***	-0.018 (11.42)***	-0.015 (10.79)***	-0.012 (10.84)***	-0.011 (7.41)***
Height	-7.807 (0.39)	14.97 (1.48)	-10.75 (0.46)	-60.21 (3.21)***	-42.31 (2.37)**
$Height^2$	2.415 (0.44)	-1.907 (0.57)	3.198 (0.50)	16.86 (3.25)***	11.96 (2.41)**
Midfield	0.200 (2.31)**	0.144 (2.02)**	0.152 (2.54)**	0.153 (2.38)**	0.180 (2.70)***
Forward	0.180 (1.56)	0.211 (2.14)**	0.201 (2.33)**	0.157 (1.77)*	0.227 (2.32)**
App03	0.015 (3.87)***	0.012 (3.69)***	0.011 (4.43)***	0.011 (4.81)***	0.004 (1.23)
App04	0.034 (6.76)***	0.026 (6.56)***	0.027 (8.89)***	0.024 (7.55)***	0.021 (4.98)***
Sub03	0.004 (0.53)	-0.006 (0.86)	-0.005 (0.70)	-0.009 (1.16)	-0.006 (0.69)
Sub04	0.029 (2.64)***	0.020 (2.35)**	0.021 (2.89)***	0.009 (1.19)	-0.007 (0.71)
Goal03pg	0.065 (0.19)	0.170 (0.54)	0.080 (0.37)	0.044 (0.17)	0.179 (0.49)
Goal04pg	1.639 (4.22)***	1.544 (5.01)***	1.522 (6.46)***	1.275 (4.19)***	1.330 (3.55)***
Champion03	0.357 (3.09)***	0.352 (4.79)***	0.274 (3.81)***	0.264 (3.20)***	0.201 (2.03)**
Champion04	0.413	0.442	0.488	0.453	0.440

	(4.11)***	(5.02)***	(7.19)***	(7.21)***	(5.18)***
UEFA03	0.140	0.215	0.134	0.125	0.042
	(1.30)	(2.80)***	(2.23)**	(1.95)*	(0.58)
UEFA04	0.184	0.270	0.302	0.191	0.190
	(1.26)	(3.07)***	(5.08)***	(2.34)**	(2.06)**
Pseudo R^2	0.42	0.40	0.37	0.37	0.38

Table 7: Footedness effects by position in European cross-section

Position	Two foot	Left foot	R^2
Defender			
(1)	0.304 (2.22)**	0.039 (0.45)	0.384
(2)	0.134 (1.27)	0.059 (0.78)	0.562
Midfield			
(1)	0.481 (4.87)***	0.118 (1.38)	0.401
(2)	0.214 (2.54)***	0.187 (2.50)***	0.597
Forward			
(1)	0.400 (3.38)***	0.230 (1.35)	0.365
(2)	0.090 (0.92)	0.081 (0.58)	0.612

Note: Model (1) specifications condition on demographics and ability to pay as per Table 4 row 4. Model (2) specifications are as per Model (1) plus controls for performance as per Table 4 row 5.

Table 8: Footedness effects for alternative model specifications with Bundesliga panel, N = 1321

Specification	Two foot	Left foot	R^2
Naïve	0.265 (2.59)***	0.055 (0.55)	0.015
Demographics	0.280 (3.08)***	-0.042 (0.49)	0.309
Job	0.249 (2.73)***	-0.028 (0.34)	0.321
Ability to pay	0.192 (2.28)**	-0.026 (0.35)	0.385
Performance	0.078 (1.37)	0.0000 (0.00)	0.611
General*	0.131 (2.65)***	0.009 (0.19)	0.664

*Conditional on positive appearances last season, N = 978; club dummies included but jointly insignificant

Table 9: Quantile regression results for Bundesliga panel, N = 1325

Variable	0.1	0.25	0.5	0.75	0.9
Two foot	0.067	0.143	0.128	0.111	0.128
	(0.88)	(2.48)**	(2.72)***	(2.15)**	(2.30)**
Left foot	0.056	0.060	0.038	-0.014	-0.026
	(0.77)	(1.10)	(0.90)	(0.30)	(0.35)
Age	0.432	0.429	0.323	0.212	0.215
	(4.11)***	(5.06)***	(4.75)***	(3.80)***	(2.64)***
Age^2	-0.008	-0.008	-0.006	-0.004	-0.004
	(4.04)***	(4.85)***	(4.65)***	(3.74)***	(2.65)***
Midfield	0.079	0.077	0.048	0.036	0.039
	(1.31)	(1.45)	(1.27)	(0.78)	(0.67)
Forward	0.133	0.093	0.057	0.013	-0.003
	(1.78)*	(1.18)	(0.74)	(0.19)	(0.04)
Log attendance	0.230	0.199	0.165	0.212	0.236
	(3.58)***	(3.22)***	(3.16)***	(4.39)***	(3.87)***
Appearances	0.036	0.029	0.017	0.016	0.009
	(9.74)***	(9.61)***	(7.07)***	(8.00)***	(3.80)***
Previous appearances	0.001	0.000	0.001	0.000	0.001
	(1.67)*	(0.66)	(1.76)*	(0.12)	(1.50)
Champion	0.230	0.235	0.144	0.150	0.085
	(3.35)***	(3.61)***	(2.52)**	(2.43)**	(1.28)
UEFA	0.066	-0.012	0.060	0.010	-0.029
	(0.79)	(0.17)	(0.98)	(0.17)	(0.40)
Goals per game	0.423	0.643	0.897	0.871	1.105
	(1.50)	(2.02)**	(3.18)***	(3.78)***	(5.30)***
South American	0.537	0.441	0.411	0.613	0.632
	(5.05)***	(4.82)***	(4.05)***	(5.05)***	(5.03)***
West European	0.358	0.251	0.261	0.292	0.469
	(4.10)***	(2.63)***	(3.70)***	(3.09)***	(4.52)***
German international	0.570	0.660	0.748	0.765	0.764
	(5.62)***	(8.29)***	(13.32)***	(10.77)***	(8.66)***
East European international	0.390	0.420	0.503	0.579	0.615
	(3.50)***	(4.53)***	(5.37)***	(6.48)***	(3.46)***

South American international	0.421 (2.03)**	0.563 (4.44)***	0.511 (4.44)***	0.280 (2.00)**	0.345 (2.47)**
West European international	-0.006 (0.05)	0.167 (1.28)	0.283 (2.58)***	0.292 (2.30)**	0.177 (1.44)
Pseudo R^2	0.48	0.40	0.38	0.40	0.39

Model also includes dummies for African, Asian and North American nationals (insignificant throughout with German national as base), other internationals (also insignificant with non-international as base) and season dummies.