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A note on the endogeneity of the pay-performance relationship in professional soccer

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Abstract

Torgler and Schmidt (2007) have recently found a positive impact of pay on player performance in German soccer, measured by the number of goals and assists scored within a season. This note shows that their result is spurious as both a player's wage and goal/assist scoring are driven by individual playing abilities. Holding the (unobserved) time-invariant and the varying talent of a player constant, the positive pay-performance link is no longer statistically significant. In professional soccer, wages seem to buy talent rather than motivation.

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1. Introduction

Recently, Torgler and Schmidt (2007) (hereafter referred to as TS) found a positive (but diminishing) pay-performance relationship in professional German soccer. They show that a player's salary affects his field performance as measured by the number of goals and assists scored. Up to a certain point, monetary rewards seem to be an adequate instrument for enforcing work motivation and performance. TS motivate their investigation of a non-linear pay-performance link at the *individual level* as an extension of the study of Simmons and Forrest (2004), who found a positive relationship between wage expenditures and performance at the *team level*. In doing so, however, TS neglect the fact that Simmons and Forrest (2004) do not explain their results with an incentive effect of wages. Rather, they argue that a positive wage expenditure-performance link is the result of teams competing on the market for playing talent in which higher salaries attract superior talent, thus leading to better team performance.[1]

Based on this reasoning, this note argues that the significant pay-performance link in professional soccer disappears when a player's talent is properly accounted for. Whereas motivational factors may play a role concerning team collaboration and interaction (see, e.g., Franck and Nüesch, 2007), neither a low salary nor one that is too high can hinder a player from striving for the great satisfaction of scoring a goal. Professional soccer players do not need to be incentivized to score goals. Using an extended data set of the same league, we will show that the significant pay-performance link of TS is spurious. After controlling for both time-constant and varying playing abilities, a player's wage no longer impacts goal and assist scoring performance.

2. Talent proxies

Having panel data, individual fixed effects may capture the time-constant talent heterogeneity of players. Besides inborn talent, however, there exists a large variety of ability characteristics that change over time: physical fitness, technical skills, and key player attitudes to name just a few. Such time-varying aspects of playing talent are hard to identify from the outside. A team's coach, however, knows quite exactly who is at his best and who is not. He constantly observes and evaluates the performance of his players and fields a team by selecting the best players. As it is a measurable outcome of extensive screening and monitoring, we regard the number of seasonal field appearances as an adequate proxy of a player's varying playing ability relative to the other team members.[2] Information about whether or not someone played for a national team in a specific season

[1] On a team level basis, there exist numerous studies that relate team performance to the team's wage expenditures with the data envelopment analysis approach (e.g., Haas, 2003a,b; Barros and Leach, 2006a) and with frontier production functions (e.g., Barros and Leach, 2006b; Barros and Leach, 2007; Barros and Garcia-del-Barrio, 2008). Barros and Garcia-del-Barrio (2008) provides a good overview of this literature.

[2] The fact that a coach's player selection for a particular match depends on the *relative* playing ability within the team is accounted for by using team dummies. Other factors that may influence the number of seasonal appearances, such as injuries, are likely to be stochastic.

offers another way to capture aspects of the changing talent of a player. TS either controlled for time-constant talent using a player fixed effects approach or considered time-varying talent characteristics, including national team membership or national team appearances as instrumental variables; but they never controlled for both at the same time.

3. Data

In order to test the mediating influence of talent on the individual pay-performance link, we use an extended version of TS's data set. After adding four more seasons, it results in an unbalanced panel of 1596 players (4746 player-season observations covering twelve seasons between 1995/96 and 2006/07), for whom we have individual pay and performance data.[3] Data on goal and assist scoring as well as player background information were collected from the webpages *www.kicker.de* and *www.fussballdaten.de*. We control for unobserved team heterogeneity regarding the pay-performance link by including team fixed effects. Concerning salary data, we use the same source as TS: hardcopies of the *Kicker Sportmagazin*. For ease of comparison, we use the same set of variables as TS and first replicate their findings both in the fixed effects and 2SLS specification. Secondly, we include further covariates of a player's talent like the number of appearances. .

