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# Football Technology Transfer: The Effect of Participating in Top-level Football Leagues on FIFA World Ranking Points

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**Abstract**

I estimate the effect of participation in top-level football leagues on national teams' FIFA world ranking points. Taking each national team's FIFA world ranking points as a proxy for the proficiency of a nation in international football, I examine this football technology transfer effect. For this purpose, I use panel data from FIFA member nations for 1999-2006 to control for unobserved nations' specific effects. Additionally, allowing for reverse causality, by which players in powerful national teams tend to play in a top league, I use real purchase power parity as an instrumental variable. When including all nations in the analysis, the number of top-league players has a small negative effect, although the estimated coefficient is not significant. By contrast, for "developing" nations (in football terms: i.e., Africa, Asia, North America, and Oceania), the number of top-league players has a small positive effect. If African national teams are excluded, the skills transfer effect in developing nations strengthens substantially. In particular, if an Asian player plays in a top-level league, the FIFA world ranking points of his national team increase by around 30%, and the estimated coefficient is significant at the 10% level.

**Keywords:** FIFA ranking; skills transfer; panel data; number of top-league players

## 1. Introduction

Football, or soccer as it is known in some countries, is the most popular sport in the world. Federation Internationale de Football Association (FIFA) estimated in Big Account 2006 that 260 million people play soccer. FIFA also announced that 700 million people watched live the final game of the 2010 World Cup in South Africa. Due to the popularity of football, FIFA calculates and announces the FIFA world rankings every month.(Note 1)

The ranking order is based on ranking points that depend on the results of international matches between national teams. These ranking points may reflect the skills of national teams, and the more ranking points held by a national team the happier the citizens of the nation will be, indicating considerable improvement in national welfare. (Note 2) Thus, analyzing the determinants of FIFA ranking points is an important economic issue. (Note 3)

To date, several researchers have tackled this problem. Houseton and Wilson (2002) used FIFA ranking points as a proxy of the popularity of football. Using the June 1999 FIFA points, they found that football is more popular in richer countries and the marginal popularity decreases with income level. In contrast, Hoffmann et al. (2002) used the January 2001 FIFA points not only to confirm the result of Houseton and Wilson (2002), but also to find that a geographical factor is important for determining FIFA points. Specifically, when the average national temperature differs from 14 degrees Celsius, the FIFA ranking points of the corresponding national team decline. Furthermore, Hoffmann et al. (2006) applied a similar analysis to women's football and found that temperature has an insignificant effect, and that the state system and the gender bias are more crucial. In a socialist country with gender equality the women's national team is stronger.

The previous studies are based on cross-sectional analyses. However, football technology might be affected by other unobservable factors. To remove such factors, Yamamura (2009, 2011) conducted a panel analysis. Yamamura (2009) used a panel data set of FIFA points over the period 1993–1998 to demonstrate the convergencing variability of FIFA points, and found that the convergence is explained by skills transfer. That is, players in countries with developing football leagues (not in Europe and Latin America) learn the game in the top professional leagues in England, Germany, Italy, and Spain and then transfer their skills to their domestic national team. Furthermore, Yamamura (2011) used the same data set and found that language differences create communication difficulties when playing football and have a negative effect on football skills.

However, there are two problems with Yamamura (2009). The first is the sample period. FIFA first published a ranking of its member associations in December 1992. Until 1999, a team received one point for a draw or three points for a victory in FIFA-recognized matches, while ignoring important measures including the number of goals and the regional strength. In February 1998, Japan ranked ninth because there are many countries in Asia, and won many preliminary games of the 2000 World Cup played in Japan. To measure the strength of national teams more accurately, FIFA updated the ranking system in January 1999 and readjusted it in June 2006. Thus, using the ranking points from the period 1993–1998 might lead to inaccurate estimates of football skills. The second problem is the proxy of skills

transfer. To estimate the effect of skills transfer, Yamamura (2009), controlling for other factors, regressed the FIFA ranking points on the average world ranking points for the most advanced countries having a top league. He insisted that when the regression coefficient is positive, the superior skills in advanced countries make less developed nations catch up with the more advanced ones via skills transfer through international player mobilization. However, this implies that the average world ranking points for the most advanced countries would have the same effect on all these countries. Rather, the skills transfer effect depends on the number of football players in top-level leagues.

