An Economic Analysis of Sports Performance in Africa

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Abstract

The purpose of this study is to develop insight into the socio-economic determinants of African sports performance. Previous studies have argued that a country's success in sports is directly related to the economic resources that are available for those sports. However, factors that are used to determine the levels of success for developed countries are not necessarily the same, or bear the same weight, as for developing countries. The premise of this study is to identify specific factors that increase success in sports in developing countries by means of several econometric specifications, using cross-sectional data for African countries. This study finds evidence that suggests that Africa's performance in sports is dependent on a range of socio-economic factors, which in some respects confirms worldwide studies, but also adds significant nuance.

Keywords: Sports performance, economic determinants, Africa
JEL Codes: L83, J4, L2, O55, Z00

1 Introduction

Why do some countries win medals whilst others do not? Research conducted internationally to identify factors that affect sports performance focuses on resource endowments, a country's population and cultural and social resources (Kiviaho and Makela 1978; Bernard and Busse 2004; Andreff, 2001; Johnson and Ali 2004). It is suggested that countries that are successful in sports have an abundance of financial resources, have a large population and an appropriate climate. The studies tend to suggest that countries such as the United States, Great Britain, and Australia have an advantage in sports competitions due to their economic endowments. The research fails to explain why poor countries are able often to compete successfully despite these apparent obstacles. For instance, Kenya and Ethiopia excel in middle distance running, Angola in basketball, and the Cameroon in football. Yet, South Africa, with its economic hegemony on the continent, underperforms relative to its economic endowment.

It can be argued that a country's success in sport should be evaluated relative to its economic resources and that medal achievement should therefore be weighted relative to a country's Gross Domestic Product (GDP) per capita. Utilising this criteria, countries including Mongolia, Jamaica, Zimbabwe and Kenya topped the list of achievement at the Beijing Olympics, while South Africa performed well below expectation. The discrepancy between actual and predicted achievement for a given amount of resources represents the total inefficiency of resource utilisation. The purpose of this study is to explore factors that increase success in sports in developing countries by means of several econometric specifications, using cross-sectional data for African countries.

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2 The Economics of Sport and Sporting Performance

Sport and recreation potentially have a significant impact on a country's economy. The sport industry creates direct economic benefits through employment, revenue from events, consumables and general taxation. In fact, sport can be considered a composite sector that contributes to hospitality and tourism, to the textile industry through the manufacture of sports clothing, and to employee productivity through activity and health. Sport has assumed an ever greater role within the globalisation process and in the regeneration of national identity .(Nauright 2004). The Olympic Games, The Federation Internationale de Football Association (FIFA) World Championship and other significant sporting events have become highly sought-after commodities. These events are used as a global platform to create an awareness of the host city, and present the country as an exciting destination for tourists. In industrialised countries sport contributes to about two percent of annual GDP. For example, in the United States, the sports sector includes the manufacturing of sports goods, sports-related services and sports events. Various studies have estimated the size of the sports industry in the US. Depending on the method employed, estimates range from $152 billion (making it the 11^{th}largest industry), to between $44 and $73 billion (Ashton, Gerrard and Hudson 2003; and Humphreys and Ruseski 2009).

2.1 Socio-Economic Determinants of Sporting Performance

Various studies have found that sporting success – or a lack of success – is an outcome of several factors, including the financial, social, and population resources of a country (Bernard and Busse 2004; Johnson and Ali 2004; Churilov and Flitman 2006). The conclusions are based on an economic and statistical analysis of the relationship between success in sport and variables including: GDP per capita, population, nature of polity, cultural and social resources, home advantage, and levels of urbanisation.

An attempt to conduct a trans-national comparison in sport on the basis of prevailing social and economic conditions can be challenging. Comparing budgets allocated to sports for different countries can provide crude results. Comparisons on the basis of the number of stadia, track and field training areas or swimming pools, measured on a per capita basis or evaluated in terms of their distribution, could be of value but may not be entirely feasible: private ownership and cross-border sponsorship of sports installations may limit the accuracy of the data. As a result, economists studying the relative effects of financial resources on sporting success have been limited to using aggregate macro-level data.

Irrespective of financial and domestic circumstances, a few countries have been able consistently to excel, through a strategic allocation of resources to sports in which they have developed a comparative advantage (Hamilton 2000). For instance, some countries have focused their resources on individual, medal-intensive sports such as swimming and gymnastics, as opposed to team sports, (Tcha 2004, Novikov and Maksimenko 1972).

