

MANAGEMENT & COACHING

LEANDRO CARLOS MAZZEI^{1(BDG)}, JULIA BARREIRA^{2(C)}, GUILHERME KIOSHI YAMANAKA^{3(E)},
VEERLE DE BOSSCHER^{4(F)}, MARIA TEREZA SILVEIRA BOHME^{5(A)}

1 ORCID: 0000-0002-0788-4668

Sport Sciences Research Centre, School of Applied Sciences, University of Campinas (Brazil)

Address: Rua Pedro Zaccaria, 1300, room LA-525D, Limeira (SP), Brazil, ZIP: 13484-350. Phone number: +55 19 3701-6706 / 6728 / 6729. Fax number: +55 19 3701-6756.

2 ORCID: 0000-0002-8065-4359

Faculty of Physical Education, University of Campinas (Brazil)

Address: Av. Erico Verissimo, 701, Cidade Universitaria "Zeferino Vaz", Campinas (SP), Brazil, ZIP: 13.083-851. Phone number: +55 19 3701-6706 / 6728 / 6729. Fax number: +55 19 3701-6756.

e-mails: jubarreira2@hotmail.com

3 ORCID: 0000-0001-8529-6522

Faculty of Physical Education, University of Campinas (Brazil)

Address: Av. Erico Verissimo, 701, Cidade Universitaria "Zeferino Vaz", Campinas (SP), Brazil, ZIP: 13.083-851. Phone number: +55 19 3701-6706 / 6728 / 6729. Fax number: +55 19 3701-6756.

e-mails: guilhermek.yamanaka@gmail.com

4 ORCID: 0000-0002-6516-2030

Department of Sports and Movement Sciences (Faculty of Physical Education) of the Vrije Universiteit Brussel, VUB (Belgium)

Sport and Society Research Group (SASO). Address: Pleinlaan 2, 1050, Brussels, Belgium.

e-mail: Veerle.De.Bosscher@vub.be

5 ORCID: 0000-0003-0932-1479

Escola de Educação Física e Esporte da Universidade de Sao Paulo (Brazil)

Address: Avenida Mello Moraes, 65, São Paulo (SP), Brasil, ZIP: 05508-900. Phone number: +55 11 3091-2135.

e-mail: terbohme@usp.br

Corresponding author: Leandro Carlos Mazzei, Rua Pedro Zaccaria, 1300, room LA-525D, Limeira (SP), Brazil, ZIP: 13484-350,

e-mail: lemazzei@unicamp.br

Socioeconomic variables and historical performance, the influences in the Olympic success at a sport-specific level, the case of judo

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Abstract

Background. The influence of socioeconomic variables on sporting success has been frequently presented in the literature. However, most of the studies on this topic have linked all sports rather than the specificities of individual sports.

Problem and Aim. Analyzing the influence of the socioeconomic and historical results of past World Championships and Olympic Games countries' performance at the Olympic Games, based specifically on judo.

Methods. The sample consists of the results (medals and 'points' - dependent variables) of 157 countries that participated in Olympic judo events/competitions between 1992 and 2016. The socioeconomic and data relating to historical past performance at World Championships and Olympic Games were used as independent variables. A country's point at the Olympic Games was modeled for data analysis, employing a random effects model and data as a panel. The software MATLAB® 2010 and the level of significance of 0.05 were also used.

Results. Variables such as Religion, Pre/Post Host (only for medals), Host, WC1, WC3 and WC4 were positive and significant for performance in the Olympic judo events between 1992 and 2016.

Conclusion. In contrast to studies that considered the results of sports in general the specificities and characteristics existing in each sport (such as judo) can inhibit the influence of socioeconomic variables on the performance of countries at the Olympic Games. Cultural and past results variables can be more influential.

Introduction

Since the 1950s, a significant number of studies have investigated the relationship between socioeconomic variables and sporting success, especially with regard to the performance of countries at the Olympic Games [Santos, Mazzei 2020; Vagenas, Vlachokyriakou 2012]. Studies on this topic assume that the social and cultural context in which people live have factors / (independent) variables that influence international sporting success such as the size of the population, the Gross National Product (per capita), religion, urbanization degree, land, time in the educational system, political system, education and military expenditures, number of elite sports facilities, climate and host nation effect [De Bosscher *et al.* 2006; Forrest *et al.* 2017]. Information about these variables is readily available in the public domain and this is probably why there are so many studies in this field. Therefore, studies used from simple correlations, (simple or multiple) regression analysis, tobit models, Data Envelopment Analysis (DEA), among others, using a series of possibilities regarding dependent and independent variables [Forrest *et al.* 2017]. Dependent variables are generally related to gold, silver, bronze medals, total medals, number of athletes between the first and the eighth position, the number of points (each medal or each position won by an athlete corresponds to a certain score, giving weight to the results) and market share (calculating how many points were achieved in proportion to the total points available) [De Bosscher *et al.* 2015; Vagenas, Vlachokyriakou 2012].