In my paper, I hypothesize that the greater the number of football players in top-level leagues, the more powerful their national team becomes, via skills transfer. Taking each national team's FIFA world ranking points as a proxy for the proficiency of a nation in international football, I examine this football skills transfer effect. I use panel data from FIFA member nations for 1999–2005 to control for unobserved nation-specific effects. Additionally, allowing for reverse causality, by which players in powerful national teams tend to play in top leagues, I use real purchase power parity as an instrumental variable

## 2. Methodology and Data

This section describes the methodology and the data used in the paper. Following Houseton and Wilson (2002) and Yamamura (2009, 2011), I use the FIFA world ranking points as a proxy for the proficiency of a nation in international football. I estimate its determinants and use panel data from FIFA member countries for the period 1999–2005. Within this sample period, some associations joined FIFA and others withdrew from it. (Note 4) Taking this into consideration, I select 205 football associations and drop some when combining them with other country data to construct an unbalanced panel data set with 180 associations.

The estimated function takes the following form:

$$\log PTS_{it} = \gamma PLAYERS + \beta_1 \log RPTS_{i,t-1} + \beta_2 \log TOPTS_t + \beta_3 YFIFA_{it} + \beta_4 WC_{it}$$

$$+\beta_5 YC_{it} + \beta_6 \log INCOME_{it} + \beta_7 \log POP_{it} + \alpha_i + \epsilon_{it},$$

where $\log PTS_{it}$, a dependent variable, represents the logarithm of the FIFA world ranking points of nation $i$ for year $t$, and $\gamma$ and $\{\beta_k\}_{k=0}^{7}$ are regression parameters. The variables $\alpha_i$ and $\epsilon_{it}$ respectively represent the unobservable specific effects of the individual effects of country $i$ and the error term in year $t$. I assume that the error term has a homoscedastic variance.

The definitions of the variables used in the paper are summarized in Table 1. (Note 5) The first four variables ($PTS$, $RPTS$, $TOPTS$, and $YFIFA$) in the table are available from the FIFA official website. (Note 6) Unlike Houseton and Wilson (2002) but similar to Yamamura (2009, 2011), $PTS$ is used as the annual average points. The variable $PLAYERS$ is calculated from the website of EUFO, (Note 7) in which Dennis Grebasch, Michael Woile, and other volunteers have constructed a database of players in most European professional leagues. Each team has profiles of its main players that include age, nationality, and joining year. The

variables $WC$ and $YC$ are available at RSSSF. (Note 8) The last three variables ($INCOME$, $POP$, and $RPPP$) are from the Penn World Table. (Note 9)

**Table 1:** Variable Definition

| Variable | Definition |
|---|---|
| *PTS* | FIFA ranking points (annual average) |
| *RPTS* | Average local ranking points |
| *TOPTS* | Average ranking points for the most advanced nations |
| *YFIFA* | The year a nation first became a FIFA member |
| *PLAYERS* | Total number of players in the top professional leagues |
| *WC* | Total number of World Cup appearances |
| *YC* | Total number of Youth World Cup appearances |
| *INCOME* | Real GDP per capita (Dollars, 2005) |
| *POP* | Population (Thousands) |
| *RPPP* | Real PPP (Dollars, 2005) |

The variable $PLAYERS$ is defined as the number of players in top professional leagues. The main purpose of the paper is to estimate the skills transfer effect of $PLAYERS$ on the FIFA ranking points. The parameter of interest $\gamma$ is interpreted as follows: one additional player in a top league is associated with a $100\gamma\%$ change in FIFA world ranking points. I hypothesize that the talented players obtain skills in the top leagues and then transfer these skills to their domestic national team. Therefore, the expected sign of $\gamma$ is positive.

Note that unlike Yamamura (2009, 2011) but similar to Willson and Ying (2003), I define the top football leagues to be the Premiership (England), Le Championnat (France), Bundesliga (Germany), Serie A (Italy), and Primera Division (Spain). (Note 10) Furthermore, some players have dual nationality. For example, Lionel Messi, one of the most famous football players, is Argentinean and Spanish. Although using this EUFO data set may prove unreliable for estimation of the transfer effect, I assume that players with two citizenships have citizenship of the country of their national team and of their playing country. In the next section, I conduct regression analysis using the data set, excluding the most developed football nations.

