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Research article

Tournament Structure and Success of Players Based on Location in Men's Professional Tennis

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Abstract
This article discusses the relationship between success of professional male tennis players according to the country and world region from which they originate and the professional tournament structure in men's tennis in that world region and country. The success of a country or world region was defined by the number of players in the top 300 ATP rankings and was calculated for seven time periods between 1975 and 2008. The results showed the correlations between the total number of top 300 ranked players, the total number of tournaments, and the annual tournament prize money of the specific country. The correlations were nearly perfect in the 1975–1990 period ($r = 0.93–0.95$; $p < 0.01$) but only high in the 2005–2008 period ($r = 0.60–0.64$; $p < 0.01$), suggesting that the association between the number of top 300 ranked tennis players and professional tournaments, while still significant, is in decline. These data should inform the policy and investment decisions of regional and national federations, particularly as they relate to domestic professional tennis tournament structures and to explore opportunities to include professional tournaments of neighbour countries in their player's development programs.

Key words: Competition, professional tennis, relative success.

Introduction

Tennis is a global sport, which is popular in developed countries and features prominently in local sporting life. Since 1972, the leading role in men's professional tennis has been played by the Association of Tennis Professionals (ATP) (Chombart and Thomas, 1990). The first ATP world ranking list was published in August 1973. It has evolved from a 52-week rolling ranking (to 2009) to the current year-to-date ranking. The ATP also organises the ATP World Tour in 32 countries from seven world regions, offering a total prize money of over 150 million US$ across several tournament categories: ATP Challengers, ATP World Tour 250 and 500 series, ATP World Tour Masters 1000, and the ATP World Tour Finals (Association of Tennis Professional [ATP], (2011). The International Tennis Federation (ITF) is the sport's governing body and is also responsible for entry level professional competitions: the Futures tournaments that are held in 60 countries and account for more than 400 weeks of play each year. The pinnacle of this combined, global professional tennis tournament calendar is the four Grand Slam tournaments (Australian Open, Roland Garros, Wimbledon, and the US Open) that provide players the opportunity to compete for over 90 million US$ in prize money (International Tennis Federation [ITF], (2011). Outside of the Grand Slams, ATP events are hosted in countries for a variety of reasons ranging from commercial or economic motives to their proposed positive effect on player development. With regards to this latter point, the inevitable question for policy makers in tennis is whether an increase in the number of professional events will yield a commensurate increase in the number of top ranked players from the host country.

According to De Bosscher et al. (2006) the factors determining top-level success in sport can be classified into three levels: (1) macro-level: the social and cultural context in which people live, (2) meso-level: sports policies and politics that may influence the long-term performance of the sport and (3) micro-level: the individual athletes and their close environment. The tournament structure adopted by a nation can be considered as a meso-level factor and was rated by De Bosscher et al (2006) among the top five most important meso-level factors for international success in tennis. The other important meso-level factors, which also have an indirect impact on the long-term player developmental process, included: professionalism and structural aspects of the federation, departments, and clubs; the coaches' education system; the training facilities for elite tennis; and the overall budget of the federation and budget for elite sport, which influences athlete support and the talent development system.

The link between the staging of international sporting events and the success of the host nations' athletes has been explored in a variety of sporting contexts (Bernard and Busse, 2004; Clarke, 2002; Johnson and Ali, 2002; Kuper and Sterken, 2003), including tennis (Crespo et al., 2003; Reid et al., 2007a). Research has reported positive and significant effects for Olympics' host countries that is based on the total percentage of medals won (Bernard and Busse, 2004; Clarke, 2002), as well as on participation (Johnson and Ali, 2002). Meanwhile Kuper and Sterken (2003) have predicted that countries that will host the next edition of the Olympic Games will perform better than on previous Olympics.

De Bosscher et al. (2003) discussed how professional tennis rankings could be used to define international success in tennis and contextualised this link by proposing that a country's number of ranked players in the top 1000 provides insight into the available resources

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Table 1. Parameters of descriptive statistics for total number of players (PL-n), players per year (PL/y), total number of professional tournaments (TRN-n) and tournaments per year (TRN/y), average annual prize money in US$ per tournament (PM-avg) for each world region in a period P1-P7.