While evidence indicates that economic resources are an important consideration, there are other factors to consider, too. Local traditions steer talented individuals in the direction of the most popular local sport. For example, India has a tendency to promote cricket as opposed to athletics, which helps explain India's consistent poor performance at multi-sport games. Other examples of how local traditions promote certain types of sport are the distance runners from Kenya and fencers from Tauberbischofsheim in Germany (Hamilton 2000). Cote *et al* (2006) conclude that the place of birth and therefore the benefits of being born in that particular area, contribute to sports performance.

Tcha and Pershin's (2003) analysis revealed that certain countries are successful in specific sports due to their geophysical and climatic conditions. This reasoning has been used in an attempt to explain Kenya's success at marathon running, even though countries that have similar altitudes and climates have not been as successful as Kenya. According to a review by Bernard and Busse (2004),

there is a lack of consensus regarding the relationship between geographic variables and sporting success.

It is assumed that countries with relatively larger populations provide a wider pool of athletes to compete. Johnson and Ali (2004) find that, in the 1996 Olympic Games, nations that won at least one summer medal had a population five times greater than non-medal populations. It is possible that the fixed costs of training, infrastructure and facilities can be shared more effectively across large populations (Rathke and Woitek 2008). However, population levels alone may not be sufficient to explain success (Condon, Golden and Wasil 1999). India, with a population of 1.5 billion people is relatively unsuccessful at the Olympic Games. It appears that the effect of a large population may only be positive for relatively wealthy countries that are able to allocate additional resources to sports development (Kuper and Sterken 2001). Hoffmann *et al* (2002) could not find evidence to suggest that success in soccer is dependent on the size of a country's population. They were, however, able to prove that success is dependent on population size if the population spoke Latin or a derivative of Latin, which they included as dummy variables. This is likely to be football specific.

2.2 Econometric Evidence

The determinants of sporting success have been investigated in many studies (Kiviaho and Makela 1978; Baimbridge 1998; Condon *et al.* 1999; Kuper and Sterken 2001; Hoffmann, Ging and Ramasamy 2002, 2004; Tcha and Pershin 2003; Bernard and Busse 2004; Johnson and Ali 2004; Matros and Namoro 2004). The researchers utilised Olympic medal counts as a dependent variable, to represent Olympic success, and socio-economic variables as independent variables. Some authors tried to improve on the methodology of the previous studies by utilising weighted medal counts, modified regression analysis, and including White-corrected errors to account for heteroskedasticity (Condon *et al.* 1999; Tcha and Pershin 2003; Bernard and Busse 2004). Two macro-economic variables, namely GDP and population, were consistently associated with sporting success. There were fewer consensuses regarding other variables, including land mass, polity, urbanisation, health and culture. All of the studies included Olympic medal achievement, or a variant, as a proxy for sporting success. Hoffmann *et al* .(2002) utilised FIFA rankings and points allocated, but only included countries that achieved medals at the previous summer Olympics and excluded zero-medal countries to adjust for censored data. Their results were in keeping with the common consensus. The studies are based on the assumption that there is equal sporting talent throughout the world, and every nation has equal opportunity of producing competitive athletes.

According to the models based on GDP and population, African countries are predicted to win few, or no medals (Bernard and Busse 2004; Johnson and Ali 2004). These models are sufficient for predictions in the developed world and for non-medal winning countries, but are poor predictors of medal winning in African countries. According to the models, South Africa was predicted to win ten medals, Tunisia five and Kenya two. The actual medal tally was South Africa and Tunisia with one medal and Kenya with 14 (Johnson and Ali 2004; Hawksworth 2008). Theories and models used for developed market economies may not be appropriate for developing economies. De Bosscher *et al* (2006) cite research which finds that the importance of these variables in explaining international sporting success has decreased over the last two decades and may only explain 45% of success after1980. Further research into sporting success is warranted and may include delving further into the systems of sport.

