Convergence vs. The Middle Income Trap: The Case of Global Soccer*

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Abstract

Unconditional convergence across countries worldwide is typically rejected in terms of GDP per capita. But when focusing on a specific internationally competitive industry, such as manufacturing, rather than the overall economy, unconditional convergence has been found to hold. As the epitome of competition and globalization, this paper uses the performance of national soccer teams as a further test case. We rely on data of more than 32,000 games between 1950 and 2014 and find clear evidence of unconditional β- and σ-convergence in national team performance, as measured either by win percentages or goal difference. We argue this catch-up process is driven by the global transfer of technologies, skills and best practices. But there are limits: we show that good teams from Africa and Asia are failing to close the gap with top European or South American teams for reasons that are analogous to the "middle income trap". Lessons for other sectors include the virtues of internationally transferable human capital as well as the mixed blessings of regional integration for worldwide convergence.

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1 Introduction

The convergence debate - whether poorer countries are catching up with richer ones - is as old as economics itself. Neoclassical growth theory suggests that countries facing a common technology should converge in terms of income, with poorer ones growing faster than richer ones thanks to the higher marginal productivity of capital in earlier stages of development. However, the empirical evidence regarding unconditional convergence across the worldwide distribution of income per capita is not supportive (Barro, 1991; Mankiw et al., 1992; Pritchett, 1997; Islam, 2003; Acemoglu, 2009). Consequently, the literature has focused on conditional convergence and club convergence, suggesting that countries tend to converge towards different steady states (Quah, 1993b, 1996; Durlauf et al., 2009; Barro, 2015).

Nevertheless, the concept of unconditional convergence may be alive and well. Rodrik (2011, p. 45) comments: "The good news is that there is unconditional convergence after all. But we need to look for it in the right place: in manufacturing industries (and possibly modern services) instead of entire economies." When examining the productivity of manufacturing plants across a global sample of countries, Rodrik (2013) finds unconditional convergence. These results have been confirmed by various other studies with different manufacturing data, including Bénétrix et al. (2012) and Levchenko and Zhang (2011). In many countries the manufacturing sector is small and different industries may or may not exhibit convergence (Bernard and Jones, 1996), so that when aggregating to the level of the entire economy there is no unconditional convergence. Rodrik (2013) argues that the manufacturing sector exhibits a number of features which make it particularly susceptible to unconditional convergence: it produces *tradeable goods* and is integrated into the *global production chain*, which leads to *global competition* and fosters *technological transfer* across borders. Thinking along these lines, we will here examine the case of another sector which might be considered the embodiment of global competition.

We examine convergence in performance in competitive international soccer, arguably the world's most popular modern service. Soccer provides an interesting case study because it exhibits several features Rodrik (2013) has highlighted about the manufacturing industry. First, it is a truly global activity; the world governing body of soccer, FIFA, currently has more members (211) than the United Nations (193). Second, the service is standardized and internationally comparable. At the level of national team competition, performance in soccer is far more accurately measured than most other data series; the game is always the same (rule changes are infrequent and regulation is strict) and large numbers of games are played (currently around 2000 per

year). Comparable data on this scale is not available for other industries and services in particular. Third, international soccer is by definition very competitive, so that small differences in skills, line-ups and preparations can have a big influence on the performance. Apart from the monetary rewards, success in international tournaments can often be a source of national pride and well-being, providing a strong incentive to perform well. Fourth, the global nature of soccer facilitates technological transfer. Weaker teams can catch up by adopting stronger nations' training and talent selection techniques and by investing in their sports infrastructure. There are direct spillovers when individual players from weaker nations are contracted to play for the world's top leagues and at the same time remain on their national teams. Finally, continental associations play a vital role in soccer as well. National soccer associations are organized into federations representing Europe, North/Central America, South America, Asia, Oceania and Africa, which roughly conform to the continental divergence of income that has been observed by researchers. In particular Africa, whose economic difficulties have been so widely discussed (see e.g. Easterly (2009), Sala-i-Martin and Pinkovskiy (2010) and Anderson et al. (2012)), has in recent decades started to emerge as a soccer power, culminating in the hosting of the 2010 FIFA World Cup.

The data used in this paper consists of the results of recorded national teams' soccer games between 1950 and 2014, matched with the Penn World Tables data for GDP and population. Based on more than 32,000 games, our main findings are as follows:
(i) There is consistent evidence of unconditional convergence in national soccer team performance, both β- and σ-convergence. This applies to the percentage of games won as well as the goal difference between the teams. While the goodness of fit is higher for a conditional convergence regression, accounting for countries' income per capita, population size and human capital (experience), the strong evidence of unconditional convergence in the absence of these factors is a striking result. A novel feature of these results derives from the universality of national team soccer competition. Thus our results are truly global and our methodology avoids all statistical questions relating to sample selection.
(ii) Despite this move towards more equal performances in soccer, our rank mobility analysis also shows that the top of the distribution continues to be dominated by a few teams from Europe and South America. We find that weaker teams from these stronger continents are among those that have made the biggest improvements. While many of the weakest teams from Africa and Asia have also advanced, the best teams from these continents have failed to catch up with top European and South American teams.

We elaborate on these findings with an analogy to the middle income trap: Thanks to the global nature of soccer, countries with weaker teams can, up to a point, achieve

unconditional convergence by adopting the same technology. The transfer of best practices as well as insights from abroad is fostered by global labor markets for coaches and players, which in the case of soccer function comparatively frictionless thanks to human capital portability and the observability of performance. But the process of catch-up by adoption reaches its limits at the transition to world-class performance levels, when teams have to build-up their own long-term talent development techniques and playing styles, in an analogy to endogenous growth theory.
Among various lessons for other sectors, we highlight the mixed blessings of regional integration for worldwide convergence. In soccer, as well as in other industries, those countries that find themselves in the same organizational group as the world's best performers can catch up more quickly, while the gaps to other regional groups might even increase.

The remainder of this paper is organized as follows: section 2 provides a discussion of competitive soccer and its structure in light of macroeconomic convergence models. Section 3 presents summary results of the dataset, while section 4 then contains the empirical results on β-, σ and club convergence as well as the distributional analysis. Section 5 focuses on the limits of convergence, discussing the analogy to the middle income trap. Section 6 concludes and outlines some lessons from the case of soccer for convergence in other globalized industries.

2 Soccer in the Light of Convergence Models

The notion of unconditional convergence, both across entire economies and within specific industries, is based on the idea that entities exhibit a higher marginal productivity of capital at lower level of capital accumulation, and that there exist incentives for cross-border adoption of technology, ideas and best practices. The first point is a simple implication of standard neoclassical growth theory, the second emerges from endogenous growth theory. To see how soccer makes for an insightful case study of the unconditional convergence hypothesis, we have to take a closer look at its structure and organization.

With 211 countries in 2017, there are more soccer nations affiliated to FIFA participating in recognized competition than there are members of the United Nations (193). By either definition, every nation on the planet participates in international team competition. In most countries soccer is the most popular sport and the success of the national soccer team is considered a matter a huge social significance. The development of broadcasting technologies since the 1960s also means that soccer games can be watched almost anywhere. The global obsession with soccer might lead one to expect that ideas and best practices would be quickly adopted.

For many economic outcomes there are significant problems associated with data reliability and comparability. Measurement error can be very large and potentially correlated with other variables of interest. Soccer is not afflicted by these problems. The result of each game played, reported in terms of the goals scored by each team, is a matter of official record and not subject to dispute.[1] National teams play many games a year against different opponents providing a rich sample of performance in a relatively short time frame.

Soccer has clear rules and a long tradition. Association football (soccer) is a game whose rules were first written down in 1863 in England. Originally played between local clubs, the first "international" match was played between England and Scotland in 1872. The game spread rapidly and by the end of the nineteenth century most European and South American nations had established a national association to administer the game, thus facilitating competition between national teams. In 1904 FIFA was created as an organization to manage soccer relations between countries, and in 1930 the FIFA World Cup was first played, with 13 national teams competing. In the first half of the 20th century, there were still rather few international games: there are less than 2,200 recorded between 1900 and 1940, an average of 54 per year, and almost all of these involved European and South American countries. But in the second half of the 20th century this changed and international soccer competition became truly global: Since 1950 there have been over 33,000 games played between men's national soccer teams, an average of around 500 per year.[2]

There are various reasons for the growth of international competition: For one, the end of colonialism in the 1950s and the break-up of the Soviet Union in the 1990s increased the number of countries with national teams. At the same time the drivers of globalization, which affected many economic sectors, impacted soccer in particular: Improvements in transport have significantly reduced the time and cost involved in organizing international matches, while at the same time development of international broadcasting enabled matches to be shown live across the globe. The growth of international competition is illustrated in Figure A-1 in the Appendix.

[1] Fans often dispute whether their team *should* have lost, but not whether it *did* lose.

[2] In this paper we will focus on men's soccer because for women's soccer the time period is too short and the number of countries too few to conduct a meaningful convergence analysis. Women's international soccer was largely ignored or actively discouraged for a long time; for example, the English Football Association rule prohibited members from supporting women's soccer until 1971. The first women's world cup only took place in 1991. Even today, there is a strong correlation between countries' performance in women's soccer and measures of gender equality, which would point to a selection effect in terms of a global sample.

Despite the truly international nature of soccer, regional associations are an important feature of the structure and organization of the game, and one consequence is that national teams from the same continent tend to play against each other more often than against teams from other continents. Our data show that 82% of all international matches pit two national teams from the same continent against each other. There are analogies to the trade literature, where both geography and membership of regional trade deals help to predict bilateral import and export flows between countries (Bergstrand, 1985; Frankel et al., 1995; Nicolini, 2003).

The continental associations also organize the qualifying competitions for entry into the FIFA World Cup, the four-yearly pinnacle of international competition.[3] Table 1 shows the regional confederations. Teams from CONMEBOL (the South American association) and UEFA (the European one), where the game first took root, have tended to dominate the World Cup; in fact, no team from outside these associations has ever won the Cup. But FIFA has consciously tried to expand opportunities for the smaller associations. While each continent controls its own qualifying process, the number of slots allocated to each continental association is agreed centrally, and as Table 1 shows, the share allocated to UEFA and CONMEBOL has been shrunk considerably over time, largely through expansion of the number of participating teams.[4]

The FIFA World Cup is without doubt the climax of the soccer cycle, but there are also other forms of international competition, including continental Cups and ad hoc international competitions that generally rely on wealthy sponsors. About 50% of international matches take place within the context of a competition, the remainder are "friendlies", which are often used as a way of preparing players for formal international competitions. Our dataset contains around 32,000 results from 1950 to 2014 including all these types of games between national teams. By analyzing countries' winning percentages as well as its goal difference over time, we can observe changes in national team performance and whether unconditional convergence has taken place.

There are some differences between national team soccer performance and the industry performance as usually defined. The output we consider does not cover all commercial soccer activity but only the national teams. Perhaps the most important difference is that output comes in the form of results of contests between rival teams, and hence cannot be produced independently. A roughly analogous case might be one where we assessed the

[3]The effects of hosting the FIFA World Cup on other economic sectors and the economy in general are investigated by, inter alia, Feddersen and Maennig (2012).

[4]A further expansion of 16 teams has been agreed for the 2026 World Cup, which will reduce the European and South American share further, possibly to as little as 46 %. Critics have argued that the distribution remains unfair and should reflect global population shares more accurately. The counter argument is that for a given quality of team it is harder to qualify through UEFA or CONMEBOL than any other federation.