World region	PL-n	PL/y	TRN-n	TRN/y	PM-avg
Africa	366	10.76	22	.65	229,034
Asia	282	8.29	92	2.71	643,120
Central America	141	4.15	17	.50	490,059
Europe	5,141	151.21	764	22.47	880,829
North America	1,964	57.76	385	11.32	997,398
Oceania	721	21.21	125	3.68	866,057
South America	1,223	35.97	36	1,06	338,674

of a federation and the popularity of the sport; while a country's number of top 100 ranked players underlined the efficiency and effectiveness of that nation's tennis policy. Crespo et al. (2003) and Reid et al. (2007a) established positive and significant relationships between the number of ATP and WTA professional tournaments organised by a nation and the performance of that nation's professional male and female players.

This article examines the relationships between the professional men's tennis tournament structure, as defined by the number of ATP tournaments and average annual prize money of these events in the different countries and world regions, and the extent to which these countries and world regions produce top 300 ATP players. These relationships were studied from 1975 to 2008 so as to explore their stability over time.

Methods

Ranking, prize money, and tournament data (for the Grand Slams, ATP World Tour Masters 1000, ATP World Tour 500, and ATP World Tour 250 events) were acquired from the ATP website (ATP, 2011). This information was collected for the period from 1975 to 2008, with the exception of the year 1981, for which no ranking list was available. A customised database running on a MySQL 5.1 community server was developed to store and probe the data. Analyses were conducted with custom-made software in C# programming language, in a MySQL database, and with SPSS 18 software.

First, descriptive statistics for the following variables were calculated for each country: (1) the total number of top 300 players (PL-n; the same player was counted each time he was on the ranking list at the end of a year); (2) the average number of top 300 players per year (PL/y; PL-n divided by the number of years); (3) the total number of tournaments (TRN-n; the same tournament was counted for each year in which it was organised); (4) the average number of tournaments (TRN/y) organised per year; and (5) the tournament's average annual prize money (PM-avg; the average annual prize money per tournament). Second, these data were summed across each of the seven world regions (Africa, Asia, Europe, Central America, North America, South America and Oceania). The total number of players defines (*PL-n*) the tennis success of a world region, while the total number of tournaments (*TRN-n*) and the average annual prize money in a tournament (*PM-avg*) represent indicators of the type of tournament structure.

The *PL-n*:*TRN-n* and *PL-n*:*PM-avg* interrelationships were assessed using Pearson correlation coefficients, where *PL-n*, *TRN-n*, and *PM-avg* for countries were used. An analysis by countries was used due to the larger number of cases compared to the analysis by world regions.

Due to the long time span of the observed period, the analysis included the average number of top 300 players per year, the average number of tournaments per year, and the average annual prize money for the organised tournaments (average values and percentages) for the following time periods: 1975–1979 (*P1*), 1980–1984 (*P2*), 1985–1989 (*P3*), 1990–1994 (*P4*), 1995–1999 (*P5*), 2000–2004 (*P6*), and 2005–2008 (*P7*) and for the countries grouped in seven world regions.

Results

The descriptive data for *PL-n*, the *TRN-n*, and *PM-avg* for each world region during the 1975 – 2008 period are presented in Table 1.

Europe and North America are the first and second highest ranked world regions across all five variables. The *PL-n* during the period from 1975 to 2008 showed differences between the world regions (Table 1). Specifically, most of the players were from countries representing Europe (5,020), with the fewest players from Africa (366). Similarly, the most top 300 players per year come from Europe and North America and the fewest from Central America and Asia. The *TRN-n* from 1975 to 2008 revealed that most of the tournaments were organised in European (53%) and North American (27.9%) countries. In fact, 36 tournaments (2.5%) were held in South America and 22 tournaments (0.1%) in African countries. The variation in the number of male professional events between world regions is depicted in Table 1, with 22.47 tournaments organised in Europe, 11.32 in North America, and 0.5 in Central America. The annual *PM-avg* per world region shows that North America has a larger number of male professional events in higher tournament categories.