3 Empirical Methodology and Estimation Results

The research includes the development of several econometric models utilising variables identified in the literature above. Several studies have reported variables that impact on sports performance, specifically at the Olympic Games (Kiviaho and Makela 1978; Bernard and Busse 2004; Johnson and Ali 2004). The four models developed below labelled A, B, C and D are representative of the

Olympic Games, FIFA World Championship Football Rankings, a separate sub-section of African countries only, and the All Africa Games. The data set for Models A and B include all countries that are participants at the event and for which there were available data –156 countries in each model. The data set for models C and D include countries from Africa only – 52 countries in each. The dependent variables for Models A and D represent the total medals achieved by a country at a competition, and have been modified with a weighted points allocation system, in which three points are awarded for a gold medal, two for a silver medal and one for a bronze medal. The weights adjust for the hierarchy and prestige of winning a particular medal. Models B and C rely on the FIFA World Championship Football Rankings. The FIFA World Ranking was introduced in August 1993 and is the definitive indicator for FIFA's member associations' respective positions in world football. The ranking is based on a points system taking into account various factors including the result, importance of match, strength of opponents, regional strength, and number of matches considered. Table 1 provides a breakdown of this calculation.

The variables emerging from prior studies were selected for the following linear specification:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + \varepsilon$$

Four models were tested and the list of dependent and independent variables in each model are presented in Table 2 (a full explanation of these variables and their sources is provided in Appendix A).

3.1 *Model A*

Model A is a representation of an econometric specification quantifying the relationship between a country's success at the Beijing Olympic Games, as measured by a cumulative weighted medal score (wtdOlympic), and the selected socio-economic dependent variables.

We test the following relationship:

WtdOlympic = $\beta_0 + \beta_1$Population + β_2 GDP + β_3Climate + β_4Elite + ε

The econometric specification derived utilising an alpha of five percent (α= 5 %) is detailed in table 3.[1] The estimation supports prior international studies that have indicated that medal results at the Olympic Games are associated with GDP and population size. We also find that countries with elite high-performance centres tend to outperform countries that do not. This is as expected, given the critical mass of financial, infrastructural and human capital investment in these centres. Our climate variable (mild mid latitude) is not significant at the 5% level and this most likely is the result of the fact that the Olympics showcase a wide variety of sports, many of which are played indoors or do not require moderate climatic conditions. Whilst GDP is significant in all our subsequent models, this is not the case for population size, which is significant only for the Olympics. This again could be the result of the diverse nature of sports at the Games, which a large population supports. Our results therefore broadly confirm previous studies.

3.2 *Model B*

Hoffman *et al* (2002) used FIFA's points allocation as a proxy of sports performance, but restricted their study to a subset of countries that competed successfully at the Olympics. Model B is a representation of an econometric model quantifying the relationship between a country's success in football, as measured by the cumulative FIFA points allocation at year end, (FIFApoints), and selected socio-economic variables. The following relationship was evaluated:

FIFApoints = β_0 + β_1Population + β_2GDP + β_3Climate + β_4Health%/GDP + β_5Latin + β_6Corruption + ε

[1] Various tests for multicollinearity were conducted for all four models and none found.

The econometric specification derived utilising an alpha of five percent (α= 5 %) is detailed in table 4. The estimation confirms GDP as being positively and significantly associated with better performance in world football in line with previous studies. Furthermore the inclusion of the Latin dummy variable is significant as in prior studies. Our climatic variable is significant, indicating that countries with mild climates at mid latitudes have a competitive advantage relative to those located at more unfavourable conditions. Lastly we find that higher levels of health spend as a percentage of GDP is positively associated with better football performance, presumably reflecting better population health which in turn supports more robust football players.

We included a proxy for corruption to test for organisational effects, although it is insignificant. The corruption variable is a Transparency International Index and represents the perception of corruption in a country. The index ranges from zero to ten, with ten indicating the best perception of a country (i.e. lowest corruption), and zero indicating the highest perception of corruption in a country. Figure 1 shows a scatter plot of perceived corruption (CPI) versus GDP per capita and FIFA points. It illustrates a positive relationship in each case indicating that lower corruption is associated with higher GDP per capita and higher FIFA rankings.

3.3 *Model C*

The model specification described in the literature discounts the effects of specific factors which affect sports performance in African countries. Most African countries perform poorly at the Olympics. As a result, subsequent models developed for sports performance specified for the Olympics, differentiates poorly for African countries. This study accommodates African countries by modelling sports performance at the All Africa Games and by examining a sub-section of African FIFA countries. Model C examines the factors affecting the performance of African countries, using the FIFA point system as the dependent variable. It is therefore a re-run of Model B, applied to 52 African countries. We do, however, drop the Latin variable, as it is largely irrelevant in the African context. Table 5 presents the results.