Table 1: Number of Countries Qualifying for the FIFA World Cup 1950-2014

World Cup	AFC (Asia)	CAF (Africa)	CONCACAF (Central+ North Am.)	CONMEBOL (South America)	OFC (Oceania)	UEFA (Europe)	Total	UEFA + CONMEBOL share
1950	1	0	2	5*	0	7	15	0.800
1954	1	0	1	2	0	12*	16	0.875
1958	0	0	1	3	0	12*	16	0.938
1962	0	0	1	5*	0	10	16	0.938
1966	1	0	1	4	0	10*	16	0.813
1970	0	1	2*	3	0	10	16	0.813
1974	1	1	1	4	0	9*	16	0.813
1978	1	1	1	3*	0	10	16	0.813
1982	1	2	2	4	1	14*	24	0.750
1986	2	2	2*	4	0	14	24	0.750
1990	2	2	2	4	0	14*	24	0.750
1994	2	3	2*	4	0	13	24	0.708
1998	4	5	3	5	0	15*	32	0.625
2002	4*	5	3	5	0	15	32	0.625
2006	4	5	4	4	1	14*	32	0.563
2010	4	6*	3	5	1	13	32	0.563
2014	4	5	4	6*	0	13	32	0.594

Notes: The * indicates the host federation. CONCACAF includes Central and North America as well as the Caribbean.

convergence of national education systems by comparing scores in standardized global tests. Our argument in this paper is that, with all the caveats of the idiosyncracies of soccer, the examination of unconditional convergence and its mechanism hold insights for other industries as well. Thus it is not unreasonable to posit a conventional production function to define the process by which the skills necessary for soccer competition are created:

$$Y = f(A, K, L) \tag{1}$$

with capital K, labor L and a broadly defined technology A. The country's capital provides the sports infrastructure - stadiums, equipment, medical support and so on - and it is obvious that countries with a higher GDP per capita can devote more resources to soccer. One can argue that, in particular, African soccer still has a capital shortage. A large population L is similarly helpful because soccer talent is drawn from the top end of population distribution. Very small countries are obviously at a disadvantage. While it might be natural to think that there are increasing returns to scale (the larger the population, the larger the chance of finding top soccer talent), the world's most populous countries have not proven particularly successful - think of India, China, Pakistan, Indonesia or even the US.[5]

[5]In 2015 President Xi Jinping announced a series of initiatives aimed at turning China into a soccer superpower in the same way the nation has reached the top of the Olympics medal table; as of 2017

Total factor productivity A, defined in a broad sense, subsumes all the other factors fostering a national team's performance, including best practices in training, widespread public support, young talent development systems and well-functioning institutions running the game at all levels. Many of the ingredients of technology spread easily across borders and we argue that the globalized and competitive nature of soccer makes it amenable to a best-practice adoption. For the economy in general, Barro and Xavier Sala-i-Martin (2004), Caselli and Coleman (2001) as well as Howitt (2000) discuss the factors facilitating and hindering the technology diffusion across countries. In the context of soccer the following seem relevant:

(i) *Technology in the strict sense.* Match recording and slow-motion replaying, satellite TV live broadcasting and information availability via the internet has allowed teams to analyze their own games more thoroughly, but also those of other countries. Consequently a team can anticipate its opponents' tactical set-up and better prepare for games. This spread of information allows teams to adopt the successful strategies of others, so that weaker teams learn from the best.

(ii) *Institutions.* The convergence debate has long focused on the role of countries' institutional quality, including property rights and the rule of law (North and Thomas, 1973; Hall and Jones, 1999; Acemoglu et al., 2005). In soccer, institutions in a broad sense range from the continental associations to the organization of soccer at all competitive levels on the ground. It is true that they have been tainted by corruption scandals in associations' governing bodies; see e.g. Maennig (2002) and Manoli et al. (2017) for discussions from an economic point of view. Nevertheless, institutions play a vital role in the process of technology diffusion by setting standards, spreading best practices across countries as well as in the whole organizational process (game scheduling, resource distribution to teams). As far as the 'rule of law' is concerned, notwithstanding widespread allegations of match fixing, it can at least be said that the rules are strictly the same for all nations, and that every referee in international games is drawn from a third country.

(iii) *Human Capital (coaches).* The players must be qualified in terms of family history or extended residency to play for a national team. However, no such rules apply to coaches and there is substantial international mobility in what is a global market. FIFA data show that 14 of the 32 national teams participating in the 2014 World Cup had a foreign coach and these include many of the comparatively weaker teams, see Table 2. Coaches from abroad can bring in new training techniques, change the tactical set-up and, more generally, spread insights gained in other countries.

China was 77th in the FIFA national team rankings.

Table 2: Squads of 32 National Teams Participating in the 2014 FIFA World Cup

Team	Coach	Players (out of 23)	
	Foreign	Home League	(Other) European League
UEFA (Europe)			
Germany	No	16	7
Spain	No	14	9
Italy	No	20	3
England	No	22	1
France	No	8	15
Portugal	No	8	15
Greece	Yes	14	9
Russia	Yes	23	0
Netherlands	No	10	13
Belgium	No	3	20
Switzerland	Yes	7	16
Croatia	No	2	21
Bosnia & Herzegovina	No	1	22
CONMEBOL (South America)			
Brazil	No	4	18
Argentina	No	3	19
Chile	Yes	5	15
Colombia	Yes	3	16
Uruguay	No	1	16
Ecuador	Yes	8	4
CONCACAV (North/Central American + Caribbean)			
United States	Yes	9	13
Mexico	No	15	8
Costa Rica	Yes	9	11
Honduras	Yes	11	5
AFC (Asia)			
Australia	No	7	13
Japan	Yes	11	12
Iran	Yes	14	6
South Korea	No	6	10
CAF (Africa)			
Nigeria	No	4	19
Cameroon	Yes	2	21
Ivory Coast	Yes	1	22
Ghana	No	1	18
Algeria	Yes	2	19

Notes: Each official squad consists of 23 players. Players which neither play in the home league nor in a European league make up the difference to 23. The data are from http://resources.fifa.com/mm/document/tournament/competition/02/36/33/44/fwc_2014_squadlists_neutral.pdf

(iv) *Human Capital (players).* While we here look at the results of national teams' games, most players make a living from playing for clubs in a national league, some of which have become substantial enterprises in recent years. Club soccer plays a vital role in the development of talent, transfer of skills and the adoption of best practices. Most of the world's best players play 50-60 competitive games per season, typically for clubs located in the main European leagues (Spain, England, Germany and Italy). Around 10 of the games per year might be played for the national team, directly benefiting

his home country from the skills gained from playing in the foreign league. This relies on the administrative structure of the game, which requires every club to release their employees to represent their national team in all forms of international competition if called upon to do so, without compensation.[6] Table 2 gives some evidence of the internationalization of top players by listing how many players of each 2014 World Cup squad played in their home league (second column) or a European league (third column). In countries with world-dominating home leagues, such as Italy and England, most of the players (20 and 22, respectively, out of 23) play domestically. But in nearly all of the other countries, the share of players in the home league is very small.[7] For instance, the national team of Belgium had only 3 players drawn from domestic teams while 20 players were employed by clubs in other European leagues. The allure of European leagues is such that the national teams of strong South American soccer countries such as Brazil and Argentina consisted of 18 and 19, respectively, players earning their money in European leagues. This holds for African countries in the same way: In each African team that participated in the 2014 World Cup, 18 or more out of 23 players played in Europe. These results are corroborated by Besson et al. (2008), who find that while on average 28% of the players in all 30 European leagues in 2008 were foreign, in the top leagues this share was much higher (65% of players in the English premier league).

Knowledge transfer and skill development resulting from this kind of (temporary) migration is therefore particularly important in soccer. There are three features, which set soccer players apart from other migratory workers in this respect: (a) Because the player remains on his national team while playing for a club in the foreign league, the skill transfer effect can be thought to be much stronger and more immediate than that of migrants returning to their country of origin (see for instance Borjas and Bratsberg (1996) and Dustmann (2003) as well as Wahba (2014) for an overview on return migration).[8] (b) The labor market for players exhibits hardly any information asymmetries. In contrast to other global labor markets, workers' performance is almost completely transparent and is measured almost exclusively in the objective terms of game success. (c) Finally, it is a particular feature of soccer that the skills acquired in one country are directly transferable, whereas human capital might not be portable for many other industries and jobs (Friedberg, 2000).

[6]See FIFA Regulations on the Status and Transfer of Players (2016) Annexe 1, paragraph 1: "Clubs are obliged to release their registered players to the representative teams of the country for which the player is eligible to play on the basis of his nationality if they are called up by the association concerned. Any agreement between a player and a club to the contrary is prohibited."

[7]Russia is an exception. The fact that none of the players from the Russian squad plays abroad might testify more to political factors than to the dominance of the Russian league.

[8]The argument that top players stay on the national team and might serve as a model to emulate is also put forth as an argument in the discussion to what extent the their exodus hampers the development of national leagues in poorer countries. This 'foot drain' is a particular case of the 'brain drain' literature where the increased human capital investment fostered by migration prospects might stands might mitigate the actual loss due to migration, see for instance (Beine et al., 2001).

For all these reasons, the central hypotheses of this paper are that performance in national teams' soccer should converge unconditionally over time and that this convergence will be clearly identifiable in the data.

3 The Dataset

Before we test for unconditional and conditional convergence of national teams' performance in the next section, let us have a closer look at the data we use. Our dataset contains more than 32,000 results of all the matches played between national teams from 1950 to 2014.[9] We have information on the date and the venue of the game, the number of goals scored by each team as well as the type of the games (ranging from 'Friendly' to World Cup). Such a worldwide dataset of industry performance is unique to soccer. Comparable data on that scale are simple not available for other economic sectors, which make our test case so appealing.

In the convergence literature, the economic growth performance of a nation is typically judged relative to that of other countries, with the 'productivity gap' (Rodrik, 2011) or 'distance to the technological frontier' (Acemoglu et al., 2006). In sporting competitions such as soccer, the agreed performance benchmark is also a relative measure of success: Winning is everything. The inherent zero-sum nature of soccer results makes our study more akin to a comparison of countries' relative rather than absolute income or productivity levels, in line with the literature. Whether at the individual game level or at the multi-year aggregate, we will here work with two relative performance measures for national teams: (a) the winning percentage and (b) the average goal difference. The two measures can be thought to be complementary: The winning percentage reflects the dichotomous and ultimately decisive outcome in terms of winning and losing, while the goal difference gives an indication of the scale of the victory.[10]

Following the discussion of the previous section, we can identify a number of factors that are likely to contribute to relative success.[11] In soccer, like any sport, playing on your home field in front of your own supporters is likely to be an advantage. Success will also depend on the talent available for selection into the team, and hence a larger

[9]The data for this paper is based on a database of international games from 1871 to 2001 compiled by Russell Gerrard (http://www.staff.city.ac.uk/~sc397/football/aifrform.htm) and updated using data kindly provided by Christian Muck (http://laenderspiel.cmuck.de/index.php?sprache=2&PHPSESSID=2e2abc971121d3382a78a6f5fbccea2e).

[10]We will see that the two measures give very similar qualitative results.

[11]This is also in line with the statistical literature on forecasting soccer results of clubs within national leagues, which assumes, for instance, that match results come from a bivariate Poisson distribution dependent on clubs' latent attack and defense strength as well as the home advantage (Maher, 1982; Koopman and Lit, 2014).

population from which to draw talent for the national team will be an advantage. As richer countries can afford to spend more on soccer, a country's GDP per capita should help to explain soccer performance. Finally, experience matters. This partly reflects acquiring familiarity with the competitive environment, but also the extent to which soccer is established as a national pastime, with young people playing it from early ages onwards. Our proxy for experience is to count the number of international games played by a given country between time t and 1872, the year of the first recognized international soccer game. We expect all these factors to explain countries' performance at a given point in time. Nevertheless, if our hypothesis of absolute convergence is correct, their importance should have decreased.

To examine these relationships the database of international games was merged with data for population and GDP per capita from the Penn World Tables, version 9.0 (Feenstra et al., 2015). Around one quarter of all games were lost in the matching process. These involve small territories with national FIFA status but without national income accounts in the Penn World Tables (e.g. several Caribbean islands, Scotland and Zanzibar), as well as nations which no longer exist (e.g. West Germany, Czechoslovakia and the USSR). Given these nations were also strong soccer nations (especially West Germany), their omission is likely to understate the variance of performance in the early decades and therefore understate any tendency toward convergence.

Table 3: Game Results by Explanatory Factors and Type of Game

Dependent variable: goal difference	(1) Friendlies	(2) Competitive (Continental and WC)	(3) World Cup and Continental qualifiers	(4) World Cup and Continental	(5) World cup
Home advantage	0.0494***	0.0699***	0.0703***	0.0651***	0.0370***
	(0.00127)	(0.00144)	(0.00151)	(0.00508)	(0.0136)
Neutral venue	0.0269***	0.0337***	0.0516***	0.0280***	0.0217**
	(0.00142)	(0.00173)	(0.00303)	(0.00384)	(0.0101)
GDP p.c. ratio	0.00595***	0.00715***	0.00670***	0.00877***	0.00697**
	(0.000581)	(0.000734)	(0.000880)	(0.00133)	(0.00295)
Population ratio	0.00697***	0.00959***	0.0105***	0.00541***	0.00808***
	(0.000394)	(0.000462)	(0.000539)	(0.000934)	(0.00217)
Experience ratio	0.0284***	0.0323***	0.0306***	0.0331***	0.0274***
	(0.000720)	(0.000864)	(0.000992)	(0.00186)	(0.00463)
Constant	3.031***	2.997***	2.996***	2.988***	3.005***
	(0.0102)	(0.00787)	(0.00797)	(0.0105)	(0.0274)
Observations	27,708	23,096	17,784	5,312	1,152
R-squared	0.219	0.361	0.391	0.293	0.250

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3 describes the results of regressing the goal difference of all available

games (1950-2014) on the explanatory factors: home advantage, neutral venue, the ratio of GDP per capita for the two teams, the population ratio and the experience ratio. We conduct different regressions for the five types of games, in line with their competitiveness. "Friendlies" (col 1) are essentially practice games in which typically very little is at stake, while "competitive games" (col 2) include all games played in tournaments or qualification stage either at the global (World Cup) or continental level (e.g. Euros, African Cup of Nations). These are then further split up into qualifying games only (col 3), tournament games only (col 4) and World Cups (col 5).