Relationships between a country's total number of players and tournaments, and the average annual prize money of tournaments

Table 2 highlights the correlations between *PL-n* and the *TRN-n*, and the *PM-avg* of the countries across the seven time periods. The *PL-n* shared the strongest correlation with the *TRN-n* in *P2* (0.95), and the lowest association in

Table 3. Number of countries which have the ATP player ranked top 300 for all periods.

Period	Africa	Asia	Central America	Europe	North America	Oceania	South America	Total number of countries
P1	4	6	2	21	2	2	10	47
P2	4	4	2	22	2	2	10	46
P3	6	4	5	24	2	2	9	52
P4	8	6	6	28	2	2	9	61
P5	7	7	4	30	2	2	9	61
P6	5	10	3	34	2	2	8	64
P7	4	9	4	34	2	1	9	63

P6 (0.61). The correlations between the *PL-n* and the *PM-avg* displayed similar trends (*P1* - 0.95 and *P6* - 0.57).

Table 2. Correlations between a country's total number of players (PL-n) and: (a) total number of professional tournaments (TRN-n) and (b) average annual prize money in tournaments (PM-avg).

Period	PL-n / TRN-n	PL-n / PM-avg
P1	.93**	.95**
P2	.95**	.93**
P3	.92**	.82**
P4	.80**	.77**
P5	.67**	.65**
P6	.61**	.57*
P7	.64**	.60**

Significant Pearson's correlation: * $p < 0.05$, ** $p < 0.01$.

Changes in the average number and percentage of the total number of players and tournaments, and the average annual prize money of tournaments at the world region level from 1975 to 2008

Table 3 shows the number of countries, belonging to a specific world region that had their players ranked among the ATP top 300. From *P1* to *P7*, the number of countries with top 300 players increased from 47 to 63, while the percentage of professional tournaments organised in specific world regions remained almost unchanged. The number of countries producing top 300 ranked players in Oceania reduced from 2 to 1, with only Australia still producing top 300 ATP ranked players. In Central America and Asia, the growth in the number of countries with top 300 players is clearly evident. In South America, the number of countries with top 300 players declined from 1984 to 2008, while the number of countries producing top 300 players peaked in *P4* in Africa. An increase in the number of top 300 players from different countries was most evident in Europe where 21 nations were represented in *P1* and 34 in *P7*.

Table 4 and Figure 1 show the presence of inter-region differences in *PL/y* throughout the seven time periods. The number of North American players decreased from 98.2 (33.7%) in *P1* to 29.5 (9.8%) in *P7*. In contrast, the number of top 300 ranked European players increased from 100.2 (33.4%) in *P1* to 196 (65.4%) in *P7*. Approximately two thirds of the players in each player group between *P5*-*P7* originate from Europe. The number of players from Asian countries increased from *P5* to 4.8% (14.5 players) in *P7*.

The number of top 300 ranked Central American players was low in all periods observed, ranging from 0.75% (2.3) to 2.35% (7) of the total number of players. Top 300 ranked players from South American countries increased from 9.4% (28.2) in *P1* to 14.6% (43.8) in *P7*, while the opposite trend was observed in top 300 ranked African players (4.9% in *P1* to 1.7% in *P7*) and Oceania players (15% in *P1* to 2.9% in *P7*).

The *TRN/y* and the percentage of professional tournaments in world regions show (Table 5 and Figure 2) that most of the tournaments were organised in European countries (51.5%- 54.4%). In Europe in *P1*, a mean of 11.8 tournaments were organised annually, growing to 30.8 per year in *P7*. In North America the percentage of ATP tournaments decreased from 34.5% in *P1* to 23.4% in *P7*, but in absolute values, the number increased from 7.8 to 14. Similar changes occurred in Oceania, where the average number of tournaments increased from 2.6 to 4, yet their percentage contribution to the calendar dropped from 11.5% to 6.7%. In Asia, 0.2 tournaments (0.9%) per year were organised in *P1* and 6 events (10%) in *P7*. In *P7*, only 3 tournaments per year (5%) were held in South America and 1 tournament (1.7%) in Africa and Central America.

