



What can econometrics tell us about World Cup performance?

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Executive summary

Econometrics is the standard technique used in explaining and, more hazardously, trying to forecast trends in economic variables such as GDP growth, inflation and unemployment. *Freakonomics* and similar books have popularised the application of econometrics to a wider range of socio-economic topics from the living arrangements of drug dealers to the incidence of cheating by sumo wrestlers. And at PricewaterhouseCoopers (PwC) we have in the past also used these same techniques to provide some insights into Olympic medal performance.

Our analysis in this paper shows that econometric techniques can also offer some useful insights into past and potential future World Cup performance. In particular, we find that host country (and host region) effects are particularly strong in the World Cup. So South Africa might be expected to do a lot better in the 2010 World Cup than its lowly FIFA world ranking of 90th would suggest.

Other African teams such as Cameroon and Nigeria also have the potential to do relatively well in 2010 compared to past World Cups (just as Korea and Japan did in 2002). Our analysis shows that their low average income levels are no barrier to World Cup success and nor is population size a critical factor – David can often beat Goliath on the football field.

The favourite, however, must be Brazil, which is the only team ever to win the World Cup outside of its home region and is ranked first both on historic World Cup performance and in the current FIFA world rankings. Germany, Italy and Argentina are also strong contenders based on their historic World Cup performances, while Spain has been a historic underperformer (notably when playing at home in 1982) that needs to do better this time to justify its 2nd place in the current FIFA world rankings. Portugal and Greece could also be strong contenders this time around based on their performances in recent years.

England remains a good bet for reaching the quarter finals based both on its current FIFA world ranking and its historic World Cup performance, but probably not to get beyond the semi-finals given that it has never achieved this except when playing at home in 1966. Indeed even to get to the quarter-finals would match the best World Cup result that England has had outside of Europe. So anything better than that would be a real success.

One question that sometimes arises is whether a combined UK or GB team (as in the Olympics) would improve the chances of a World Cup victory relative to having separate English, Scottish, Welsh and Northern Irish teams. But, since our model suggests that an increased population adds little to World Cup performance, this may not produce significant benefits in the long run even if it produces a stronger team on paper in the short run. After all, the unified German team has not won the World Cup since it was formed, often appearing less than the sum of its historic West and East Germany parts. The same might happen with a unified UK team.

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Introduction

Econometrics is the standard technique used in explaining and, more hazardously, trying to forecast trends in economic variables such as GDP growth, inflation and unemployment. *Freakonomics* and similar books have popularised the application of econometrics to a wider range of socio-economics problems from the living arrangements of drug dealers to the incidence of cheating by sumo wrestlers. We have in the past also used these same techniques to offer some insights into Olympic medal performance. But can similar techniques offer any insights into past and potential future World Cup performance?

In our earlier analysis of the 2000, 2004 and 2008 Olympics we developed a simple model that suggested that the following factors could boost Olympic medal totals in a statistically significant way:

- Population – as it gives you a bigger pool of potential talent to select from;
- Average income levels (GDP per capita) – as richer countries can afford to invest more in Olympic sports
- Political background – where current or former centrally planned economies (China now, USSR and other Soviet bloc countries in the past) tended to invest in Olympic success as a way to boost national prestige
- Host country – which tended to performed better than these other factors (and past Olympic performance) would suggest.

There is no sign of a similar centrally planned economy effect in football. China is not yet a power in the game and, while Russia and some other former Soviet bloc countries have enjoyed some success, this is not obviously out of proportion to the scale or wealth of their populations.

The other three factors are, however, considered in turn below. First, however, we look briefly at how to measure national performance in football.

Alternative measures of national performance in football

There have only been 18 World Cups since the competition began in 1930 and Brazil (5) and Italy (4) have won half of them. Germany (3), Argentina and Uruguay (2 each), and France and England (1 each) complete the winner's roster.