In this case our estimation finds only GDP to be significantly associated with better football performance . None of the other variables that came through as significant in Model B for all FIFA countries, including climate and health, appear significant when we focus on the 52 African countries only. The main driver of football performance in Africa is the size of a country's economy, indirectly reflecting the prominent role that money plays in football – even in poorer developing countries. In the case of Africa it may well reflect the lack of basic sporting facilities in the poorest countries; GDP may act as a useful proxy for such sport investment.

3.4 *Model D*

Model D is a representation of an econometric model which quantifies the relationship between a country's success at the All Africa Games, as measured by a cumulative weighted medal score (wtdAfrica), and the selected socio-economic and organisational dependent variables. The following relationship was evaluated:

WtdAfrica = $\beta_0 + \beta_1$GDP + β_2 Climate + β_3Education +β_4 Health%/GDP + β_5 Corruption + ε

The econometric specification derived using an alpha of five percent (α= 5 %) is detailed in table 6. The All Africa Games represent a multitude of sport and is thus more representative of the types of sports conducted at the Olympic Games. GDP once again is positively associated with better performance and is highly significant. Our climate variable is significant, with dry climate being positively related to performance. Our final variable that is significant is education, which captures the percentage of the population that enrolled for formal secondary education. It indicates that having a greater proportion enrolled in secondary education is associated with better performance in high-level sport. This could reflect various possibilities, with one explanation being that it is a

proxy for better coaching and administrative/managerial staff in sporting administrations. It could also reflect the fact that skill levels in some sports may be associated with overall skill levels, which would be captured by educational enrolment.

Our research has thus confirmed some previous results but also illustrated the nuance required when examining the case of African sporting performance. The one result which is consistent throughout the four model specifications is the importance of GDP. Regardless of whether one is looking at the Olympics, FIFA points, the All Africa Games or indeed a sub-section of African countries – GDP matters for sport performance. A summary of the results is presented in Table 7.

This study adds further evidence to the Revealed Comparative Advantage (RCA) theory proposed by Tcha and Pershin (2003), by explaining and developing the association between high income and sports performance. Countries with larger GDPs have a higher probability of exploiting and creating a dynamic comparative advantage. Whilst variables like climate may be associated with static comparative advantage, larger economies allow one the possibility of creating comparative advantage through excellence in coaching and through high-quality facilities for example. In addition to a higher income, a country needs to allocate its resources appropriately to realise its comparative advantage. The theory of RCA is incomplete without considering that the required allocation may be misspecified without alluding to allocative and technical efficiency. A modified perspective suggests that countries that have a higher GDP, and that are able to allocate and utilise the resources efficiently, will have an increased probability of success in sports (Gerrard, 2005). This may be a more feasible explanation in describing the success of Great Britain and Australia in sports (Bloomfield, 2002; Green, 2004). In as much as there is an abundance of financial input by the governments of both Australia and Great Britain, both sports systems were forced into change to ensure that the financial inputs were appropriately utilised to maximise the output ...(Green and Oakley 2001). It may also account for the fact that whilst South Africa is the economic powerhouse on the continent, it has not been able to translate that into any real comparative advantage. Thus, although GDP is one component of sports success, it needs to be translated effectively into medals and points through a competent production function. Some countries are more successful at this translation process than others.

4 Conclusion

Sport is tied intimately to issues of national pride and has the potential to transcend deep divides in fragmented societies. But it also has the capacity to further polarize and expose underlying schisms. Matters are complicated further by the fact that sport is big business. This research has shown that money does indeed matter: GDP was the overwhelmingly consistent dependent variable in all four models tested. Interestingly we do find important shades of distinction between the various dependent variables. With respect to the Olympics, besides GDP, we also indicate the importance of population size and elite facilities. Climate does not seem to matter in sporting success, which is probably the result of the diversity of sports represented at the Olympics, many of them indoors. On the other hand, football success is explained by GDP, climate and health spending for all FIFA countries, but, when only African countries are considered, only GDP appears significant. In the case of the All Africa Games, the explanatory power of GDP and climate are confirmed, and the importance of education is introduced.