Table 6 and Figure 3 demonstrate the *PM-avg* for the world regions across the different time periods. The analysis of the differences in percentage throughout the observed periods (Figure 3) shows relatively constant shares of annual prize money for each world region, with the exception of Europe (with a slight increase from 49.5% to 51.4%) and North America (with a more notable decrease from 39.2% to 29.6%). The shares of Europe equate to 50%, North America 30%, Oceania 10%, and

Table 4. Average number of top 300 professional players per period for specific world region (the total number of players in a specific period divided by the number of years in a period).

Period	Africa	Asia	Central America	Europe	North America	Oceania	South America
P1	14.8	10	3.4	100.2	98.2	45	28.2
P2	9.4	3.4	2.4	88.2	80.8	23.6	31.8
P3	12.2	4.2	5.6	139.8	78	21.4	38.4
P4	12.2	4.8	7	165	51.6	19.4	38.4
P5	12.8	8.4	4.8	183.6	32.4	18.4	33
P6	7.8	14	3.2	194.6	28.2	9.4	39.8
P7	5	15	2.25	196	29.5	8.75	43.75

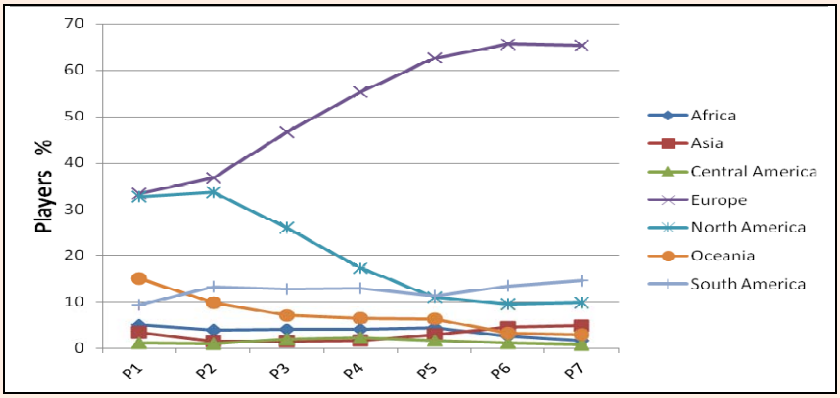

Figure 1. Percentage of top 300 professional players per period for specific world region (the total number of players in a specific period expressed in percentages).

Asia 4%, while shares of other world regions are equal to or smaller than 1%. Table 6 illustrates the growth in the annual value of prize money in professional tournaments across Europe, North America, Oceania, and Asia. The highest increase of prize-money value occurred in the *P3* and *P4* periods.

Discussion

Competition is considered to play an important role in the long-term development of male and female tennis players (Crespo et al., 2001). This assertion was generally supported by the findings of the present study, which revealed correlations between professional tournaments and the number of top ranked ATP players in the periods *P1* to *P7* to be gradually decreasing but still moderate to high. Over the 33 years under investigation, the total number of countries with players ranked among the top 300 increased from 47 to 63, while the number of ATP tournaments and prize money available increased in each world region. In *P7*, 94.6% of the top 300 ranked players represented Europe (65.34%), South America (14.6%), North America (9.8%), and Asia (4.8%). Between 1975 and 2008, the relative share of top ranked players increased the most in Europe (33.4% to 65.4%) and South America (9.4% to 14.6%), and declined the most in North America (32.7% to 9.8%) and Oceania (15% to 2.9%).