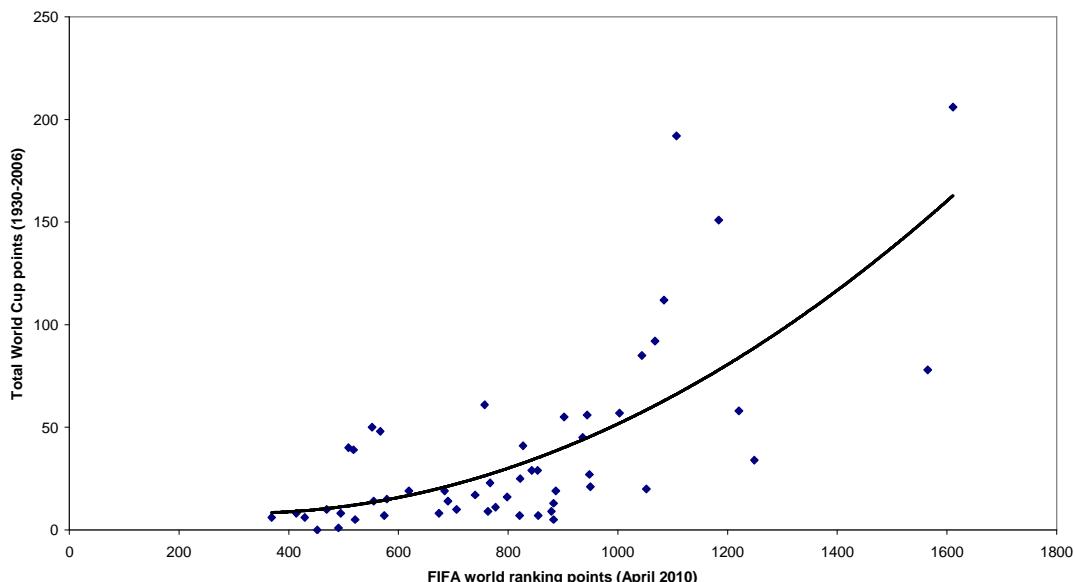
The chances of one of these 7 teams winning again in 2010 must be high, but this is too small a sample for a statistical analysis. Instead we considered two broader measures of national football performance:

- the total number of points scored by each country in all World Cups since 1930, using the current scoring system of 3 points for a win and 1 point for a draw (using data compiled by the website www.planetworldcup.com); and
- the current FIFA/Coca-Cola World Rankings as at 28 April 2010 (using the point scores for each country rather than just the ordinal rankings).

As shown in Figure 1, these measures show a reasonable but far from perfect correlation. Each dot represents a country that has played at least 5 World Cup final matches in its history. The dots above the trend line are countries for which total historic World Cup point scores are high relative to their current FIFA ranking, which would include Brazil, Germany, Italy, Argentina, England, France, Sweden, Poland and Hungary. In some cases, this may just reflect the more limited number of competitors in early World Cup competitions.

The dots below the line indicate countries where their historic World Cup performance has been lower than their current FIFA ranking would suggest. Spain is the most notable case here, ranking second on the current rankings but only 7th in terms of historic performance. Portugal, Netherlands and Greece would be other examples where current FIFA rankings suggest the potential to do better than historically in the 2010 World Cup.

Figure 1: Historic World Cup performance vs current FIFA ranking



The table below shows the full top 20 rankings on these two alternative measures.

Table 1: Top 20 nations by historic World Cup performance and current FIFA rankings

Total World Cup points scored (1930-2006)			Current FIFA world ranking (28 April 2010)		
Rank	Country	Points*	Rank	Country	Points
1	Brazil	206	1	Brazil	1611
2	Germany	184	2	Spain	1565
3	Italy	151	3	Portugal	1249
4	Argentina	112	4	Netherlands	1221
5	England	92	5	Italy	1184
6	France	85	6	Germany	1107
7	Spain	78	7	Argentina	1084
8	Sweden	61	8	England	1068
9	Netherlands	58	9	Croatia	1052
10	Russia/USSR	57	10	France	1044
11	Serbia/Yugoslavia	56	11	Russia	1003
12	Uruguay	55	12	Greece	968
13	Poland	50	13	Egypt	967
14	Hungary	48	14	US	950
15	Mexico	45	15	Chile	948
16	Czech Republic**	41	16	Serbia	944
17	Austria	40	17	Mexico	936
18	Belgium	39	18	Uruguay	902
19	Portugal	34	19	Cameroon	887
20	Romania	29	20	Nigeria	883

*World Cup final games only: 3 points for win, 1 point for draw, 0 for loss.