4. Results

The fixed effect estimates in Table 1 show that a player's wage does no longer significantly affect performance if the number of seasonal appearances is taken into account (specifications (2) and (4)). The time-varying aspects of talent increase the variance explained by the model (R^2 within) from 9% to 24% regarding goals and from 8% to 26% regarding assists.

Tables 2 and 3 illustrate the 2SLS estimates of goal and assist scoring using status as an international player and national team membership as instruments of a player's wage. Since these instruments partly reflect a player's changing playing ability, the humped-shaped pay-performance relationships of TS already lose statistical significance if player fixed effects are included. Nevertheless, the number of seasonal appearances still explains additional 14% in the variation of goals (specification (7)) and 18% in the variation of assists (specification (10)). The more a player plays, the more he scores.

In addition, we find evidence for a humped-shaped relationship between a player's performance and his age. The high joint significance of the player fixed effects illustrates the importance to control for the time-constant unobserved talent of a player. Team and season fixed effects are not jointly significant in all specifications.

[3] Along the lines of TS, goalkeepers have been neglected in the estimations.

Table 1: Fixed effect estimates of player performance

	(1)[a] Dep. V.: Goals		(2) Dep. V.: Goals		(3)[b] Dep. V.: Assists		(4) Dep. V.: Assists	
Independent variables	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
Salary								
ABSOLUTE VALUE $_{(t-1)}$	0.284 **	2.26	-0.062	-0.52	0.238 *	1.53	-0.059	-0.42
SQ ABSOLUTE VALUE $_{(t-1)}$	-0.020 *	-1.41	0.008	0.53	-0.008	-0.31	0.015	0.66
Time-constant talent								
PLAYER FIXED EFFECTS	yes ***		yes ***		yes ***		yes ***	
Time-varying talent								
APPEARANCES			0.125 ***	20.63			0.107 ***	24.49
Controls								
AGE	1.218 ***	6.06	0.498 ***	-3.46	0.962 ***	5.95	0.344 ***	2.38
AGE SQ	-0.024 ***	-6.69	-0.011 ***	2.03	-0.018 ***	-6.29	-0.007 ***	-2.68
CHANGED TEAM	-0.697 **	-1.97	0.643 **	2.03	-0.184	-0.67	0.968	3.81
DEFENCE	-0.603 *	-1.70	-0.620 *	-1.92	-0.007	-0.02	-0.021	-0.07
MIDFIELD	-0.424	-1.20	-0.335	-1.07	0.063	0.20	0.139	0.51
TEAM	yes ***		yes		yes ***		yes ***	
SEASON	yes		yes		yes		yes	
R^2 within	0.089		0.244		0.075		0.255	
Change in R^2 within			0.155				0.180	
Observations	4746		4746		4746		4746	

Notes: Player fixed effect estimates. Robust SEs. [a]Replication of model 2 in TS. [b]Replication of model 4 in TS. Salary data are expressed in 2003 Euro millions and adjusted for inflation. Significance tests are one-tailed for directional variables and two-tailed for controls. *, **, *** denote statistical significance at the 10, 5 and 1% level, respectively.

Table 2: 2SLS estimates of goal scoring

	(5)[a] Dep. V.: Goals		(6) Dep. V.: Goals		(7) Dep. V.: Goals	
Independent variables	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
Salary						
ABSOLUTE VALUE $_{(t-1)}$	1.290 ***	5.26	0.367	0.63	0.645	1.27
SQ ABSOLUTE VALUE $_{(t-1)}$	-0.041 *	-1.30	-0.028	-0.47	-0.063	-1.24
Time-constant talent						
PLAYER FIXED EFFECTS			yes ***		yes ***	
Time-varying talent						
APPEARANCES					0.119 ***	18.42
Controls						
AGE	0.255 *	1.91	1.170 ***	3.12	0.134	0.30
AGE SQ	-0.004 *	-1.73	-0.023 ***	-3.51	-0.005	0.01
CHANGED TEAM	-0.313	-1.22	-0.685 **	-2.18	0.681 **	0.28
DEFENCE	-3.118 ***	-22.29	-0.601 *	-1.74	-0.605 *	0.32
MIDFIELD	-2.365 ***	-17.09	-0.426	-1.46	-0.355	0.27
TEAM	yes **		yes ***		yes	
SEASON	yes ***		yes		yes	
R^2 (within)	0.344		0.089		0.230	
Change in R^2 within					0.141	
F-test for excluded IVS	269 ***		269 ***		226 ***	
Anderson canon. corr. LR statistic	514 ***		514 ***		436 ***	
Observations	4746		4746		4746	

Notes: Two-Step-Least-Square (2SLS) estimation with being a foreigner and playing for the national team weighted with the centered national team's FIFA scores as instruments. [a]Replication of model 5 in TS. Salary data are expressed in 2003 Euro millions and adjusted for inflation. Significance tests are one-tailed for directional variables and two-tailed for controls. *, **, *** denote statistical significance at the 10, 5 and 1% level, respectively.