All of the explanatory variables are statistically significant, almost all at the 1% level, and all have the expected sign. For instance, playing a competitive game at home (row 1, column 2) increases the expected goal difference by 0.07 goals. The R^2 of 0.22 to 0.39 is high, given that the attractiveness of competition relies on at least some level of unpredictability. We also note the coefficients are of comparable magnitude across the different types of games, but always slightly higher for competitive games than for friendlies: Being a richer, more populous and soccer-experienced country matters more when more is at stake. By contrast, in friendlies the best teams sometimes let their top players rest and give their second string a chance to play, which tends to lead to more even outcomes. Keeping this in mind, we will control for it, when we use all the available data for our convergence analysis.

Table 4: Game Results by Explanatory Factors and Type of Game

	(1)	(2)	(3)	(4)
Dependent variable:	*Competitive Games*			
goal difference	Before 1980	1980-1995	1995-2005	2005-2014
Home advantage	0.0924***	0.0749***	0.0716***	0.0517***
	(0.00374)	(0.00291)	(0.00298)	(0.00243)
Neutral venue	0.0395***	0.0266***	0.0373***	0.0186***
	(0.00416)	(0.00357)	(0.00365)	(0.00310)
GDP p.c. ratio	0.00591***	0.0106***	0.00923***	0.00633***
	(0.00216)	(0.00158)	(0.00158)	(0.00136)
Population ratio	0.00876***	0.00691***	0.0102***	0.0113***
	(0.00131)	(0.000965)	(0.000974)	(0.000828)
Experience ratio	0.0367***	0.0318***	0.0363***	0.0290***
	(0.00216)	(0.00183)	(0.00194)	(0.00201)
Constant	3.038***	2.976***	2.996***	3.017***
	(0.0342)	(0.0137)	(0.0173)	(0.0130)
Observations	3,872	4,796	6,494	6,492
R-squared	0.421	0.433	0.406	0.346

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In Table 4 we look at the importance of the explanatory variables over time. We restrict our sample to competitive games and divide it into four time periods. While

all the coefficients keep their strong significance, we find some tendency for them to decrease in size, in line with the convergence hypothesis. This is most noticeable in terms of the home advantage coefficient which has almost halved since 1950. Since 1980 the coefficient of the GDP per capita ratio has fallen, the coefficient on the population has increased and the one on the experience ratio has risen and then fallen. The fact that we are working with an unbalanced panel, with many new nations entering international competition in recent decades, may account for these mixed results. Nonetheless, overall the R^2 of the regression has decreased in line with the convergence prediction. We now turn to our principal evidence on convergence.

4 Empirical Results on Convergence

Turning from the game level to the country level, we have to adequately define the performance of a national team. We work with averages of the variables, win percentages and goal difference, of all the countries' games over four-year World Cup cycles (i.e. four-year periods ending in a FIFA World Cup year, for instance 2011-2014). Averaging the results over World Cup cycles allows us to eliminate seasonal and cyclical effects as well as one-off events so that we can adequately trace national team performance over the decades.[12] Countries that played fewer than five games over the cycle were omitted to avoid a small sample bias. This process generated 1,644 observations, roughly 15 games per country per cycle.

4.1 Beta-Convergence

In the economic growth literature, β-convergence is defined as a negative and significant coefficient of the lagged level term in a growth rate regression

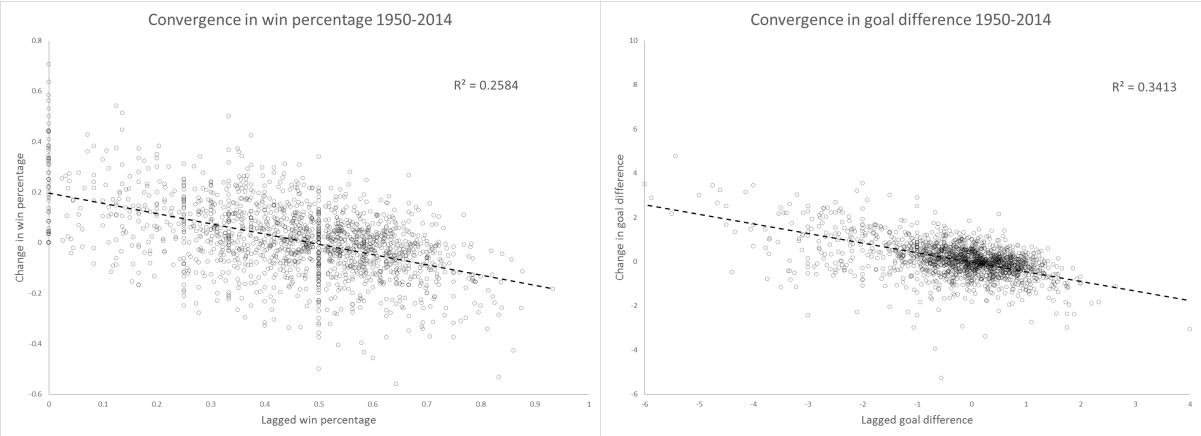
$$\Delta y_{it} = \alpha + \beta \cdot y_{i,t-1} + \epsilon_{it}, \tag{2}$$

where the error term ϵ_{it} fulfills the usual assumptions. With four-year averages of countries' performance y_{it} (win percentage and goal difference), we calculate lags and changes.

The scatter plots in Figure 1 shows changes versus lagged levels of win percentages and goal differences over the last 16 World Cup cycles (1950-2014). The clear negative

[12] When averaging across win percentages, ties are treated as half a win. Also, note that starting in 1950 means that the first cycle comprises five years (1950-1954). Robustness checks with other periods than four-year cycles, such as eight-year periods spanning two FIFA World Cups, lead to comparable results.

Figure 1: Changes vs. Lagged Levels of Win Percentages and Goal Differences over 16 World Cup Cycles (1950-2014)



slope, with an R^2 of 0.26 for the win percentage and 0.34 for goal difference, suggests that β-convergence is present.

Table 5 contains the results of the β-convergence regression of changes in win percentages on lagged levels (unconditional convergence, col 1) and other explanatory variables (conditional convergence, other columns). Table A-1 in the Appendix shows that using goal difference rather than win percentages as the performance measure leads to very similar results.

First of all, we note a large and highly significant coefficient for lagged win percentage in the absence of any other regressors (β=-0.435). This implies unconditional β-convergence, which is a striking result. Unconditional convergence in a particular industry has until now only been found in manufacturing (Rodrik, 2013; Bénétrix et al., 2012), but, to our knowledge, it has not yet been empirically established in any other sector, and certainly not for any activity in which the performance of all nations is measured and compared. Our result is therefore new to the literature.

Turning to the conditional convergence specifications in the other columns of Table 5, we see the effects of including additional regressors. The GDP per capita ratio, population ratio and experience ratio of a national team compared to those of its average opponents during the 4-year cycle all help to explain improvements in the win percentage (col 2). However, the lagged level remains highly significant and the estimated value of β even increases in absolute value: Countries with poor soccer performances are predicted to catch up with better teams. Also, the convergence rate seems to be largely independent of the region in which the team is located (col 3, indicated by membership of its continental confederation). Fixed effects are highly significant, suggesting that the

Table 5: Estimates of β-convergence in win percentage

Dependent variable: Change in win percentage (wpc)	(1) Unconditional	(2) Economic controls	(3) Economic controls + confed. dummies	(4) Fixed effects	(5) Economic controls + fixed effects
Lagged wpc	-0.435***	-0.590***	-0.597***	-0.818***	-0.872***
	(0.0167)	(0.0180)	(0.0182)	(0.0212)	(0.0210)
GDP p.c. ratio		0.0115***	0.0122***		0.0170**
		(0.00374)	(0.00378)		(0.00721)
Population ratio		0.0181***	0.0187***		0.00639
		(0.00235)	(0.00236)		(0.00627)
Experience ratio		0.0569***	0.0562***		0.0725***
		(0.00515)	(0.00516)		(0.00803)
CAF			0.0133		
			(0.00829)		
CONCACAF			0.00131		
			(0.0104)		
CONMEBOL			0.0200*		
			(0.0116)		
OFC			0.000979		
			(0.0349)		
UEFA			0.0191**		
			(0.00832)		
Constant	0.208***	0.288***	0.280***	0.248***	0.343***
	(0.00828)	(0.00903)	(0.0101)	(0.0351)	(0.0354)
Observations	1,644	1,644	1,644	1,644	1,644
R-squared	0.291	0.396	0.399	0.538	0.575

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group in column 3 is the Asian Football Confederation (AFC). The continental confederations are AFC (Asia), CAF (Africa), CONCACAF (North and Middle America and the Caribbean), CONMEBOL (South America), OFC (Oceania) and UEFA (Europe).

convergence process is not homogeneous and that country-specific characteristics matter (col 4). Still, we are left with a highly significant and sizable β-coefficient, also when including both fixed effects and economic controls (col 5).

In light of the performance differences between teams from different regional confederations, we then rerun the estimations with a continental interaction term, so that we can estimate different β-coefficients:

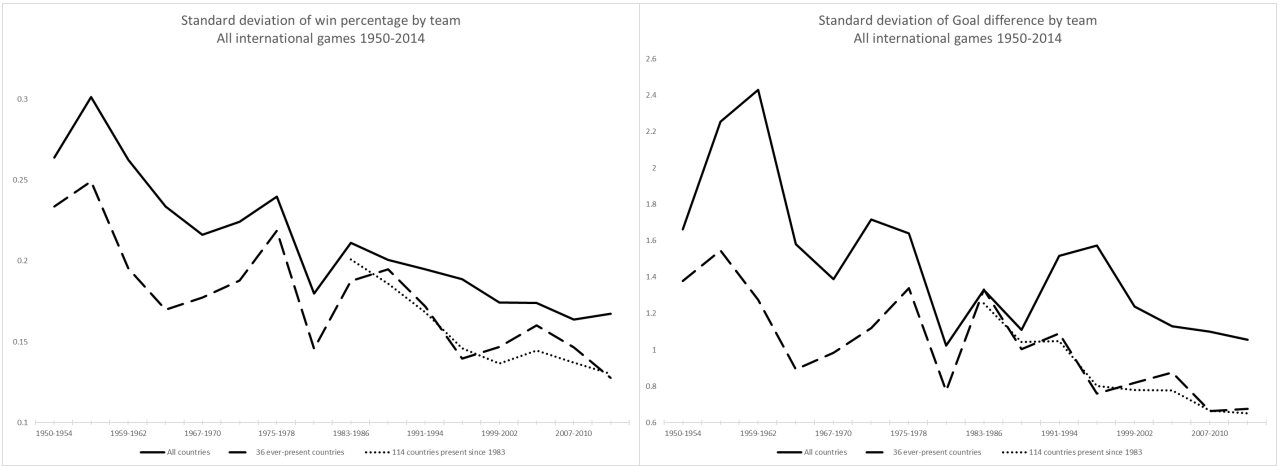
$$\Delta y_{it} = \alpha + \beta \cdot y_{i,t-1} \cdot \mathcal{D}_C + \epsilon_{it}, \tag{3}$$

where $\mathcal{D}_C$ denotes a dummy for the continental confederations listed in Table 1. The results in Table A-2 in the Appendix are, however, very similar for different continents. If anything, the rates of convergence appear higher for the weaker soccer confederations, suggesting that that they should be catching up relatively quickly. We will return to this point later.

4.2 Sigma-Convergence

Quah (1993a) and Friedman (1992) argue that β-convergence is only a necessary but not a sufficient condition for σ-convergence: Due to the presence of random shocks, evidence of a negative β in (2) might result from a general reversion to the mean and need not necessarily imply that poorer or weaker individuals are systematically catching up ('Galton's Fallacy'). Random shocks do play an important role in an essentially unpredictable sport such as soccer. Let us therefore solidify our β-convergence result by checking for σ-convergence, defined as a decreasing variance in our performance variable y.

Figure 2: The Standard Deviation of (a) Win Percentage and (b) Goal Difference over 16 World Cup cycles 1950-2014



Simple descriptive statistics immediately suggest evidence of σ-convergence in soccer. Figure 2 shows that the standard deviation of both win percentage and goal difference halved over the entire period covered by the data (1950-2014). This is true whether one considers all the countries in each four-year cycle of the data (the solid line) or just the small group of nations that have been ever present in the data since 1950 (the dashed line). It is also true for the last 32 years considering the 117 nations continually present in the data since 1983 (the dotted line).