The correlation between the total number of players ranked and the total number of tournaments steadily declined from *P1* to *P7*. The correlation between the tennis success, the total number of tournaments and the annual tournament prize money was higher from *P1* to *P3* (from 1975 to 1989), before gradually decreasing in *P7* (from 2005 to 2008). The change observed in the correlation between the total number of top 300 ATP ranked players and the number of professional tournaments from *P1* to *P3* implies that it may have been more important for the development of top tennis players to be able to participate in professional tournaments in their own country or world region early in the professional tennis era. In a similar study, Crespo et al. (2003) reported a correlation of 0.82 between the number of professional tournaments and the number of all players ranked on the ATP list in 2002. A lower correlation (0.74) was noted between the number of professional tournaments and the number of ATP ranked top 200 players. Reid et al. (2007a) found a similar correlation between the number of women's professional events and the total number of professional players ranked on the WTA list (0.60) and the top 200 ranked players (0.60). A well-structured tournament system is important, but it is not the only factor which influences success in male and female professional tennis. The results of the correlations emphasize the importance of a nation's professional tennis tournament as it relates to that nation's number of top ranked tennis players.

An interesting finding was that 53% of the professional events on the current ATP calendar are held in Europe and almost 28% in North America. European players appear to have a substantive advantage. To this end, Crespo et al. (2003) showed that the countries organising more than 20 professional events annually (many of which were European including Spain, France, and Germany) not only had a higher number of ATP ranked players, but were also more successful in the Davis Cup

Table 5. Average number of professional tournaments organised per period for specific world region (the total number of tournaments in a specific period divided by the number of years in a period).

Period	Africa	Asia	Central America	Europe	North America	Oceania	South America
P1	0	.2	.2	11.8	7.8	2.6	0
P2	0	1.0	.2	16.2	9.2	3.8	0
P3	.8	1.2	0	18.0	10.6	3.4	0
P4	.8	2.2	.4	24.6	12.2	4.0	1.0
P5	1.0	4.4	.8	28.2	13.0	4.0	1.2
P6	1.0	4.6	1.0	29.4	13.0	4.0	2.6
P7	1.0	6.o	1.0	30.8	14.0	4.0	3.0

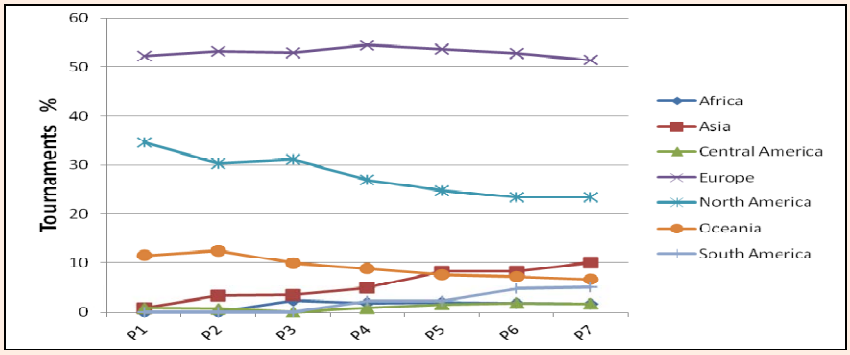

Figure 2. Percentage of professional tournaments organised per period for specific world region (the total number of tournaments in a specific period expressed in percentages).

team competition. Indeed, the benefits associated with organising professional tournaments in one's own country or world region are vast: firstly, it provides players with the opportunity of playing at home. Secondly, organisers can award the most talented young players with "wild cards" and thus help them to win ATP points. Thirdly, media coverage at the tournaments can indirectly influence people's awareness of tennis and its popularity. Finally, most of the professional tournaments are ideally suited for the commercial and promotional activities of tennis federations, companies, and individuals.

It must be noted however, that only the strongest tennis federations have a tiered structure of national, junior, entry level, and professional tournaments. Indeed, Reid et al. (2007b) highlighted a positive and significant relationship between success on ITF boy's junior tournaments and professional rankings to suggest that access to these events might be important to aspiring tennis professionals. Significantly, smaller tennis federations often have neither their own tiered structure nor even any entry level tournaments (Crespo et al., 2003). Further, due to limited financial, human, and infrastructure resources, some national federations do not have their own player development programmes. As such, they merely become one of the observers in player development, together with parents, tennis clubs, and management agencies.