Table 3: 2SLS estimates of assist scoring

	(8)[a]		(9)		(10)	
	Dep. V.: Assists		Dep. V.: Assists		Dep. V.: Assists	
Independent variables	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
Salary						
ABSOLUTE VALUE $_{(t-1)}$	1.179 ***	6.06	0.048	0.10	0.254	0.64
SQ ABSOLUTE VALUE $_{(t-1)}$	-0.059 **	-2.23	0.011	0.23	-0.016	-0.40
Time-constant talent						
PLAYER FIXED EFFECTS			yes ***		yes ***	
Time-varying talent						
APPEARANCES					0.104 ***	20.60
Controls						
AGE	0.031	0.29	1.071 ***	3.56	0.183	0.77
AGE SQ	0.000	-0.13	-0.020 ***	-3.74	-0.004	-0.94
CHANGED TEAM	-0.117	-0.52	-0.211	-0.84	0.985 ***	4.39
DEFENCE	-1.191 ***	-14.29	-0.010	-0.04	-0.014	-0.06
MIDFIELD	0.003	0.04	0.067	0.29	0.130	0.62
TEAM	yes **		yes ***		yes ***	
SEASON	yes ***		yes		yes	
R^2 (within)	0.263		0.073		0.251	
Change in R^2 within					0.177	
F-test for excluded IVS	269 ***		269 ***		226 ***	
Anderson canon. corr. LR statistic	514 ***		514 ***		436 ***	
Observations	4746		4746		4746	

Notes: Two-Step-Least-Square (2SLS) estimation with being a foreigner and playing for the national team weighted with the centered national team's FIFA scores as instruments. [a]Replication of model 6 in TS. Salary data are expressed in 2003 Euro millions and adjusted for inflation. Significance tests are one-tailed for directional variables and two-tailed for controls. *, **, *** denote statistical significance at the 10, 5 and 1% level, respectively.

5. Concluding remarks

In summary, salary does not affect individual goal and assist scoring on the field. Instead, both pay and performance are endogenous to a player's talent. Salaries buy talent rather than motivation, at least regarding the highly visible aspect of scoring.[4] So far, we have treated the number of appearances as a proxy for the time-varying aspects of individual playing ability as identified by the team's coach. There exists, however, a totally different, rather irrational explanation for why the number of seasonal appearances may bias TS's pay-performance relationship. Staw and Hound (1995) empirically show that playing time in the National Basketball Association (NBA) is not only granted according to a player's expected on-court productivity but also according to the draft order. Staw and Hound (1995) explain their finding by a sunk-cost effect as the amount teams spent for players influences how much playing time they get. In order to test potential sunk-cost effects in German soccer, further empirical analyses

[4] We consider that motivation – unlike talent – is not endogenous to the player's salary, at least in our special context, in which performance in itself is generating a lot of satisfaction. If motivation were seen as an aspect of talent, we could not make this distinction. However, we regard the differentiation between talent and motivation as plausible, as the idea that salaries do not affect motivation (but talent) is common in other fields like organizational science as well (see, e.g., Osterloh and Frey, 2000).

would be necessary. Either way, a player's wage impacts the number of appearances, either directly due to a sunk-cost effect or indirectly via the player's talent.[5]

6. References

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[5] The question of on what bases is playing time awarded, however, gains relevance again when non-linear effects of the number of appearances are examined. If playing time is considered a proxy for time-varying playing talent, the second order effect is expected to be positive as more talented players not only receive more playing time but also use this time more efficiently. Additional tests using a squared term of the number of appearances confirm a convex relationship between playing time and scoring performance, which supports our view that playing time is determined by talent appraisals of the coach more than by a sunk-cost effect.