A more formal test of σ-convergence was suggested by Carree and Klomp (1997). They propose an adjusted ratio of variances test statistic R

$$R = \frac{\sqrt{N}(\frac{\hat{\sigma}_1^2}{\hat{\sigma}_T^2} - 1)}{2\sqrt{1 - \hat{\beta}^2}}, \tag{4}$$

where $\hat{\sigma}_i^2$ and $\hat{\sigma}_T^2$ refer to, respectively, the cross country variance at the beginning and end of the period, and $\hat{\beta}$ is the estimate of β from the standard β-convergence regression (2). R has asymptotically a standard normal distribution. Estimated values of R and their significance levels are reported for win percentage and goal difference in Table 6, estimated using consecutive 4-year World Cup cycles. From the table it can be seen that the standard deviations trend downwards with a high level of consistency – there are only two cases where the trend reverses for win percentage and only one for goal difference. The test statistics in the last two columns are highly significant in most of the cycles, in particular in the 1960s and 1980s/1990s. The lack of significance in the latest years is mirrored in the flattening of the standard deviation graphs in Figure 2.

Table 6: Ratio Test Statistics for σ-Convergence in Win Percentage and Goal Difference

Cycle	Obs.	St. dev. of win percent	St. dev of lagged percent	St. dev of goal diff	St. dev of lagged goal diff	Win percent beta	Goal diff beta	Win percent ratio test	Goal diff ratio test
1955-1958	40	0.268	0.246	1.724	1.589	-0.573	-0.618	-0.740	-0.773
1959-1962	46	0.217	0.287	1.668	2.178	-0.643	-0.68	4.327***	4.455***
1963-1966	63	0.212	0.250	1.406	2.276	-0.805	-0.791	4.435***	17.198***
1967-1970	78	0.183	0.231	1.045	1.541	-0.572	-0.545	3.921***	7.390***
1971-1974	98	0.198	0.213	1.130	1.226	-0.524	-0.469	1.074	1.122
1975-1978	108	0.233	0.219	1.431	1.671	-0.429	-0.344	-0.722	2.125*
1979-1982	104	0.174	0.221	0.998	1.401	-0.519	-0.502	4.343***	6.614***
1983-1986	110	0.193	0.178	1.205	0.998	-0.309	-0.256	-0.897	-1.763*
1987-1990	117	0.190	0.202	1.055	1.255	-0.336	-0.365	0.759	2.584***
1991-1994	125	0.172	0.200	1.108	1.114	-0.436	-0.264	2.403**	0.070
1995-1998	163	0.177	0.192	1.232	1.495	-0.369	-0.493	1.237	3.980***
1999-2002	174	0.170	0.189	1.109	1.573	-0.395	-0.524	1.799*	9.185***
2003-2006	177	0.172	0.174	1.128	1.239	-0.326	-0.376	0.200	1.592
2007-2010	178	0.167	0.171	1.102	1.129	-0.297	-0.244	0.351	0.348
2011-2014	179	0.166	0.167	1.055	1.099	-0.339	-0.299	0.037	0.622

We conclude that for most of the time period since 1950, we observe both unconditional β- and σ- convergence in countries' soccer performance. These remarkable results warrant a closer look so we will now analyze the intra-distributional changes which have driven these developments.

4.3 Distributional Analysis

How has the shape of the performance distribution evolved over time, as weaker national teams have caught up with stronger ones? A first glimpse can be gained from Figure A-2 and Figure A-3 in the Appendix, which show histograms and kernel density estimates for the win percentage and goal difference for every four-year World Cup cycle. The densities have clearly become taller and thinner, consistent with σ-convergence. Note however, that the number of countries varies.

For a full analysis of the distributional dynamics of countries, including tests for club convergence and cluster formation between groups of countries, one has to work with a balanced panel. There is a trade-off between the number of countries and the number of time periods that can be accommodated, and so we opt for multiple samples. Our baseline Sample 1 contains 76 countries and 10 four-year cycles (1975-2014), while the shorter Sample 2 contains 127 countries and 6 four-year cycles (1990-2014). These samples are restricted to countries with more than 1m inhabitants because it can be argued that tiny countries lack the human and financial resources to make significant improvements in their relative soccer performance against their more populous peers. As a robustness check we build Sample 3, which extends Sample 1 to include countries with less than 1m inhabitants as well.[13]

Table 7 shows the evolution of various distributional statistics for Sample 1, while Table A-4 and Table A-5 in the Appendix contain the results for Samples 2 and 3. The distributional changes underpin the convergence evidence.[14] Across all subsamples we see very large decreases in the standard deviation of win percentages and mean goal difference (column 2). The decrease in, respectively, skewness and kurtosis (columns 3 and 4), which is particularly strong since the 1990s, makes the distribution less skewed and flattens the tails, specifically the left one where the worst performing teams are located. Countries' positions move closer together as weaker teams catch up. According to the Jarque-Bera test statistic (column 5), in recent years we cannot reject the hypothesis that win percentages and goal differences follow a Gaussian

[13]Note that in all samples we only include countries which played at least 5 games per cycle in order to avoid a small sample bias in calculating win percentage averages.

[14]We note that there is a small increase in the average win percentages of the subsamples, which reflects both convergence within the group and improving performance against teams outside the subsamples.

Table 7: Distribution of Win Percentages and Goal Difference Sample 1 (76 countries)

Panel a) Distribution of Win Percentage

	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pval.	(6) Unimod pval.	(7) CC Ind.	(8) Pola	(9) Gini
1975-78	0.5002	0.1683	-0.3445	2.8710	0.3564	0.6567	0.3024	0.1594	0.1885
1979-82	0.5134	0.1371	-0.1872	3.1298	0.5000	0.4733	0.3142	0.1059	0.1473
1983-86	0.5258	0.1316	-0.6700	3.1216	0.0436	0.9400	0.2265	0.1038	0.1379
1987-90	0.5159	0.1465	-0.5679	2.7126	0.0698	0.1533	0.4125	0.1180	0.1574
1991-94	0.5224	0.1341	-0.4842	2.4387	0.0812	0.5133	0.3499	0.1314	0.1442
1995-98	0.5326	0.1226	-0.3149	3.1776	0.4086	0.9633	0.2070	0.0971	0.1277
1999-02	0.5451	0.1001	-0.1941	2.1501	0.1514	0.5833	0.3563	0.0992	0.1045
2003-06	0.5432	0.1177	-0.2323	2.2168	0.1656	0.2200	0.4314	0.1181	0.1231
2007-10	0.5408	0.1188	0.1811	2.9808	0.5000	0.8733	0.2527	0.0980	0.1227
2011-14	0.5431	0.1052	-0.0154	2.3663	0.4338	0.3467	0.3781	0.0959	0.1099

Panel b) Distribution of Goal Differences

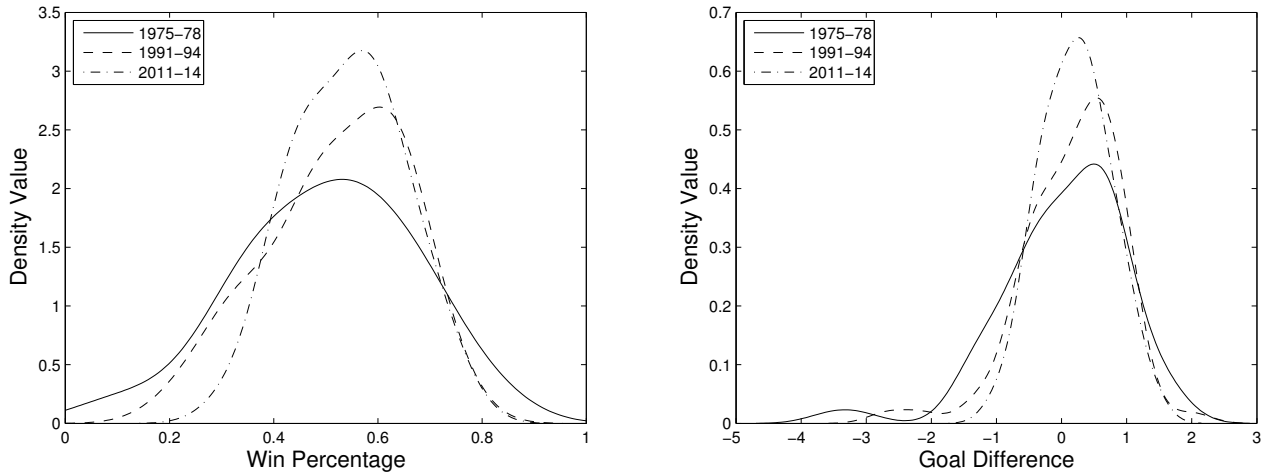
	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pvalue	(6) Unimod pvalue	(7) CC Ind.
1975-78	0.0352	0.9450	-1.1445	5.4890	0.0010	0.7733	0.2466
1979-82	0.0708	0.7895	-0.6210	4.1080	0.0205	0.8200	0.2422
1983-86	0.1985	0.6819	-0.4944	3.0985	0.1217	0.3933	0.3525
1987-90	0.0637	0.7217	-0.7806	3.5111	0.0215	0.5400	0.3127
1991-94	0.1647	0.7554	-1.0087	5.2635	0.0014	0.6467	0.2844
1995-98	0.2251	0.6279	-0.1753	3.1777	0.5000	0.9533	0.2167
1999-02	0.2837	0.5343	0.0838	2.6192	0.5000	0.3067	0.3798
2003-06	0.2494	0.5706	-0.1930	2.6359	0.5000	0.3633	0.3698
2007-10	0.2084	0.5749	-0.3756	3.3441	0.2289	0.7600	0.2539
2011-14	0.2108	0.5273	0.0416	2.5391	0.5000	0.8233	0.2614

Notes: The analysis is based on a balanced sample of 76 countries (Sample 1) with more than 1m inhabitants throughout the sample period. Columns 1-4 report the distributional moments mean, standard deviation, skewness and kurtosis. Column 5 contains the p-values of the Jarque Bera test with the null hypothesis being the Gaussian distribution. Column 6 shows the p-values of Silverman's (1981) multimodality test with the null hypothesis being a unimodal distribution. Column 7 present the club convergence indicator by Krause (2017), Column 8 the bi-polarization index by Wolfson (1994) and Column 9 the Gini coefficient as a measure of inequality. Due to the presence of negative values in the goal differences, Wolfson's (1994) bi-polarization index and the Gini coefficient cannot be computed for this data.

distribution, which is symmetric and light-tailed. This is also illustrated in Figure 3a for win percentage and Figure 3b for goal difference: the distributions clearly appear less skewed, less dispersed and more Gaussian since the 1980s. The disappearance of the long left tails of weak countries in the distribution of goal difference is particularly striking.

Only when we include the very small nations (Sample 3) is the tendency of the distribution to become more Gaussian brought into question. As can be seen in Figure A-4 the left tail stays rather long, leading to rejection of normality under the Jarque-Bera test in Table A-5. This suggests that while there is convergence, very small nations face significant obstacles to improving their performance due to scarce resources in terms of population and wealth.

Figure 3: Densities of Win Percentages and Goal Differences in Various Years, Sample 1 (76 Countries)



That the distribution of countries' soccer performance has moved towards a Gaussian distribution is a remarkable result and stands in stark contrast to the evolution of countries' GDP per capita distribution, which is characterized by asymmetry and multimodality. For GDP per capita, the literature has failed to find unconditional convergence in the global distribution and attention has focused on the narrower notion of club convergence, which denotes convergence only within certain groups of countries (Baumol, 1986; Quah, 1993a, 1996). With national teams playing in continental federations, "club convergence" in performance is a further concept to investigate with our data.

If the distribution is multimodal, the separation of the groups might become more explicit over time and it is possible to test this by measuring if various peaks become more pronounced (Krause, 2017). However, we find little or no evidence of multimodality at any point in time either for the distribution of win percentage or goal difference. Even for the years before the move towards a symmetric, Gaussian distribution, there is scant evidence that groups of countries are distributed in multiple modes. Across the years, Silverman's (1981) unimodality test never rejects the unimodality hypothesis at any reasonable significance level; the p-values never go below 0.15 for the win percentage distribution (column 6 of Table 7).[15] Accordingly, the dynamic club convergence indicator shows no clear pattern across time periods (column 7). If anything, there is a slight decrease in recent years, which suggests that possible convergence clubs are becoming even less pronounced. Obviously, as countries have clustered more and more

[15]We follow the version of Silverman's (1981) unimodality test with the sample variance adjustment by Efron and Tibshirani (1993), as it is typically implemented, see for instance Bianchi (1997) and Krause (2017). For the bootstrap procedure we use 2500 replications.

around a 0.5 win percentage and a goal difference close to zero, no separate clubs based on this performance are discernible. At the same time, the global GDP per capita distribution has gone through various periods of club convergence and de-clubbing (Krause, 2017).