The level of development of national and regional tennis federations is strongly related to the economic development (De Bosscher et al., 2003). An increase in the number of professional tournaments and average prize money in professional events in the period from *P1* to *P7* is noted in all world regions. These investments in the professional tournament structure showed positive results in the number of top 300 professionally ranked players for Europe, Asia, and South America. From *P1* to *P7* absolute annual values of prize money of professional tournaments increased in Europe from 1.5 million US$ to 41.4 million US$, in Asia from 25,000 US$ to 4.3 million US$, and in South America from 0 to 1.2 million US$. For a more detailed analysis of developments in individual world regions it is necessary to use the information on changes in the tournament structure, organization, and activities of tennis associations, private academies, and players in individual countries within that world region.

In Europe, the high number of professional tournaments, two Grand Slam events (French Open and Wimbledon) a strong tennis tradition, a high-level of organisation in clubs and at regional and national levels, a tiered system of national and regional junior tournaments, as well as a high-level of sports science and coach education, are contributing factors to the success of European players (Reid et al., 2007a). A high standard of living, public and private investments into sport, as well as excellent transport connections, could also be interpreted as offering players from developed European countries an advantage over their counterparts from less developed European nations.

Asian players, mostly from India and Japan, were successful on the ATP ranking list in *P1*. Investment in professional events started in *P4*, leading to a 100% increase in the number of elite Asian male tennis players in *P5*. In Asia, the reasons underpinning this progress are related to the growth of private investment in tournaments, together with well organised national federations, clubs, and centres (Japan, Thailand), a growing tennis tradition, and a large population (India). Menon (2004) suggests that Taipei's recent production of top ranked juniors is among the early signs of blossoming and

Table 6. Average prize money (US$) in professional tournaments per period for specific world region (the sum of prize money in a specific period divided by the number of years in a period).

Period	Africa	Asia	Central America	Europe	North America	Oceania	South America
P1	0	25,000	10,000	1,482,130	1,172,762	30,5000	0
P2	0	120,000	60,000	3,307,954	2,277,735	71,4000	0
P3	40,000	305,000	0	7,561,775	4,924,950	838,102	0
P4	123,750	1,578,500	115,000	20,837,471	11,066,650	2,580,312	200,500
P5	206,800	3,102,050	246,000	31,566,165	17,235,930	4,138,978	275,550
P6	347,200	3,284,000	678,400	36,752,008	21,085,883	6,005,232	1,005,000
P7	362,500	4,273,563	696,000	41,354,006	23,794,675	8,837,238	1,196,750

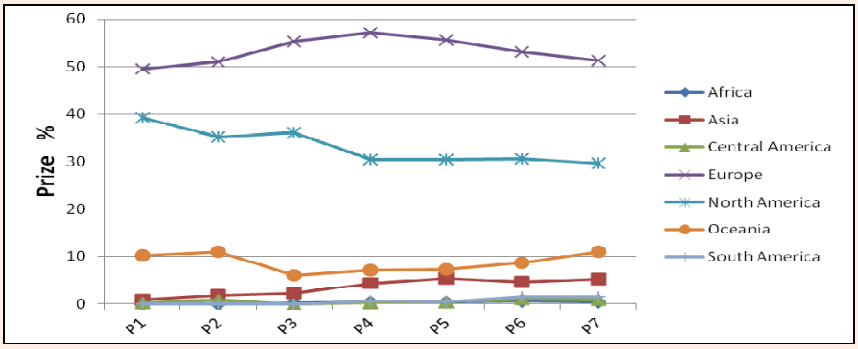

Figure 3. Percentage of annual prize money (US$) in professional tournaments per period for specific world region (the sum of prize money in a specific period expressed in percentages).

sustained player development in the region, while it has been suggested that the education of coaches will play an increasingly important role in the future (Crespo et al., 2001).

The leading countries in male professional tennis in South America include Argentina, Brazil, and Chile; all of which organised their first ATP events in *P4*. Argentina has a rich tradition of developing professional players. Segal (1999) has attributed this success, in part, to popular club competition in Argentina, complemented by the strong tennis tradition, and a determination to travel. It should be noted that two number 1 players: Marcelo Rios (in P5) from Chile and Gustavo Kuerten from Brazil (in P6), increased media attention and popularity of tennis in South America. In the *P6* period, the prize money of ATP tournaments increased fourfold, unfortunately, without positive effect on the success of the players in the region.