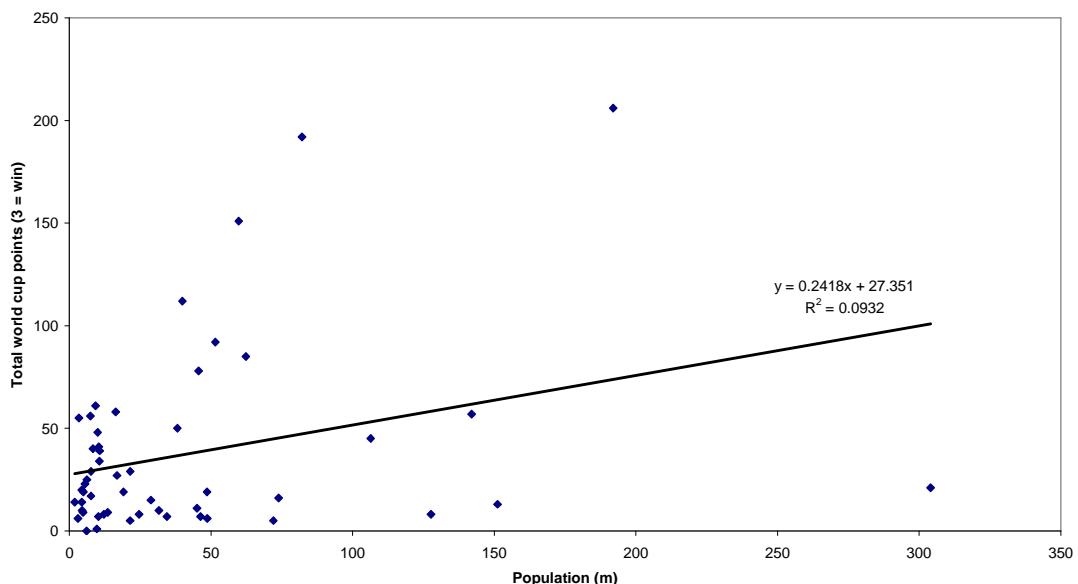
**Includes former Czechoslovakia results. Similarly for Russia/USSR and Serbia/Yugoslavia.

Source: www.planetworldcup.com and FIFA/Coca-Cola rankings from www.fifa.com

Relationship of national football performance with population

You would expect a larger population to improve national football performance due to having a larger talent pool to choose from and, indeed, simple regressions confirm that is the case both for historic World Cup performance and for current FIFA rankings. But the relationship is far from uniform, as illustrated by Figure 2 below:

Figure 2: Total World Cup points vs population



Although the relationship is statistically significant at the 95% confidence level (t -statistic = 2.2), there are clearly many exceptions where countries lie well above or below the trend line. The US, for example, scores well below expectations based on its population size, while Brazil is well above expectations. This reflects the ascendancy of football in Brazilian sport as contrasted to the greater popularity of sports such as American football and baseball in the US. China and India would be even more dramatic examples of low levels of World Cup success relative to populations of over 1 billion.

Against this, there are clearly several footballing 'Davids' that regularly outperform 'Goliaths' with much larger populations. Portugal and Croatia are examples from the top 10 of the current FIFA rankings, while Argentina has often matched Brazil despite only having a population only around a fifth as large. Tiny Uruguay, with a current population of only 3.3 million, twice won the World Cup in its early days (admittedly from a smaller field and only when playing at or close to home) and remains in the Top 20 of the FIFA rankings. Sweden has also 'punched above its weight' in past World Cups.

More generally, population explains only around 9% of the variation in total World Cup points (as indicated by the R -squared statistic of 0.09 in Figure 2) and 8% of the variation in FIFA world rankings. So population size is only a relatively small part of the overall story. This may reflect the fact that, if a country has a strong footballing tradition, then finding 11 international class players should not be that difficult even from a population of just a few million. This is in contrast to the Olympics where only the large countries can produce world class performers across the broad range of sports necessary to reach the top of the overall medals table.