Previous studies have treated countries as a homogenous grouping and allowed the broad aggregates to reveal the determinants. In this study we focus on a sub-group of countries that are relatively poor, have had a complex past with colonial masters, and that generally have weak administrative structures. We find that a country's performance in sports is not only dependent on financial resources, but also on the level of investment in education and health. This raises interesting questions. In a developing country, sport is a luxury good and one needs to question whether countries should indeed be preferentially allocating funds directly to sports performance, or whether

they should rather concentrate on improving economic growth, education and health which may in any event indirectly promote an improved sports performance.

On the African continent, South Africa is an interesting case of underachievement, given its relatively high level of resources. It has the largest GDP on the continent by a large margin, but is ranked only 17^{th} amongst African countries in football, with poor countries like Guinea, Congo, Uganda and Angola featuring higher up the rankings. Likewise, at the summer Olympics in Beijing, South Africa was ranked 12^{th} amongst African countries, with Kenya, Ethiopia and Zimbabwe achieving superior positions. The bang for buck in South Africa in terms of its production function is poor and this reveals internal problems and inconsistencies. The promotion in South Africa of mass access and efforts to eradicate the inequalities of the past contrast with the single-minded focus in other countries on pushing medals. While not the focus of this study, this does expose the classic dilemma where organisations face a multitude of performance indicators and goals, but do not reconcile these fully into an overarching mission. It also illustrates the importance of further study at the micro and organisational level within sport (see Weinberg and McDermott, 2002).

There is a lack of research in the field of sports and organisational economics especially in emerging countries. This paper used cross-sectional data to suggest that sporting performance is dependent on a range of socio-economic and organisational determinants. Future research should focus on longitudinal studies of countries and their sport performance over time. Panel studies, case studies eliciting a detailed understanding of a chosen country or organisation and its sports performance, and impact assessments of real interventions, would also be valuable.

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Table 1 - Basic Calculation Criteria of FIFA World Rankings

Matches	All international "A" matches
Result: Win-Draw-Defeat	3 points – 1 points – 0 points
Importance of match	1 (friendly match) to 4 (FIFA World Cup)
Strength of opponent	Position in world ranking (no 1 = 2.00, no. 30 = 1.70, no 118 = 0.82 etc.) Formula: [200 - Position] / 100
Regional strength	Based on results in last three FIFA World Cups (wins per confederation per match)
Period	Last four years, gradual decline in importance of results: 100% - 50% - 30 % - 20 %
Number of matches considered per year	Average points gained from all matches in last 12 months (minimum: 5 matches)

Source: www.FIFA.com

Table 2 - A list of variables utilised for the development of the econometric models

Description of Model	Dependent variable	Independent Variables
Model A A sample of 152 countries Beijing Olympics, 2008	Weighted Olympic Medals 3 points for a gold 2 points for a silver 1 point for a bronze	Elite Log GDP Log Population Mild mid latitude
Model B A sample of 152 countries FIFA 2008 Rankings	Points at year end	Corruption Perception Index Latin Log GDP Log Population Mild mid latitude Health spending as % of GDP
Model C A sample of 52 countries FIFA 2008 Rankings: African Countries Only	Points at year end	Corruption Perception Index Log GDP Log Population Mild mid latitude Health spending as % of GDP
Model D A sample of 52 countries All Africa Games, 2007	Weighted All Africa Medals 3 points for a gold 2 points for a silver 1 point for a bronze	Corruption Perception Index Dry Climate Education Log GDP

Table 3 - The multiple regression results for model A

Regression Equation: Olympic Games					
	Regression	Standard	T-Value	Probability	Reject
Independent	Coefficient	Error	to test	Level	H0 at
Variable			H0:B(i)=0		5%?
Intercept	-359.9939	70.0298	-5.141	0.0000	Yes
Elite	57.8872	17.9293	3.229	0.0015	Yes
Log_gdp2007	8.9142	3.9134	2.278	0.0242	Yes
Log_population2006	10.1264	4.3669	2.319	0.0218	Yes
Mildmidlatitude	12.8008	11.3468	1.128	0.2611	No
R^2=0.3557					
Adjusted R^2=0.3376					