North America has an extensive professional tournament structure both in men's and women's tennis. The United States Tennis Association (USTA) has organised the US Open since 1881 and had several number 1 ATP players (i.e. Connors, McEnroe, Sampras, and Agassi). Canada, on the other hand, has experienced comparatively little success in men's tennis. While North American players in *P1* were as successful as their European counterparts, their numbers began to decline through to *P6*. The reasons for the negative trend are complex and might be found in the policies of the tennis federation, as well as the more competitive international tennis landscape. Crespo et al. (2003) reported that the USTA in 1999 clearly outlined the intention to increase the professional tournaments opportunities for its players. The growth was marked and in 2002 there were 20% more men's professional events held in the USA than in any other country. This may relate to the rise in the number of top 300 US professional players that has been noted recently.

Oceania has only organised four ATP events since *P4*; one in New Zealand, one Grand Slam, and two ATP events in Australia. In *P1*, 15% of the top 300 professional tennis players came from Oceania, which contrasts with only 3% in *P7*. Despite the decline in this world region's tennis success, *P5* and *P6* periods were extremely successful due to two top ranked Australian players; Patrick Rafter and Lleyton Hewitt. The geographic isolation of Australia, which can limit its players' access to international competitions (De Bosscher et al., 2003), and the increasing number of sports that are competing for the typical adolescent's interest, are believed to have contributed to the decline in this nation's success (Tennis Australia, 2002, Fèderation Française de Tennis, 2001).

Africa and Central America are the world regions with just one ATP event per year and lower values of prize money. While Central America has never been particularly successful in men's tennis, Africa in *P1* had 5% of the players ranked among the ATP top 300. More recently in *P7*, South Africa, Algeria, Morocco, and Ghana had players ranked among the top 300. South Africa, as the most economically developed country in Africa, has consistently produced tennis players. However, many African nations are still in the early stages of their domestic tennis development (Reid et al, 2007a), partly the result of political and socio-economic factors, which in turn influence tennis success (De Bosscher et al., 2003).

Conclusion

This study investigated the relationships between the number of professional tournament opportunities in men's tennis and the number of top 300 professionally ranked male players within different world regions and countries. Interestingly, correlations between the tournament structure at country level and the number of top 300 ranked professional players reduced from nearly perfect in *P1* – *P2* to very high in *P3* – *P4* to high in *P5* – *P7*. In the periods *P1* to *P3*, the majority of top 300 ranked players originated from European and North American countries. From *P4* to *P7*, the highest increase in the number of countries with top 300 ranked players was observed in Europe, mainly due to the dissolution of the Soviet Union and Yugoslavia.

At present, 53% of all professional events take place in Europe, which intuitively offers an advantage to European players hoping to break into the ATP top 300. Leading tennis countries, such as France, Germany, or Spain, each organise over 20 professional tournaments per year. Countries such as Argentina, the Czech Republic, or Russia organise 10 or fewer professional events, yet still have many top ranked players, which might suggest that players from these countries extensively use the tourna-

ment structures of their neighbouring countries.

The authors believe that the observed correlations are likely to plateau or continue to weaken over time as other factors like a high level of coaches' education; more sophisticated talent identification systems; flexible and individualised player development pathways; improving sport and tennis infrastructure; and an interdisciplinary approach to athlete support exert growing influence on success of the professional players.

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Key points

- This paper observes relation changes between the total number of players, total number of ATP tournaments and total annual prize money in particular continents from 1975 to 2008.
- The correlation between the tennis success, total number of tournaments and total annual prize money in tournaments was highest from 1975 to 1989 and was gradually decreasing from 1990 to 2008.
- The leading tennis countries organise over 20 ATP tournaments and entry professional tournaments per year. Tennis less developed countries very often is using the competition systems of the most successful tennis countries.
- Indications are that tennis will continue to become increasingly global and that this trend may be unlikely to reverse.

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