We conclude that the convergence results in countries' soccer performance holds across the worldwide distribution. This is further underlined by a steady decrease in Wolfson's (1994) bi-polarization index (Column 8 of Table 7), which measures the size of the distribution at both ends compared to the middle.[16] Lastly, the Gini coefficient of inequality in performance (Column 9) also decreases significantly across all samples and time periods, solidifying our results.

5 The Limits of Convergence and the Middle Income Trap Analogy

5.1 Country Analysis

While our evidence strongly suggests that there has been convergence in men's soccer national team performance since 1950, it is also obvious that significant differences remain between continental federations. The prediction by the celebrated Brazilian player Pele in the 1980s that "An African nation will win the World Cup before the year 2000" has proved to be wide off the mark. Only European and South American teams have achieved this feat so far.[17]

Table A-3 in the Appendix sheds further light on this by listing the equilibrium win percentages of the strongest and weakest national teams for four 12-year cycles between 1967 and 2014, using all countries. Based on the estimating equation $\Delta y_{it} = \alpha_i + \beta y_{i,t-1} + \epsilon_{it}$, the equilibrium value of win percentage can be derived from the Least Squares Dummy Variables regression as $\frac{\hat{\alpha}+\hat{\alpha}_t}{-\hat{\beta}}$ with $\hat{\alpha} = \frac{1}{N}\sum_{i=1}^{N}\hat{\alpha}_i$. The equilibrium win percentages correlate strongly with the empirical data and we see that the best teams have win percentages of 0.7 to 0.8. The repeated presence of particular nations in the top ten in each of these 12-year cycles is striking, in particular Brazil, which is ranked first or second in each period, Spain, the Netherlands, England, Germany and Argentina. Out of the top forty places across these four periods, 23 places were taken by teams from Europe and 6 by teams from South America. Thus these two confederations

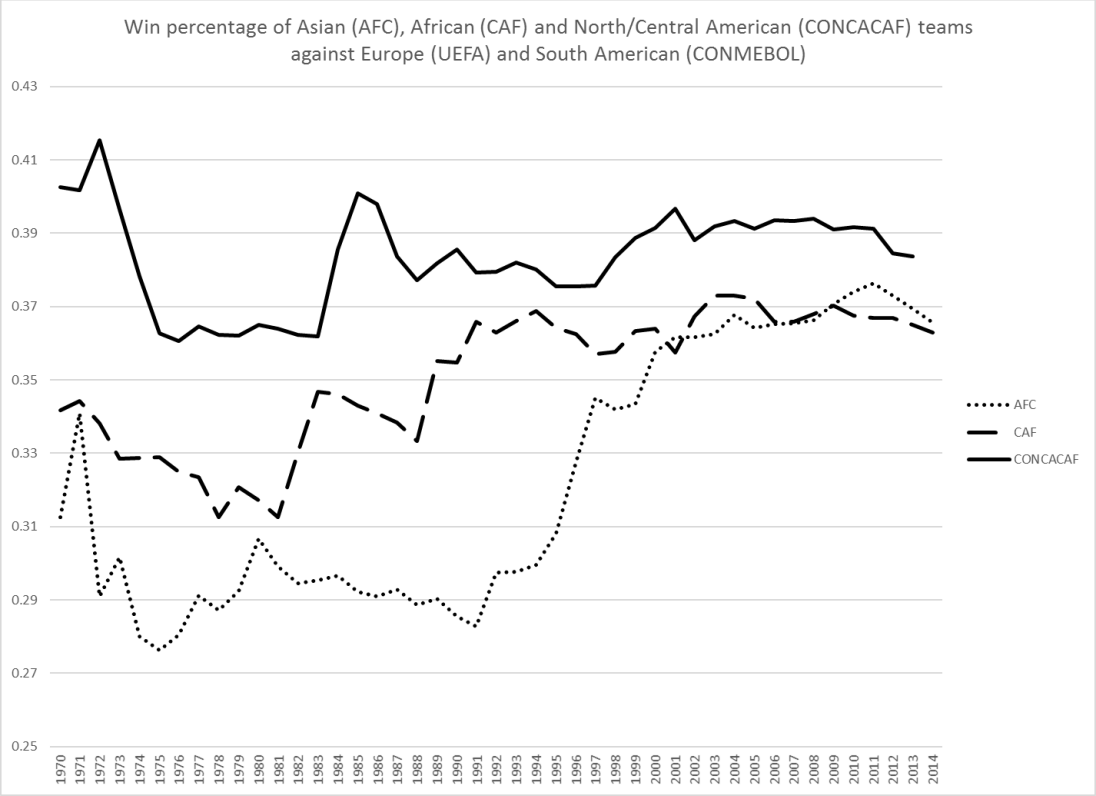
[16] The polarization index by Esteban and Ray (1994) mirrors this development and is not shown for space constraints.

[17] Teams from outside the big two regional confederations have reached the semi-finals twice: the USA in the first World Cup in 1930 (contested by only 13 nations), and South Korea in 2002.

accounted for almost three quarters of the top teams.

This leads us to question how teams from other continents have fared against European and South American teams: are they catching up and winning more often in direct encounters? Figure 4 reports the cumulative win percentage of the newer confederations (Asia, Africa and Central/North America) against the established powers of Europe and South America since 1970.[18] The graph suggests that each continent has enjoyed some periods of catch-up, but that in all three cases convergence toward the elite confederations has stalled in the last decade and might even be going into reverse. The win percentage seems stuck at just below the 40% level, a significantly lower level of performance compared to European and South American teams.

Figure 4: The Evolution of Selected Countries' Win Percentages per four-year Cycle



Further evidence is provided a decomposition of performance inequality (in terms of win percentages) into inequality within and between continental confederations. Using the 76 countries from Sample 1 (four-year cycles from 1975-2014), shows that the Theil index of global inequality in win percentage decreased markedly over the years (col 1), but this evolution has been driven by the strong decrease in performance inequality within

[18]The sixth confederation, Oceania (OFC) is omitted here since it largely consists of small islands from the Pacific which struggle to compete outside of the confederation.

continental confederations (col 2).[19] This holds for inequality within all the individual confederations except North/Middle America, with performance inequality within Europe decreasing by 75% (Table A-6) in the Appendix. By contrast, between-continent inequality in performance (col 4) stood at the same value as at the beginning of the sample. Its share of global performance inequality has therefore increased considerably (col 5). While most of the differences in performance can still be attributed to within-continent inequality (col 3), the relatively increasing gaps between continents are worth investigating.

Table 8: Inequality in Win Percentage and its Decomposition Within and Between Continental Confederations, Sample 1 (76 countries)

	Theil Index of Inequality	*Within Continents*		*Between Continents*	
		Theil-Index	Share of Total	Theil-Index	Share of Total
	(1)	(2)	(3)	(4)	(5)
1975-1978	0.0630	0.0604	0.9588	0.0026	0.0412
1979-1982	0.0373	0.0357	0.9551	0.0017	0.0449
1983-1986	0.0340	0.0324	0.9506	0.0017	0.0494
1987-1990	0.0440	0.0408	0.9285	0.0031	0.0715
1991-1994	0.0350	0.0324	0.9270	0.0026	0.0730
1995-1998	0.0277	0.0244	0.8793	0.0033	0.1207
1999-2002	0.0170	0.0145	0.8491	0.0026	0.1509
2003-2006	0.0240	0.0195	0.8140	0.0045	0.1860
2007-2010	0.0241	0.0223	0.9274	0.0017	0.0726
2011-2014	0.0188	0.0163	0.8638	0.0026	0.1362

In order to square the results of unconditional convergence across the worldwide soccer performance distribution with the remaining rift between the top national teams and the rest, let us analyze which countries have caught up the most. For our mobility analysis, we again use the 76 countries from Sample 1 (four-year cycles from 1975-2014) and rank them in each cycle based on their empirical win percentage.[20] The main result of our mobility analysis shows that the biggest beneficiaries of worldwide convergence have been second-tier national teams from Europe and South America. The gains of the Asian and Central/North American teams have been limited, while numerous African teams have in recent years experienced declining relative performance. These observations are based on various insights.

First of all, there is a lot of mobility in the distribution of win percentages over four-year cycles, much more than is typically found in, say, the distribution of countries'

[19]The Theil index of inequality is used because it can be decomposed into its within- and between-group components, unlike the Gini index (Cowell, 2009).

[20]When using the shorter Sample 2 or looking at ranks in the distribution of goal differences, the results are very similar. Note that the sample used does not include countries with less than 1m inhabitants, which we know lack the human capital and financial resources to catch up, which is validated by a look at the bottom ten countries in terms of equilibrium winning percentages in Table A-3.

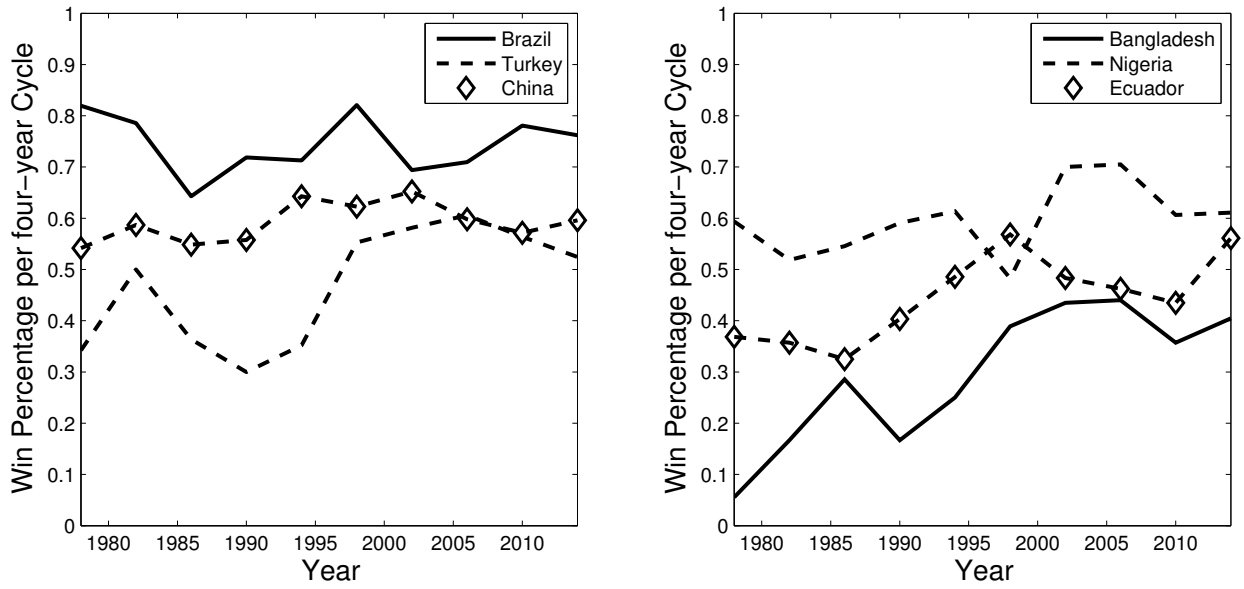
income per capita. The relatively low correlation coefficients of 0.5-0.7 from cycle to cycle in Table A-7 in the Appendix demonstrate that strong teams can have bad cycles and that weak teams can improve. Nevertheless, there are clearly some limits to the catch-up process and we see big differences across continental federations. This is revealed by Table 9. Across the whole period (1975-2014), European countries had the highest rank on average (32.1 out of 76), while the average Asian, African and South American team were on similar levels. But the changes are remarkable, when the ranks of the average country at the beginning (1975-86, using three four-year cycles to ease out random variation) and end (2003-14) are compared: The average countries from Europe and South America managed to improve their ranks (from 34.3 to 30.8 and 44.6 to 38.9), while the average African team fell further behind in relative terms (from 37.5 to 39.6). This becomes even clearer when looking only at countries which were in the bottom half of ranks in 1975-86 (rows 6 to 9) and therefore had the biggest catch-up potential: Both weak teams from Europe and South America made big improvements - by 15 ranks for the average European bottom-half team -, while the average African bottom-half team fell slightly further behind.

Table 9: Countries' Ranks in the Win Percentage Distribution over Four-Year Cycles by Continental Federation, Sample 1 (76 countries)

	Asia	Africa	America (N,C)	South America	Pacific	Europe
Mean Rank	39.3	40.2	44.2	41.5	58.0	32.1
St.Dev. of Rank	16.7	14.2	14.5	12.2	23.6	14.6
Rank in 1975-86	41.8	37.5	38.9	44.6	35.0	34.3
Rank in 2003-14	41.4	39.6	47.3	38.9	75.0	30.8
No. of Countries	15	23	6	10	1	21
Bottom Half: Rank in 1975-86	57.1	50.9	45.6	55.3		52.7
Bottom Half: Rank in 2003-14	48.4	52.3	51.6	50.6		37.6
No. of Bottom Half Countries	9	11	4	7	0	9

Figure 5 illustrates some cases in point: The world's dominant national teams like Brazil kept an empirical winning percentage at 0.7 throughout the sample period. Turkey in the left panel and Ecuador in the right panel are examples of formerly weaker European and South American countries which showed big improvements. The weakest teams, such as Bangladesh (the world's 8th most populous country) that had a win percentage of 0.1 in the 1970s, exhibited the biggest catch-up potential. Bangladesh duly showed steady performance increases. But the better national teams from Africa and Asia, such as China and Nigeria, have failed to make long-lasting improvements and remain at middling performance levels. In order to understand why, we will consider the parallels to an empirical phenomenon in the GDP per capita growth literature: the Middle Income Trap.