In the estimation of the transfer effect, another possible serious problem exists in that the variable $PLAYERS$ might be endogenous. That is, some players who play football in a top league surely contribute to the national team. However, at the same time, some players whose performance is remarkable in an international match have an opportunity to join a team in a top professional league. To avoid such reverse causality, I use an instrumental variable correlated with $PLAYERS$ but uncorrelated with $PTS$. For this purpose, I use $RPPP$, real purchasing power parity, as an instrumental variable. Strong $RPPP$, unrelated to the FIFA ranking points, makes playing in the domestic league more financially beneficial to players. Along with $INCOME$ and $POP$, I will discuss the construction of $RPPP$ later.

Following Yamamura (2009, 2011), I also add $\log RPTS$ and $\log TOPTS$ to the estimated function. The variable $\log RPTS$ denotes the existing local skill level. To obtain this variable, I subtract own ranking points from total ranking points in the locality and divide it by the number of FIFA members minus 1. The localities are the six continental football associations: UEFA (Europe), CONMEBOL (South America), CAF (Africa), CONCACAP (North America), AFC (Asia), and OFC (Oceania) (Note 11). The expected sign is positive. The local spillover in skills matters, and learning from neighbor nations become the engine of skills development. Note that I use lagged $\log RPTS$ to control for simultaneous endogenous bias.

The variable $\log TOPTS$ is used as a proxy variable for the most advanced skills. This is calculated from the average world ranking points for the most advanced countries having top leagues: England, France, Germany, Italy, and Spain. Yamamura (2009, 2011) expected the sign of this variable to be positive because skills transfer leads to less developed nations catching up with the more advanced ones. Although this effect might exist, $\log TOPTS$ is essentially the same as the time effect dummy, implying that such a transfer effect exists equally for all countries. Along with $\log TOPTS$, I incorporate $PLAYERS$ in the estimated function to allow for the hypothesis that more players in top leagues produce a larger skills transfer effect in the national teams.

Other control variables are the years a nation has been a FIFA member ($YFIFA$), the total number of World Cup and Youth World Cup appearances ($WC$ and $YC$), the logarithm of real GDP per capita and population ($\log INCOME$ and $\log POP$). These variables are defined similarly to (Houseton and Wilson (2002) and Yamamura (2009, 2011)). The expected signs of the parameters are all positive. Football experience ($YFIFA$, $WC$, and $YC$) seems to result in an accumulation of football skills. People with higher incomes ($\log INCOME$) tend to spend more leisure time playing football. Those countries with a larger talent pool ($\log POP$) have people with more natural ability for football.

To calculate $WC$ and $YC$, note that some countries that have played in the World Cup and Youth World Cup merged and disappeared. After the fall of the Berlin Wall, the Federal Republic of Germany (West Germany) incorporated the German Democratic Republic (East Germany) in October, 1990. The number of appearances of Germany, therefore, does not include the number for East Germany. In the past, the Soviet Union, Czechoslovakia, and Yugoslavia appeared in the World Cup and the Youth World Cup. These appearances are included in those of Russia, the Czech Republic, and Serbia and Montenegro (Note 12), respectively.

As mentioned in Table 1, I use the Penn World Table (PWT 7.0) to calculate $INCOME$, $POP$, and $RPPP$. The first two variables correspond to rgdpl and POP in PWT 7.0. The final variable is referred to as the real purchase power parity and obtained from dividing ppp by XRAT. Most countries have only one football association, and the data set constructed from PWT 7.0 is combined with the football data set. However, the United Kingdom has four football associations: England, Scotland, Wales, and Northern Ireland. I assume that these four associations are the same with respect to $INCOME$ and $RPPP$. Population data are calculated from each country's statistics department. Of 205 football associations, I choose 180 countries for the unbalanced panel data set.

Before closing this section, I summarize the different ways in which my methodology differs from Yamamura (2009). First, my sample period is 1999–2005, while his was 1993–1998. Second, I added the variables $PLAYERS$ and $YC$ to the estimated function. As I consider $PLAYERS$ to be endogenous, I conduct an instrumental variable (IV) regression using the instrument variable $\log(RPPP)$. Third, instead of $\log(YFIFA)$, I use $YFIFA$. This variable is interpreted as a time effect. As $\log TOPTS$ is already included in my estimated function, I do not use $YFIFA$ except in the pooled IV regression. Fourth, the localities correspond to the six continental football associations, while Asia and Oceania are integrated as in Yamamura (2009). Fifth, I consider the most developed football nations to be England, France, Germany, Italy, and Spain.