Table 4 - The multiple regression results for model B

Regression Equation: FIFA Points					
	Regression	Standard	T-Value		Reject
Independent	Coefficient	Error	to test	Probability	H0 at
Variable			H0:B(i)=0	Level	5%?
Intercept	-1643.4717	266.0535	-6.177	0.0000	Yes
CPI2007	-16.6179	18.8316	-0.882	0.3791	No
Latin	126.4581	57.6730	2.193	0.0300	Yes
Log_gdp2007	93.8662	24.5398	3.825	0.0002	Yes
Log_population2006	-15.3302	27.0981	-0.566	0.5725	No
Mildmidlatitude	153.3622	47.4301	3.233	0.0015	Yes
Health%/GDP	11.3907	5.4950	2.073	0.0400	Yes
R^2=0.4481					
adjusted R^2=0.4241					

Table 5 - The multiple regression results for model C

Regression Equation: FIFA Points Africa only					
Independent Variable	**Regression Coefficient**	**Standard Error**	**T-Value to test H0:B(i)=0**	**Probability Level**	**Reject H0 at 5%?**
Intercept	-1923.2076	458.3035	-4.196	0.0002	Yes
CPI2007	-29.1701	39.0595	-0.747	0.4599	No
Log_gdp2007	91.0148	32.9460	2.763	0.0089	Yes
Log_population2006	24.5790	34.3679	0.715	0.4790	No
Mildmidlatitude	-47.0041	74.1495	-0.634	0.5300	No
Health%/GDP	-2.4746	8.1139	-0.305	0.7621	No
R2=0.4577					
Adjusted R2=0.3845					

Table 6 - The multiple regression results for model D

Regression Equation: All Africa Games					
Independent Variable	**Regression Coefficient**	**Standard Error**	**T-Value to test H0:B(i)=0**	**Probability Level**	**Reject H0 at 5%?**
Intercept	-401.2893	95.6568	-4.195	0.0002	Yes
CPI2007	-8.3275	7.9858	-1.043	0.3038	No
Dry	26.0956	11.1740	2.335	0.0251	Yes
Education	4229.9805	1215.4305	3.480	0.0013	Yes
Log_gdp2007_	19.3885	4.1487	4.673	0.0000	Yes
Health%/GDP	-1.1914	1.6052	-0.742	0.4627	No
R2=0.6594					
Adjusted R2=0.6134					

Table 7 – Summary of Outcomes for Models A to D

	Model A Olympics	**Model B FIFA Total**	**Model C FIFA Africa**	**Model D Africa Games**
CPI2007		No	No	No
Latin		Yes		
Log_gdp2007	Yes	Yes	Yes	Yes
Log_population 2006	Yes	No	No	
Mildmidlatitude	No	Yes	No	
Health%GDP		Yes	No	No
Elite	Yes			
Dry				Yes
Education				Yes