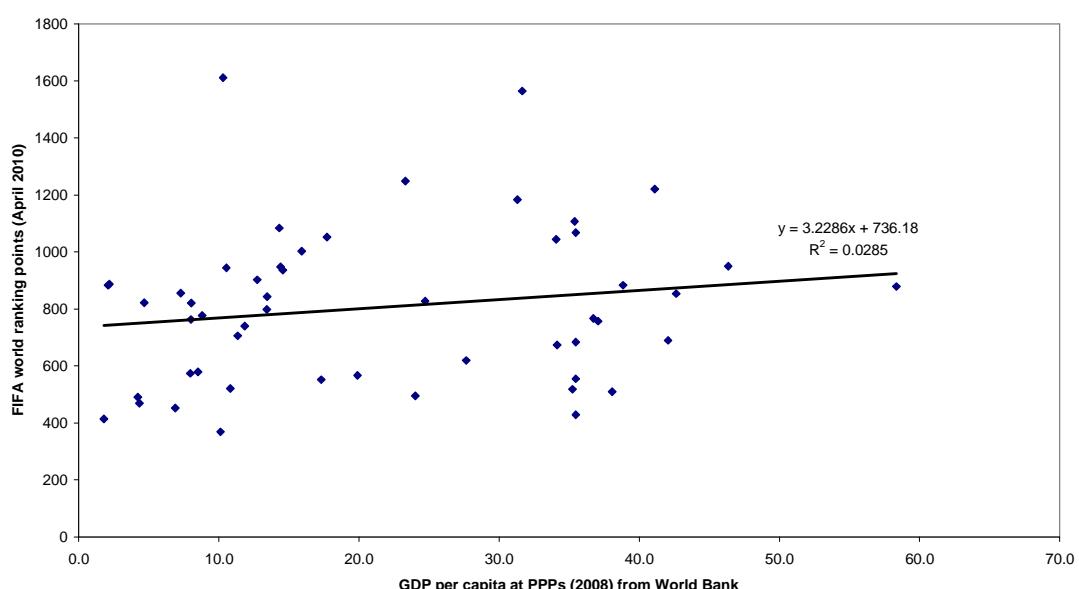
One question that sometimes arises is whether a combined UK or GB team (as in the Olympics) would improve the chances of a World Cup victory relative to having separate English, Scottish, Welsh and Northern Irish teams. But, since our model suggests that an increased population adds little to World Cup performance, this may not produce significant

benefits¹ in the long run even if it produces a stronger team on paper in the short run. After all, the unified German team has not won the World Cup since it was formed, often appearing somewhat less than the sum of its historic East and West Germany parts. By contrast, Russia and Ukraine emerged as strong individual teams after the disintegration of the former USSR, as have Serbia and Croatia from the former Yugoslavia. This may reflect the greater number of opportunities for players to get international experience with separate teams, as well as perhaps a stronger sense of national identity and pride with smaller but more cohesive nations.

Relationship of national football performance with average income levels

In the case of the Olympics, we also found a statistically significant positive relationship between number of medals won and average incomes, as measured by GDP per capita. But no such significant relationship is evident for football, as shown in Figure 3 below.

Figure 3: FIFA world rankings vs GDP per capita



Although there is a slight upward slope to the trend line, this is statistically insignificant (*t*-statistic = 1.2 relative to a 95% confidence level of around 2) and GDP per capita explains only around 3% of the variation in FIFA rankings across countries. For historic World Cup points scores, the relationship is similarly very weak and statistically insignificant.

It seems, therefore, that richer countries do not generally outperform poorer countries at football. This may reflect the fact that basic footballing skills can as easily be honed in the back streets as in an expensive sports centre. Furthermore, football may represent one of the most appealing ways out of poverty for boys in lower income countries, just as England's greatest football stars have traditionally come from working class backgrounds rather than middle class suburbs (in contrast to tennis, for example, which has tended to be more of a middle class sport in the UK, although not necessarily in other countries).

How important is host country advantage?

Host countries tended to outperform prior or subsequent medal totals in most cases at the Olympics, with the odd exception (notably the US in Atlanta in 1996). Here the footballing

¹ There could also be costs in terms of losing votes in international football governance and possibly fewer slots in European competitions for UK club teams with one national team rather than four.

evidence seems equally clearcut that there is a significant host country advantage. We can see this first from looking at the performance of host countries since 1930 as summarised in Table 2 below.

Table 2: Host country performance at the World Cup

Year	Host country	Performance of host country
1930	Uruguay	Won
1934	Italy	Won
1938	France	Lost in quarter final vs eventual winner (Italy)
1950	Brazil	Lost in final vs Uruguay
1954	Switzerland	Lost in quarter-final (5-7 to Austria)
1958	Sweden	Lost in final vs Brazil
1962	Chile	3 rd place
1966	England	Won
1970	Mexico	Lost in quarter final (vs Italy)
1974	West Germany	Won
1978	Argentina	Won
1982	Spain	Lost in second group phase (last 12) vs West Germany
1986	Mexico	Lost in quarter-final (vs West Germany)
1990	Italy	Lost in semi-final (vs Argentina)
1994	US	Lost in last 16 to eventual winner (Brazil, 0-1)
1998	France	Won
2002	S. Korea/Japan	S. Korea reached semi-finals; Japan lost in last 16
2006	Germany	3 rd place (lost to Italy in semi-final)

Source: www.planetworldcup.com

We can see that the host country has won 6 out of 18 World Cups and, even when they did not win, they have generally had a good run. England and France won their only World Cups when playing at home, while Switzerland, Sweden, Chile, US, South Korea and Japan all performed above their normal level to varying degrees when playing at home. Spain was perhaps the most clearcut disappointment in 1982 and Italy and Germany might have hoped for better in 1990 and 2006 respectively, but they are the exception to the general rule.