## 3. Results

The regression results are summarized in Table 2. (Note 13) Column (1) presents the results for the IV regression without fixed effects. According to this estimate, when one player moves to a professional team in a top-level league, his national team increases its ranking points by 6%. The null hypothesis that the coefficient is zero is rejected in favor of the two-sided alternative at the 1% significance level. However, this regression does not satisfy the sign conditions with respect to experience in international matches ($WC$ and $YC$).

**Table 2:** Empirical Results

| log(*PTS*) | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| *PLAYERS* | 0.0631** | -0.1121 | -0.0108 | 0.0754 | 0.1935 | 0.2604+ | 0.3008+ |
| | (0.0209) | (0.1602 ) | (0.0159) | (0.0516) | (0.1395) | (0.1473) | (0.1639) |
| log(*RPTS*(-1)) | 0.0010 | 0.5970 | 0.7487 | 0.2292 | 0.1408 | 0.2828 | 0.1691 |
| | (0.2248) | (0.3779) | (0.5055) | (0.1664) | (0.3225) | (0.2600) | (0.3842) |
| log(*TOPTS*) | 2.8880 | 0.8030 | 0.0903 | 2.445* | 1.6763 | 1.4606 | 2.6646 |
| | (1.679) | (1.2800) | (0.5092) | (0.9032) | (1.2474) | (1.2653) | (1.6628) |
| *YFIFA* | 0.0032** | - | - | - | - | - | - |
| | (0.0012) | - | - | - | - | - | - |
| *WC* | -0.1338** | 0.2233 | 0.0307 | -0.2721+ | -0.2584+ | -0.3808** | -0.3278+ |
| | (0.0449) | (0.3838) | (0.0340) | (0.1453) | (0.1321) | (0.1699) | (0.1768) |
| *YC* | -0.0524 | 0.0372 | 0.0158 | 0.0126 | -0.0101 | 0.0074 | -0.0110 |
| | (0.0340) | (0.0419) | (0.0138) | (0.0148) | (0.0354) | (0.0255) | (0.0408) |
| log(*POP*) | 0.1165** | 1.6852 | 0.2943 | 0.6279 | 2.0094** | 1.5691** | 1.8476** |
| | (0.0157) | (1.0669) | (0.4608) | (0.4401) | (0.6690) | (0.5541) | (0.7882) |
| log(*INCOME*) | 0.0988** | -0.2886 | -0.0335 | 0.0706 | -0.1010 | -0.0337 | -0.1222 |
| | (0.0215) | (0.4374) | (0.1584) | (0.1102) | (0.1850) | (0.1842) | (0.2492) |
| Sample | 1070 | 1070 | 307 | 763 | 451 | 397 | 235 |
| Group | 180 | 180 | 52 | 128 | 76 | 67 | 40 |

Note: The individual coefficient is statistically significant at the +10% level or *5% level or **1% level using a two-sided test.

In contrast, the regression results in column (2), which include fixed effects, satisfy the sign conditions of $WC$ and $YC$ in that they are both positive. However, this regression indicates the number of players in a top-level league and the income level of the country have a negative effect on ranking points. As suggested in Yamamura (2009), the transfer effect for developed or developing nations is different.

The IV regression estimates using the developed nations (Europe and Latin America) sample are presented in column (3) and using the other developing nations sample in column (4). The skills transfer effect is negative in the developed nations and positive in the developing nations. That is, one player transferring to a top league is expected to result in a 6% increase in ranking points in developing nations. However, the coefficients of $PLAYERS$ are insignificant in (3) and (4).

In (3) and (4), the existing local skill level ($\log RPTS$) and the most advanced skill level effect ($\log TOPTS$) are both positive. Consistent with Yamamura (2009), the coefficient of $\log TOPTS$ is higher in developing nations (4) than in developed nations (3). The coefficient of $WC$ in (4) is negative and significant at the 10% level. This might be because developing countries appearing in the World Cup rarely win their matches. In contrast, the coefficient of $WC$ in (4) is negative. In a fixed effect model, $\log INCOME$ represents the gap from the steady state level rather than the macroeconomic income level, and this business cycle effect has a negative effect on developed countries.