Figure 5: The Evolution of Selected Countries' Win Percentages per four-year Cycle



5.2 The Middle Income Trap Analogy

The term 'middle income trap' first appeared in a book by two World Bank economists (Gill and Kharas, 2007). It refers to the challenge countries face after prolonged periods of economic catch-up growth, as the returns to capital diminish and wages rise. Export-based growth strategies based on abundant labor then reach their limits: They lose competitiveness against poorer countries with lower wages and higher returns, but at the same time they do not yet have the technological and human capital resources to compete with richer countries on innovation.[21] In terms of income per capita, the Asian Tiger countries (Korea, Taiwan etc), have typically been more successful in making the transition than stagnating Latin American countries, such as Brazil and Argentina.

While some of countries involved differ, let us examine to what extent might these mechanisms be applicable to what we observe in countries' soccer performance.[22]

First, it is obvious that for very weak teams, performance improvements are easier to achieve than for teams in the middle. Starting at low levels, better sports infrastructure, better nutrition and fitness plans, more effective training techniques, expanded knowledge

[21] Gill and Kharas (2015) lament that no economic growth model has yet been developed particularly for middle-income countries to fill the gap been the Solow-Swan capital accumulation model for poorer economies and endogenous growth theory for richer ones.

[22] Soccer has a long history in Brazil and Argentina, and the countries are continually investing in their talent to stay among the top teams. By contrast, their position in the middle income trap owes a lot to a resource-dependent economy, slow industrialization and inefficient institutions, in contrast to some Asian economies who invested in high-end technology exports and human capital formation to catch up in terms of GDP per capita.(Lee, 2013).

of tactics and insights from abroad, gained by players or a foreign coach, can go a long way. There have also been many other directed initiatives reflecting the soccer equivalent of foreign aid and foreign direct investment. For instance, since the 1970s FIFA has had an explicit policy of supporting the emerging continental associations through grants paid out of the profits generated by the FIFA World Cup. Moreover, clubs from rich countries, such as Feyenoord Rotterdam and Ajax Amsterdam, have set up training and cooperation facilities in African countries. Philanthropists are playing a role, too - George Weah, the FIFA World Footballer of the Year in 1995, has invested considerably in soccer development of his native Liberia. Taken together, all these measures are showing results in terms of increasing win percentages of the world's weakest teams. But once these low-hanging fruits have been picked, it becomes harder for a national team to improve performance. Failure to progress is all the more likely if their opponents have improved in similar ways.

The development of new talent becomes increasingly important if teams aspire to be among the world's best. In this respect, soccer follows the model put forward by Acemoglu et al. (2006): They argue that at early stages of development, the potential of existing firms and managers can be easily improved; but closer to the world technology frontier, successful economies focus on broadening the talent pool, providing incentives to foster new firms and high-potential managers. In soccer, it is similarly vital for sustained performance gains that nations move beyond a small core of selected individuals. Attention needs to shift to enlarging the pool of potential players in order to maximize the potential of the national population, which requires a national network of scouting and training schemes for young players. The number of people actively playing football as a pastime is a strong predictor of the strength of the national team; a FIFA survey from 2006 found that 15 out of the top 20 nations in terms of active footballers at the youth or senior level were located in Europe or South America.[23] Germany is widely appreciated for its youth development system, involving, for instance, 121 regional training centers throughout the country so that every aspiring German teenager has access to intensive training programs within 25 km of their hometown. The creation of a national league for players under the age of 17 further helps top talents be identified early on to gain competitive experience.[24] Other countries are starting to recognize the importance of such a scheme; for instance 2017 China announced plans to create 50,000 football youth academies by 2025. Establishing a youth development system can in the long run be expected to help countries escape the 'middle performance trap'.

[23] http://www.fifa.com/mm/document/fifafacts/bcoffsurv/bigcount.statspackage_7024.pdf

[24] For the discussion of the German youth development system by the international press, see for instance https://www.theguardian.com/football/2015/sep/05/germany-football-team-youth-development-to-world-cup-win-2014 .

In the 'middle income trap' literature, another important factor is the role played by innovations for continued growth in rich countries (see the endogenous growth models by Romer (1990) and Grossman and Helpman (1991)). Eichengreen et al. (2013) found that countries with more high-tech production were less likely to have growth slowdowns at the typical transition level of the middle income trap. In soccer, the adoption of best-practices from abroad has helped many teams to catch up but beyond a certain point is just as important for a team to develop its own style. In soccer, playing styles spread very quickly across countries, but typically originate in the world's leading football nations. One example of a style which quickly become adopted by teams around the world was the 'Tiki Taka' style of short passes and movements associated with the Spanish team's victory in the UEFA Euro 2008 and 2012 as well as the FIFA World Cup 2010 (Gyarmati et al., 2014).[25]

Innovation originating in the world's leading European and South American soccer countries underlines their reputation and continued success. Many of their competitors have improved - but Brazil's winning percentage is still in the 0.70's rather than dipping towards the equal 50-50 prediction. In this respect, incentives matter a lot for further investment. According to Aghion et al.'s (2005) model of market competition and innovation, competition spurs investment in innovation for neck-and-neck countries/firms more than for laggards. In other words, the prospect of winning the next World Cup against other top teams is a strong incentive to keep on investing in state-of-the-art talent identification, training and tactical skill innovation. But for teams stuck in the middle of distribution this objective is too far away; the playing field is just too uneven.

A final, but crucial factor helping to explain the 'middle performance trap' in soccer is the network effect from regional integration. According to Ayiar et al. (2013), countries from Central and Eastern Europe, such as Poland and Hungary, have avoided the middle income trap thanks to frequent interactions, via trade and technology spillovers with richer European neighbors. In soccer, regional blocks are particularly vital because teams from the same federation most often play against each other, as Table A-8 in the Appendix shows. Out of all international pairings from 1950 to 2014, 82.07% pitted two teams from the same regional federation against each other. European teams played against other European teams 83.95% of the time. This is not only due to geographical proximity but underlines the role of the continental confederations in organizing games and setting standards.

Our mobility analysis has revealed that weaker teams from Europe and South America

[25]There is a big discussion among sports commentators to what extent the adoption of 'Tiki Taka' by other teams is proving successful or long-lasting, see https://www.supersport.com/football/blogs/sunday-oliseh/Why_Tiki_Taka_still_rules_the_world and http://bleacherreport.com/articles/1391050-barcelonas-tiki-taka-4-teams-whove-tried-to-emulate-them.

have improved their performance a lot. Playing against the world's best teams on a regular basis has allowed them to gain top-level experience and catch up. Being part of the UEFA and CONMEBOL regional associations means that they also share the same institutional environment as the top teams, facilitating the technology transfer.
By contrast, relatively good teams from Africa or Asia can gain less from regional integration where they meet even weaker peers. They simply have fewer opportunities to hone their skills against the world's top national teams, becoming stuck in the soccer analogue of the middle income trap. This leads us to conclude that the strong role of regional associations in soccer has come with a mixed blessing in terms of helping weaker teams to catch up.

6 Discussion and Conclusion

Examining the performance of national soccer teams from 1950 to 2014, this paper has found strong evidence of unconditional convergence. The results of the β- and σ-convergence tests suggest that weaker teams have made improvements and caught up with better ones. Unlike countries' income per capita distribution, the worldwide soccer performance in terms of win percentages and goal differences is evolving towards a Gaussian distribution, as countries move towards each other. We identify the biggest beneficiaries as (i) the world's weakest teams with huge catch-up potential and (ii) second-tier teams from Europe and South America, benefiting from regional integration into the world's top soccer continents. By contrast, the stronger teams from Africa and Asia are failing to close the gap with the world's best national teams and, with continued middling performances, remain in the soccer analogue of the middle income trap.

Our study is the first to find unconditional convergence in a particular sector other than manufacturing and the first of its kind to use a truly global dataset. Performance in other industries and service sectors, from banking to tourism, is much more different, if not impossible, to measure on a consistent and comparable basis for a global sample. International soccer obviously has some unique features which differ from other economic sectors. However, unconditional convergence in such a competitive, globalized and regionally-integrated service holds lessons for other sectors:

(i) Technological transfer by way of best-practice adoption can facilitate convergence if the product/service involved is standardized, globally traded and performance is easily observable. Global labor markets for soccer players and coaches ensure the transfer of skills and insight, which, in the case of soccer, is helped by the portability of human capital and low information asymmetries. Obviously, this may be more difficult to achieve in other sectors; however, efforts to better recognize migrants' skills, to foster

industry-specific experience abroad and to internationalize the talent pool of skilled workers are known to pay dividends.

(ii) At low levels of development/performance, there is a lot of catch-up potential and the low-hanging fruit can easily be harvested with simple improvements in infrastructure, skills and techniques. Directed efforts from abroad by multilateral organizations, companies or donors can also help at this stage of development, as the case of soccer has shown. At higher performance levels, however, long-term talent development becomes crucial.

(iii) Incentives to invest are crucial, but can be helped by appropriability of the asset at stake. In many developing economies, weak enforcement of legal claims diminish the incentives to invest because of fear that assets will later be disowned. It is less easy to steal the returns to an individual's soccer talent, so that there clear incentives for individuals to continue investing in their development. Even if wages might sometimes go unpaid,[26] a star player can trade on a reputation from which they cannot easily be separated. For other industries, this holds various lessons: A strengthening of property laws, also regarding intellectual property, helps investment in general. But for individuals investing in their human capital, the applicability and transferability of their skills matter.

(iv) Regional integration fosters trade, common standards and the diffusion of best practices between the countries involved. Regional associations are important in soccer but they have played an ambiguous role for worldwide convergence in performance: Weaker teams from Europe and South America have gained from the continued exposure to top teams and their institutional environment, at the expense of teams from other continents. This calls for stronger integration not only within but also between regions, an argument which can easily be made for other industries as well.

[26] At the 2006 World Cup the Togo players went on strike because they had not received promised wages from the Togo Football Association.

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Appendix A More Tables and Figures

Figure A-1: The Growth of International Soccer Competition

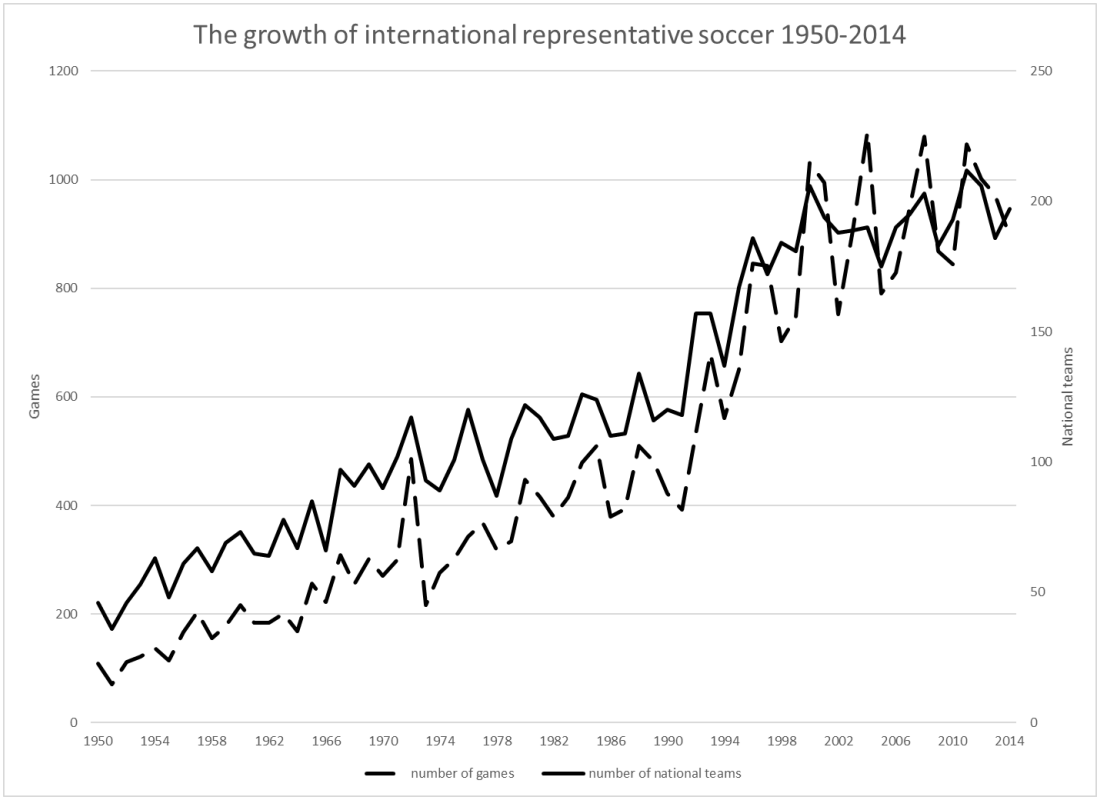

Table A-1: Estimates of β-convergence in Goal Difference

Dependent variable: Change in goal difference (GD)	(1) Unconditional	(2) Economic controls	(3) Economic controls + confed. dummies	(4) Fixed effects	(5) Economic controls + fixed effects
lagGD	-0.456***	-0.587***	-0.594***	-0.796***	-0.859***
	(0.0148)	(0.0160)	(0.0162)	(0.0187)	(0.0184)
lgdppcratio		0.0433**	0.0475**		0.0831**
		(0.0219)	(0.0222)		(0.0411)
lpopratio		0.0948***	0.0983***		0.0256
		(0.0137)	(0.0137)		(0.0358)
lexpratio		0.337***	0.334***		0.502***
		(0.0306)	(0.0307)		(0.0464)
CAF			0.108**		
			(0.0487)		
CONCACAF			0.0447		
			(0.0608)		
CONMEBOL			0.113*		
			(0.0679)		
OFC			0.117		
			(0.205)		
UEFA			0.123**		
			(0.0488)		
Constant	-0.0495***	-0.0317*	-0.113***	-0.656***	-0.215
	(0.0188)	(0.0176)	(0.0363)	(0.201)	(0.198)
Observations	1,644	1,644	1,644	1,644	1,644
R-squared	0.367	0.455	0.457	0.594	0.637