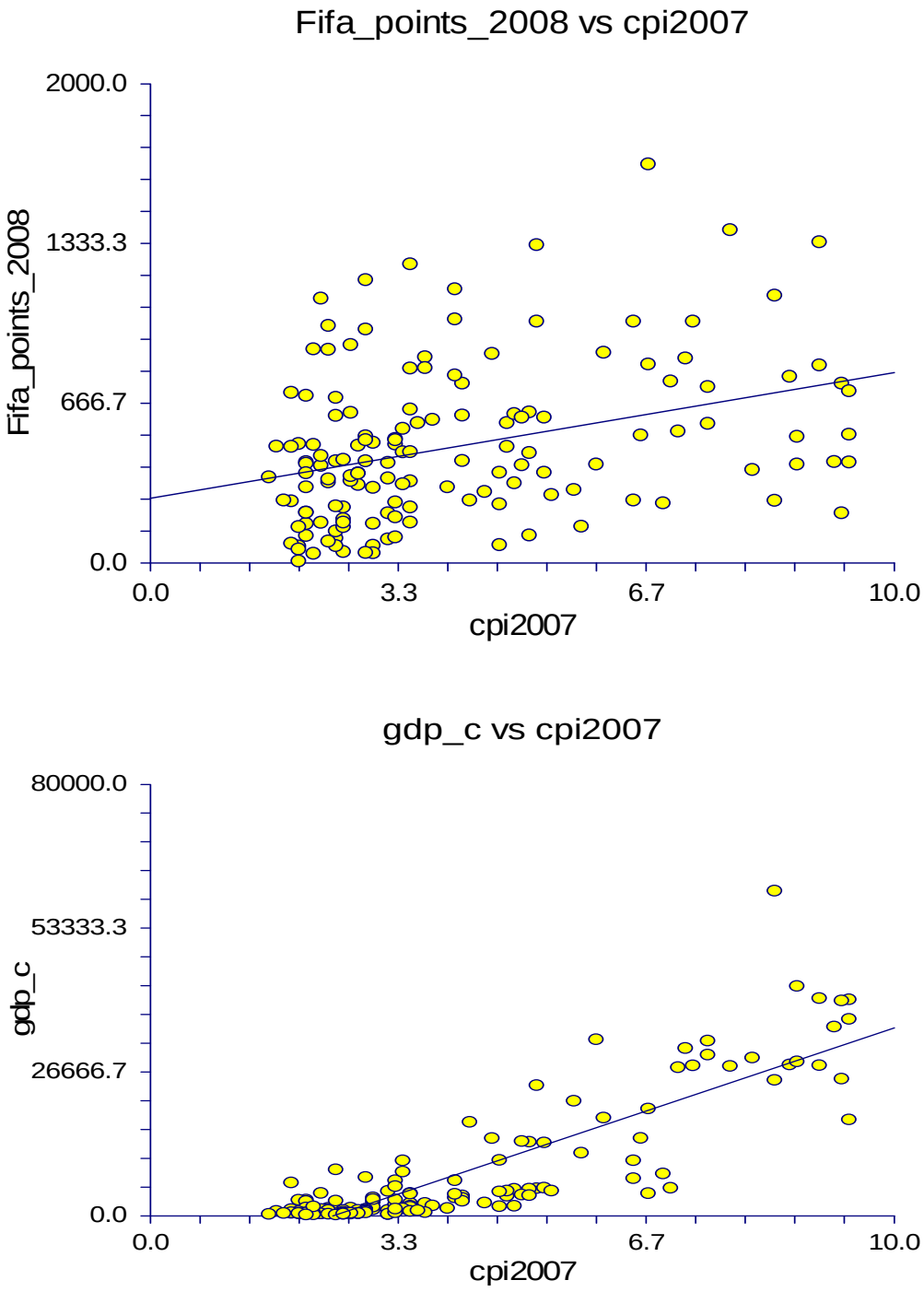

Figure 1 – Scatter plot of perceived corruption index (CPI) versus GDP per capita and FIFA points

Appendix A – Data, Variables and Data Sources

The independent variables selected for this research include:

GDP and Population: data for these variables have been obtained from the United Nations Database (2009).

Latin: The variable "Latin" represents countries that have a common Luso-Hispanic culture. This variable is a categorical variable and is represented as a dummy variable. Categorical variables are assigned a value of one (1) for all Latin Central and South American countries including Spain and Portugal, and a zero (0) for other countries (Hoffmann et al. 2002).

Total Health Spend as a percentage of GDP (Health%/GDP): This variable is used as a proxy to represent the allocation of resources in a country towards overall wellness, and is further indicative of a population's health (Source: United Nations Database, 2009).

Education: This variable has been calculated using data gathered from the United Nations Database (2009). The education variable represents the percentage of the population that is enrolled for formal secondary education. The variable has been selected to represent the allocation of resources in a country towards education, and as a proxy for the level of administrative skills of employees.

Elite: It is a categorical variable and denotes countries that had an established High Performance Centre prior to 2005. This variable is represented as a dummy variable, which is assigned a value of one (1) for countries that have a High Performance Centre, and a zero (0) for other countries (Martin *et al*. 2005). The data is gathered from http://www.forumelitesport.org (International Forum on Elite Sport, 2005).

Climate: Climate information was obtained utilising the Koppen-Geiger climate classification (KGT) and by visual inspection of the KGT climatic world map from http://www.worldclimate.com. The KGT classification is based on climate zone boundaries, which are delineated by vegetation distribution, combined average annual and monthly temperature, and the seasonality of precipitation. Countries are grouped according to Tropical, Dry, Mild mid altitude (temperate), Continental or Polar climates.

Corruption Perception Index (CPI2007): This variable represents the perception of corruption by multinational firms and institutions as impacting on commercial or social life. It is developed as a public opinion survey that assesses the general public's perception and experience of corruption around the world. This variable is utilised as a proxy for corporate governance. The data was retrieved from http://www.transparency.org (Transparency International 2007)