There is also a clear 'host region' effect that may reflect a mixture of strong home crowd support and familiar climatic conditions. European countries have only won the World Cup when it has been held in Europe, while Latin American teams have won all the World Cups held in the Americas. Only Brazil of the Latin American teams has won the cup in Europe (in Sweden in 1958). Brazil also won the only World Cup held outside Europe or the Americas (Korea/Japan in 2002), which could be a pointer to the likely result in South Africa in 2010.

Econometric model results

These results are confirmed by a more formal statistical analysis in which total World Cup points is regressed against population, average income levels and a dummy variable based on the number of times a country has hosted the competition (with values 0, 1 or 2).

Table 3: Model results for explaining total World Cup points by country

Explanatory variables	Coefficient	Standard error	t-statistic	Comment
Constant	19.7	9.2	2.1	Statistically significant
Population	0.05	0.1	0.5	Positive but insignificant
GDP per capita at PPPs	-0.05	0.35	-0.14	No significant effect
Host country dummy	45.9	8.7	5.3	Highly significant positive effect

R-squared = 0.44, F = 12.8

Source: PwC analysis for 52 countries that have played at least 5 World Cup final matches

We can see from Table 3 that, once the host country variable is added, this is seen to be highly significant and positive, but the population effect, although still positive, is no longer statistically significant and the income effect essentially falls to zero.

These results need to be interpreted with some care, since there could be reverse causality here: countries more likely to do well may be more inclined to host the World Cup. Larger and richer countries may also be more able to do so in general, so leading to correlations between explanatory variables that could complicate the interpretation of the individual coefficients. Furthermore, willingness to host may be a proxy for the strength of a country's footballing tradition, which could be a missing variable in these kinds of regressions, rather than implying a large home advantage per se.

This latter point can be supported by repeating this exercise with the FIFA world rankings as the variable to be explained. For the same sample of 52 countries, the results are as shown in the table below.

Table 4: Model results for explaining FIFA world ranking points

Explanatory variables	Coefficient	Standard error	t-statistic	Comment
Constant	702.3	47.7	14.7	Statistically significant
Population	0.89	0.65	1.36	Positive but insignificant
GDP per capita at PPPs	0.01	0.7	0.02	No significant effect
Host country dummy	182.2	58.4	3.1	Highly significant positive effect

R-squared = 0.27, F = 5.8

Source: PwC analysis for 52 countries that have played at least 5 World Cup final matches

We can see that the host country dummy is still significant here, although less so than in Table 3, even though the rankings are based on recent performance covering more than just World Cup competitions (and excluding most of the past World Cups). So the host country effect does seem to be picking up more than just home advantage but also something about the strength of footballing tradition in different countries.

The other results are similar to those in Table 3, although the population effect is somewhat larger and closer to being statistically significant ($t = 1.4$ vs $t = 0.5$). The income effect is still essentially zero.

The other point to note from both Tables 3 and 4 is that the explanatory power of the equations is not great: 44% for historic World Cup performance and just 27% for the FIFA rankings. So there is a great deal that is unexplained here reflecting the particular strengths and weaknesses of national teams that would require a more football-specific analysis to pin down. But this should be reassuring to the fans: no-one wants sporting results to be too predictable (not least England fans if we end up in another penalty shoot-out!).

Conclusions and implications for World Cup 2010

Our analysis in this paper shows that econometric techniques can offer some useful insights into past and potential future World Cup performance. In particular, we find that host country (and host region) effects are particularly strong in the World Cup. So South Africa might be expected to do a lot better in the 2010 World Cup than its lowly FIFA world ranking of 90th would suggest.

Other African teams such as Cameroon and Nigeria also have the potential to do relatively well in 2010 compared to past World Cups (just as Korea and Japan did in 2002). Our analysis shows that their low average income levels are no barrier to World Cup success and nor is population size a critical factor after adjusting for host country effects – David can often beat Goliath on the football field.

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