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group in column 3 is the Asian Football Confederation (AFC). The continental confederations are AFC (Asia), CAF (Africa), CONCACAF (North and Middle America and the Caribbean), CONMEBOL (South America), OFC (Oceania) and UEFA (Europe).

Table A-2: Estimates of β-convergence in win percentage by Confederation

Dependent variable: Change in win percentage (wpc)	(1) Unconditional	(2) Economic controls	(3) Economic controls + confed. dummies	(4) Fixed effects	(5) Economic controls + fixed effects
Lagged wpc*AFC	-0.451***	-0.611***	-0.572***	-0.739***	-0.817***
	(0.0212)	(0.0219)	(0.0307)	(0.0391)	(0.0382)
Lagged wpc*CAF	-0.448***	-0.603***	-0.698***	-0.892***	-0.938***
	(0.0200)	(0.0209)	(0.0338)	(0.0410)	(0.0398)
Lagged wpc*CONCACAF	-0.487***	-0.634***	-0.725***	-0.888***	-0.920***
	(0.0250)	(0.0248)	(0.0441)	(0.0540)	(0.0520)
Lagged wpc*CONMEBOL	-0.406***	-0.564***	-0.480***	-0.684***	-0.742***
	(0.0256)	(0.0257)	(0.0570)	(0.0834)	(0.0804)
Lagged wpc*OFC	-0.633***	-0.639***	-0.725***	-0.451*	-0.479**
	(0.0777)	(0.0719)	(0.157)	(0.239)	(0.230)
Lagged wpc*UEFA	-0.414***	-0.568***	-0.495***	-0.836***	-0.882***
	(0.0186)	(0.0196)	(0.0316)	(0.0454)	(0.0438)
GDP p.c. ratio		0.0112***	0.0104***		0.0181**
		(0.00378)	(0.00378)		(0.00721)
Population ratio		0.0182***	0.0170***		0.00621
		(0.00235)	(0.00239)		(0.00627)
Experience ratio		0.0562***	0.0575***		0.0712***
		(0.00517)	(0.00518)		(0.00804)
CAF			0.0700***		
			(0.0209)		
CONCACAF			0.0670***		
			(0.0246)		
CONMEBOL			-0.0263		
			(0.0317)		
OFC			0.0659		
			(0.0769)		
UEFA			-0.0204		
			(0.0210)		
Constant	0.210***	0.290***	0.270***	0.253***	0.345***
	(0.00827)	(0.00905)	(0.0144)	(0.0367)	(0.0369)
Observations	1,644	1,644	1,644	1,644	1,644
R-squared	0.301	0.402	0.411	0.542	0.578

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group in column 3 is the Asian Football Confederation (AFC). The continental confederations are AFC (Asia), CAF (Africa), CONCACAF (North and Middle America and the Caribbean), CONMEBOL (South America), OFC (Oceania) and UEFA (Europe).

Table A-3: Equilibrium Win Percentages Per Twelve-Year Cycle, Top Ten and Bottom Ten

period	1967-1978		1979-1990		1991-2002		2003-2014
obs.	100		116		171		175
st. dev.	0.171		0.159		0.164		0.145
				Top Ten			
Brazil	0.775	France	0.721	Brazil	0.744	Spain	0.798
Poland	0.718	Brazil	0.719	Germany	0.738	Brazil	0.746
Netherlands	0.706	Italy	0.711	Iraq	0.725	Netherlands	0.712
England	0.702	Iraq	0.691	Italy	0.697	Germany	0.701
Italy	0.700	Ghana	0.689	Argentina	0.694	Argentina	0.694
South Korea	0.687	Honduras	0.661	France	0.693	Iran	0.690
Kuwait	0.683	England	0.653	Spain	0.688	Egypt	0.686
Belgium	0.671	Mexico	0.653	Czech Republic	0.671	England	0.684
Guinea	0.667	Spain	0.651	Croatia	0.658	Portugal	0.683
Spain	0.664	South Korea	0.639	Netherlands	0.657	Croatia	0.675
				Bottom Ten			
Iceland	0.185	Venezuela	0.190	Luxembourg	0.104	Brit. Virgin Isl.	0.206
Malta	0.172	Eq. Guinea	0.185	Taiwan	0.102	Cambodia	0.179
UAE	0.171	Botswana	0.180	Montserrat	0.084	Comoros	0.174
Burundi	0.158	Oman	0.156	Brunei	0.079	Brunei	0.173
Luxembourg	0.118	Cyprus	0.141	Mongolia	0.046	Malta	0.168
Syria	0.113	Taiwan	0.139	Djibouti	0.035	Macau	0.162
Oman	0.079	Panama	0.082	Nicaragua	0.035	Luxembourg	0.148
Cyprus	0.070	Luxembourg	0.059	Philippines	0.033	Bhutan	0.068
Bangladesh	0.066	Nepal	0.046	Aruba	0.028	Djibouti	0.018
Jamaica	0.064	Pakistan	0.000	Eq. Guinea	0.000	Anguilla	0.000

Notes: Based on the estimating equation $\Delta y_{it} = \alpha_i + \beta y_{i,t-1} + \epsilon_{it}$, the equilibrium value of win percentage is given by $\frac{\hat{\alpha}+\hat{\alpha_i}}{-\hat{\beta}}$ with $\hat{\alpha} = \frac{1}{N}\sum_{i=1}^{N}\hat{\alpha_i}$.

Figure A-2: Histograms and Kernel Density Plots: Win Percentage per World Cup Cycle (varying numbers of countries)

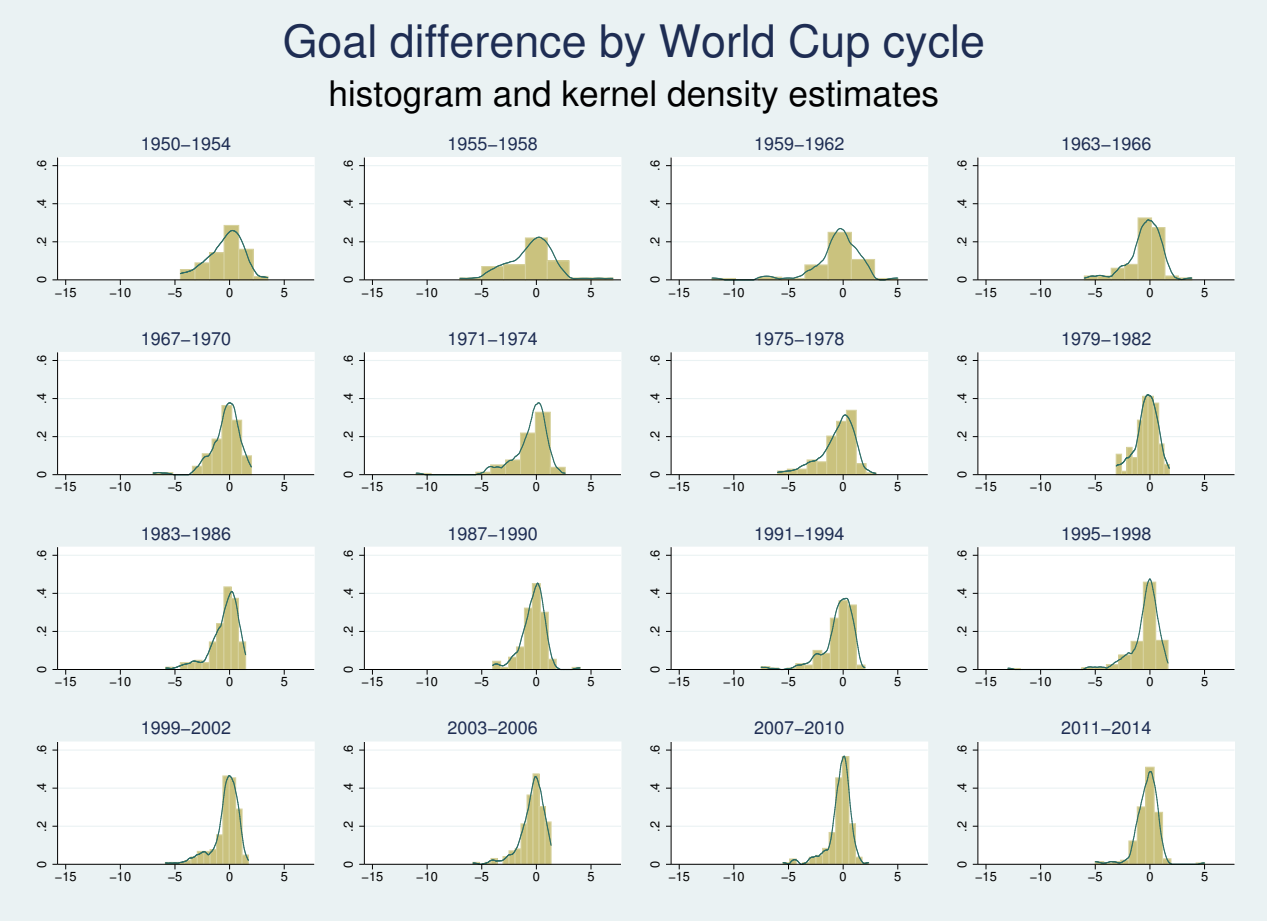

Figure A-3: Histograms and Kernel Density Plots: Goal Difference per World Cup Cycle (varying numbers of countries)