The $P$-value of $PLAYERS$ in (4) is 14%. The null hypothesis that the coefficient is zero is rejected in favor of the one-sided alternative at the 10% significance level, but it is not rejected for the two-sided alternative. Then, I examine the transfer effect for each continental football association. I estimate the IV regression using three data sets. In column (5), I exclude the data for Africa (CAF) from the developing nations data set and use the data for North America (CONCACAP), Oceania (OFC), and Asia (AFC). The coefficient of $PLAYERS$ increases from $0.075$ to $0.193$. That is, if a player from a developing nation, excluding Africa, moves to a top-level league, his national team increases its ranking points by around 20%. This result suggests that the skills of African players tend to make a smaller contribution to national teams than for players in the other developing nations.

The $P$-value of $PLAYERS$ in (5) is 16%, and the coefficient is small. Furthermore, I exclude the data for Oceania (OFC) in the estimation of (5) and provide the regression results in column (6). In this case, the coefficient of $PLAYERS$ is $0.26$ and the $P$-value is 7.7%. The null hypothesis is rejected in favor of the one-sided alternative at the 5% level and in favor of the two-sided alternative at the 10% level. Finally, I estimate the IV regression using only Asian data in column (7). The coefficient of $PLAYERS$ is $0.30$ and the $P$-value is 6.6%. In sum, if an Asian player plays in a top-level league, the FIFA world ranking points of his national team increase by around 30%, and the estimated coefficient is significant at the 10% level.

## 4. Conclusion

In this paper, I estimated the effect of playing in a top-level football league on the FIFA world ranking points of the player's national team. I hypothesize that the more football players that play in one of the top-level football leagues, the more powerful is their national team, via skills transfer. Although the estimated coefficient is not significant, for the data set containing all nations, the number of top-league players has a small negative effect, while for the data set containing only developing nations (Africa, Asia, North America, and Oceania), it has a small positive effect. If African national teams are excluded, the skills transfer effect in developing nations increases substantially. In particular, if an Asian player plays in a top-level league, the FIFA world ranking points of his national team increase by around 30%, and the estimated coefficient is significant at the 10% level.

I close this paper by outlining three future tasks. First, the sample period of the data used in this paper is from 1999 to 2005. In June 2006, FIFA modified the calculation method of FIFA ranking points. At present, there is insufficient macroeconomic country data to examine this later period separately. In future, I intend to use an extended post-June 2006 data set to confirm the results of this paper. Second, I considered skills transfer only for the top leagues. I also intend to estimate the effect of importing coaches and players on the advanced countries. From the viewpoint of data availability, I might be able to estimate the import effect using data from fewer countries but with more detailed information on the professional leagues. Finally, I intend to develop a better model, because the estimation of the parameter of interest ($\gamma$) is only significant at the 10% level. Using a different approach, I may be able to change the dependent variable from FIFA ranking points to the number of players who play in top leagues.

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## Notes

Note 1. The official name is FIFA/Coca-Cola World Ranking. Male rankings are published monthly, whereas female rankings are published every quarter.

Note 2. Other sports may also make people happier, but their popularity varies from country to country. I implicitly assume that football is loved in every country in the world.

Note 3. Many other aspects of the relationship between economics and football are also discussed. See Simon and Szymanski (2009) and Dobson and Goddard (2011).

Note 4. For example, the football association of Yugoslavia was renamed as Serbia and Montenegro in 2003, but I treat it as the same association.

Note 5. I construct the data set for the period September 2011 to December 2011.

Note 6. http://www.fifa.com/worldranking/

Note 7. http://en.eufo.de/

Note 8. http://www.rsssf.com/

Note 9. http://pwt.econ.upenn.edu/

Note 10. Yamamura (2009, 2011) dropped France because the records of teams belonging to Le Championnat are inferior to others in the UEFA Champions League. However, many foreign players, especially Africans, joined the Le Championnat, and thus it is appropriate for transfer effect estimation to include France as a top league.

Note 11. Though currently with AFC, the football association of Australia was affiliated with OFC within the sample period 1999–2005.

Note 12. Serbia became an independent state in 2006, but this does not affect my data set for the sample period 1999–2005.

Note 13. These results are obtained using Stata 12.