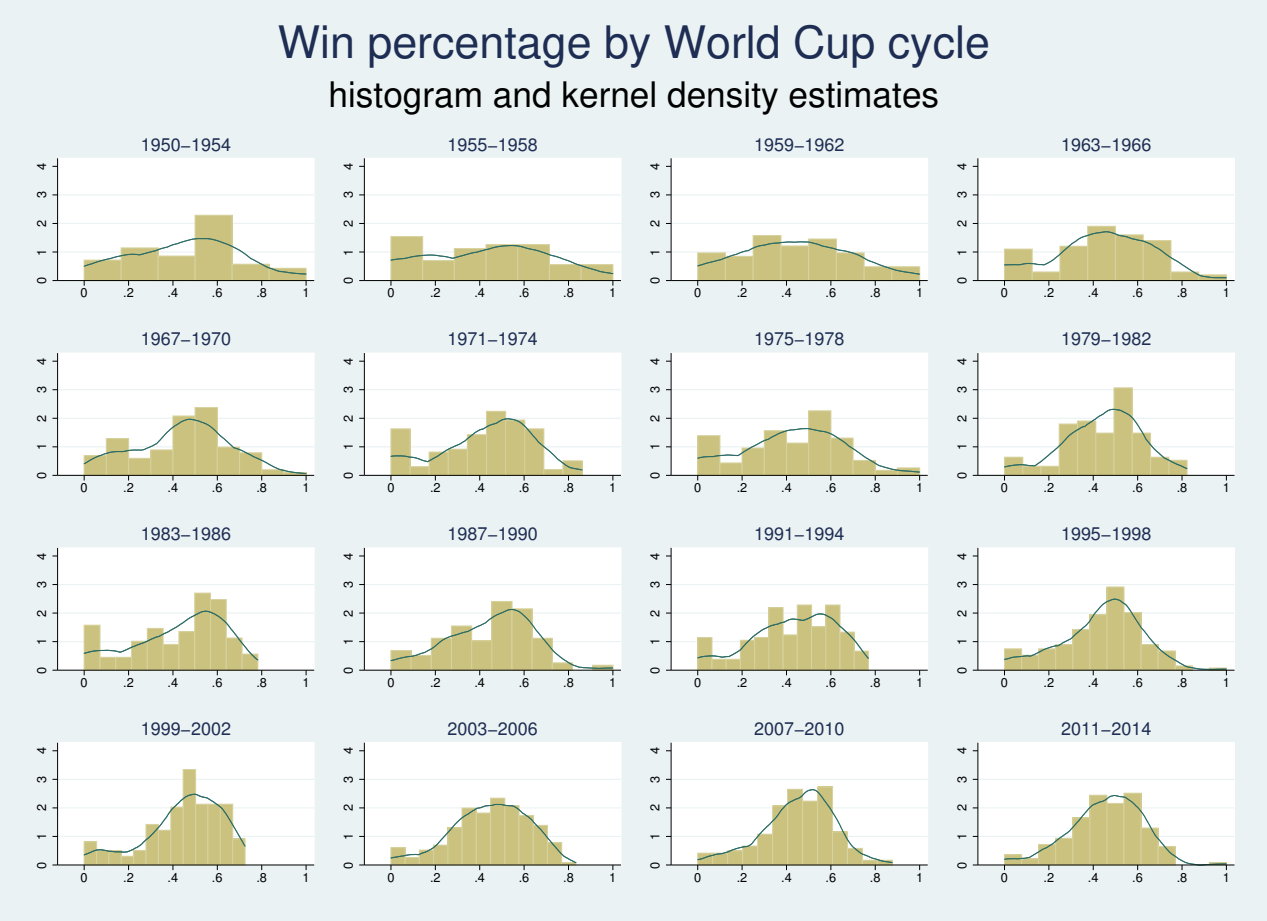

Figure A-4: Densities of Win Percentage and Goal Differences in Various Years, Sample 3 (86 Countries)

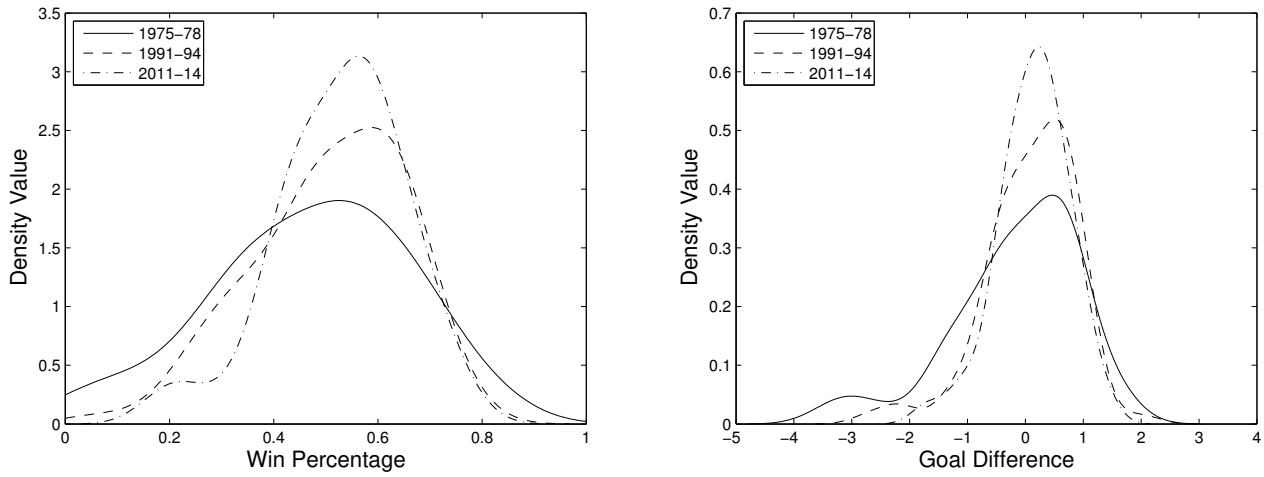

Table A-4: Distribution of Points and Goal Difference Sample 2 (127 countries)

Panel a) Distribution of Win Percentage

	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pvalue	(6) Unimod pvalue	(7) CC Ind.	(8) Pola	(9) Gini
1991-94	0.4752	0.1668	-0.5967	2.9474	0.0280	0.1433	0.3313	0.1482	0.1963
1995-98	0.4858	0.1480	-0.4899	3.3679	0.0460	0.9567	0.1948	0.1071	0.1686
1999-02	0.4986	0.1356	-0.7987	3.5606	0.0062	0.3633	0.3473	0.1110	0.1498
2003-06	0.4959	0.1394	-0.2458	2.2911	0.0941	0.3667	0.3403	0.1328	0.1602
2007-10	0.5007	0.1310	0.0276	3.2144	0.5000	0.5067	0.2732	0.1073	0.1459
2011-14	0.5003	0.1301	-0.2388	2.5107	0.2149	0.5300	0.2967	0.1168	0.1474

Panel b) Distribution of Goal Differences

	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pvalue	(6) Unimod pvalue	(7) CC Ind.
1991-94	-0.1545	1.0823	-1.4467	6.0484	0.0010	0.3267	0.3006
1995-98	-0.0451	0.8217	-0.7569	3.8306	0.0057	0.2700	0.3563
1999-02	0.0427	0.7578	-1.0645	5.1369	0.0010	0.4567	0.2709
2003-06	-0.0177	0.7381	-0.5354	3.2609	0.0379	0.8633	0.2246
2007-10	0.0188	0.6426	-0.5112	3.6708	0.0255	0.7667	0.2219
2011-14	0.0020	0.6497	-0.1382	2.3739	0.2141	0.4900	0.2899

Notes: The analysis is based on a balanced sample of 127 countries (Sample 2) with more than 1m inhabitants throughout the sample period. Columns 1-4 report the distributional moments mean, standard deviation, skewness and kurtosis. Column 5 contains the p-values of the Jarque Bera test with the null hypothesis being the Gaussian distribution. Column 6 shows the p-values of Silverman's (1981) multimodality test with the null hypothesis being a unimodal distribution. Column 7 present the club convergence indicator by Krause (2017), Column 8 the bi-polarization index by Wolfson (1994) and Column 9 the Gini coefficient as a measure of inequality. Due to the presence of negative values in the goal differences, Wolfson's (1994) bi-polarization index and the Gini coefficient cannot be computed for this data.

Table A-5: Distribution of Points and Goal Difference Sample 3 (86 countries, including those with less than 1m inhabitants)

Panel a) Distribution of Win Percentage

	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pvalue	(6) Unimod pvalue	(7) CC Ind.	(8) Pola	(9) Gini
1975-78	0.4690	0.1888	-0.3993	2.7193	0.1802	0.7333	0.2848	0.1807	0.2260
1979-82	0.4856	0.1573	-0.4490	3.4461	0.0988	0.6300	0.2738	0.1263	0.1781
1983-86	0.5045	0.1537	-0.9286	3.6328	0.0082	0.8933	0.2383	0.1183	0.1651
1987-90	0.4970	0.1582	-0.6722	3.0560	0.0359	0.4567	0.3186	0.1321	0.1757
1991-94	0.5074	0.1443	-0.6202	2.9253	0.0473	0.3700	0.3535	0.1385	0.1584
1995-98	0.5159	0.1341	-0.4774	3.2503	0.1045	0.9733	0.2086	0.1059	0.1437
1999-02	0.5292	0.1160	-0.8369	4.7137	0.0033	0.1967	0.3952	0.1061	0.1199
2003-06	0.5253	0.1360	-0.7245	3.7247	0.0182	0.1300	0.4101	0.1232	0.1431
2007-10	0.5222	0.1356	-0.3753	3.7377	0.0839	0.9900	0.1797	0.1048	0.1422
2011-14	0.5272	0.1232	-0.5948	3.4196	0.0450	0.4667	0.3361	0.1020	0.1289

Panel b) Distribution of Goal Differences

	(1) Mean	(2) St.Dev.	(3) Skew	(4) Kurt	(5) JB pvalue	(6) Unimod pvalue	(7) CC Ind.
1975-78	-0.1622	1.1141	-0.9871	3.8775	0.0053	0.2033	0.4277
1979-82	-0.0947	0.9184	-0.7554	3.9015	0.0130	0.3000	0.3348
1983-86	0.0685	0.8227	-1.0952	4.9705	0.0011	0.6333	0.2617
1987-90	-0.0241	0.7702	-0.8152	3.5144	0.0147	0.4600	0.3250
1991-94	0.1020	0.7827	-0.9667	4.7886	0.0020	0.7833	0.2518
1995-98	0.1257	0.7142	-0.5727	3.7947	0.0317	0.9633	0.1934
1999-02	0.1973	0.6291	-0.7496	4.9710	0.0028	0.2033	0.3495
2003-06	0.1614	0.6953	-1.0305	5.2054	0.0010	0.8167	0.2348
2007-10	0.1124	0.6660	-0.7816	4.0398	0.0099	0.4967	0.2991
2011-14	0.1359	0.6138	-0.5612	3.6389	0.0415	0.5800	0.2843

Notes: The analysis is based on a balanced sample of 86 countries (Sample 3), which, in contrast to Sample 1 include those with less than 1m inhabitants. Columns 1-4 report the distributional moments mean, standard deviation, skewness and kurtosis. Column 5 contains the p-values of the Jarque Bera test with the null hypothesis being the Gaussian distribution. Column 6 shows the p-values of Silverman's (1981) multimodality test with the null hypothesis being a unimodal distribution. Column 7 present the club convergence indicator by Krause (2017), Column 8 the bi-polarization index by Wolfson (1994) and Column 9 the Gini coefficient as a measure of inequality. Due to the presence of negative values in the goal differences, Wolfson's (1994) bi-polarization index and the Gini coefficient cannot be computed for this data.

Table A-6: Theil-Index of Inequality in Win Percentage Within Continental Confederations, Sample 1 (76 countries)

	Asia	Africa	America (N,C)	America (South)	Europe
1975-1978	0.1430	0.0439	0.0081	0.0764	0.0358
1979-1982	0.0805	0.0259	0.0140	0.0423	0.0233
1983-1986	0.0437	0.0155	0.0290	0.0683	0.0311
1987-1990	0.0630	0.0160	0.0764	0.0809	0.0310
1991-1994	0.0509	0.0233	0.0122	0.0540	0.0254
1995-1998	0.0249	0.0199	0.0180	0.0459	0.0207
1999-2002	0.0121	0.0127	0.0104	0.0334	0.0114
2003-2006	0.0165	0.0218	0.0431	0.0216	0.0135
2007-2010	0.0206	0.0237	0.0123	0.0301	0.0217
2011-2014	0.0139	0.0175	0.0137	0.0334	0.0097

Notes: In this sample Oceania only consists of one country (New Zealand), so that within-continental inequality in performance is zero.

Table A-7: Correlation of Countries' Ranks in the Win Percentage Distribution over Four-Year Cycles, Sample 1 (76 countries)

Variables	1975-78	1979-82	1983-86	1987-90	1991-94	1995-98	1999-02	2003-06	2007-10	2011-14
1975-78	1.00									
1979-82	0.54	1.00								
1983-86	0.54	0.51	1.00							
1987-90	0.50	0.36	0.61	1.00						
1991-94	0.39	0.27	0.47	0.62	1.00					
1995-98	0.53	0.36	0.53	0.43	0.61	1.00				
1999-02	0.43	0.22	0.39	0.46	0.57	0.57	1.00			
2003-06	0.52	0.33	0.52	0.57	0.60	0.57	0.73	1.00		
2007-10	0.41	0.17	0.46	0.45	0.57	0.53	0.70	0.73	1.00	
2011-14	0.48	0.37	0.48	0.59	0.63	0.58	0.55	0.68	0.65	1.00

Table A-8: Regional Matches Involving Teams from the Various Federations, 1950-2014

	Asia	Africa	America (N,C)	America (S)	Oceania	Europe
Asia	9586	691	161	202	130	788
Africa	691	12524	99	124	9	460
America (N,C)	161	99	4214	666	17	456
America (S)	202	124	666	3454	15	711
Oceania	130	9	17	15	32	26
Europe	788	460	456	711	26	11884

Notes: The table shows the number of international matches pitting Team 1 from the regional federation in the row against Team 2 from the regional federation in the column. The continental confederations are AFC (Asia), CAF (Africa), CONCACAF (North and Middle America and the Caribbean), CONMEBOL (South America), OFC (Oceania) and UEFA (Europe).