Despite the decrease in the importance of the socioeconomic variables, they can still determine about 50% of the success achieved by the countries at the Olympic Games and / or in major international sports events [De Bosscher *et al.* 2015; Forrest *et al.* 2017]. Highlighting the influence of the population size and Gross Domestic Product per capita (GDP per capita) [Bernard, Busse 2004; Hoffmann *et al.* 2004; Johnson, Ali 2004; Wu *et al.* 2010]. Fewer consensuses exist on the influence of other factors, such as land, religion, and the political system (between more or less centralized), the degree of urbanization, and other macro-level factors [De Bosscher *et al.* 2006].

For De Bosscher and colleagues [2015], it is intuitive that the size of population influences the international sporting success since there is a large population size, there is a larger pool from which talent can be recruited, and there are greater opportunities to organize training and competitions. On the GDP per capita, the authors also present that there are reasonable explanations for the fact that wealthy countries perform better than poorer countries. Richer countries can invest more in sport and elite sport, and individuals may participate in a broader number of sports and have better living conditions. In summary, in the elite sport context, there are few win-

ners and many losers [Digel 2013], and the medal tables in Olympic Games were dominated by relatively rich countries, medals won are far from equally distributed across nations [Forrest *et al.* 2017].

However, taking into account just the population size or wealth is rudimentary in two respects: it disregards other potentially important determinants, and it assumes an implicit linear relationship between these two factors and success [De Bosscher *et al.* 2015]. As an example, how to explain the performance of countries that have a smaller population as well as the values for wealth compared to other countries, such as Kenya, Jamaica, and Cuba, among others, or the success achieved by some countries in some specific sports?

After all, almost all studies on this topic address the results achieved considering all the sports events in the respective editions of the Olympic Games [Forrest *et al.* 2017; Rathke, Woitek 2008; Waguespack, Salomon 2015], leaving room for the application of statistical methods on the relationship between socioeconomic variables and Olympic success considering a sport-specific level.

Despite some common characteristics, each sport is different by nature [Breuer *et al.* 2011], and there are countries that have a competitive advantage in individual sports, and others in collective sports, or in combat sports or even in some disciplines present in sports competitions during the Olympic Games (e.g. sprint or long distance events) [Sport Industry Research Centre - SIRC 2002]. In each sport, there are numerous differences, ranging from cultural, environmental, historical and even structural situations [Brouwers *et al.* 2015; Sotiriadou *et al.* 2013; Truyens *et al.* 2014]. Therefore, the socioeconomic variables already identified in the performance in general also significantly influence the Olympic performance at sport-specific levels?

A few studies have tried to answer this question. Forrest *et al.* [2017] concluded that the socioeconomic variables (specifically population size, GDP per capita, host nation effect and planned economies or centralized political systems) may significantly influence (more or less) the Olympic performance at the level of an individual sport. The authors analyzed this influence in 15 sports (Athletics, Boxing, Canoeing/Kayaking, Cycling, Diving, Equestrian, Fencing, Gymnastics, Judo, Rowing, Sailing, Shooting, Swimming, Weightlifting, and Wrestling) and despite the results of a more general and macro approach, the results suggest that the sports such as wrestling, boxing, judo, weightlifting and many athletic events are more 'democratic' (in terms of which countries have a realistic chance of medals in the Olympic Games), presenting a lesser need of investment (since these sports generally can be practiced in multi-purpose sports halls or may be practiced in parks and recreational areas and even on public streets), and bringing more possibilities for achievements of athletes from different countries. The authors also suggest a detailed sport-by-sport historical

analysis [Forrest *et al.* 2017].

In this study, the proposal is to investigate more deeply the influence of socioeconomic variables (and others) in judo sport. Judo has a millenary tradition and culture, but it is also a well-established Olympic combat sport, practiced by millions of people around the world [Gutierrez-Garcia *et al.* 2018; Niehaus 2006; Peset *et al.* 2013]. In 2016, 56 Olympic medals were awarded in this sport, being the fourth sport that offers the greatest number of medals, behind athletics, swimming, and wrestling. In the upcoming Tokyo Olympics, now in 2021, there will be 60 medals available in judo, with the inclusion of team competition. Although a country can only win up to 14 medals (15 in 2021), many nations consider judo an attractive investment target in their elite sports policies.

Therefore, this article aims to analyze the influence of socioeconomic variables on countries' performance at the Olympic Games, but considering the results in one sport, in this case, judo. As an innovation, this article proposes to add to the analysis more independent variables, specifically on the historical results of the World Championships and Olympic Games of the analyzed sport. To achieve this objective, statistical modeling was used, considering the performance of the countries in the events/competitions of judo between 1992 and 2016. More details and information will be presented below.

Method

The sample consisted of the 157 countries that participate at least in one Olympic judo event between 1992 (when the weight categories were finally stabilized, and women were included in the Olympic judo) and 2016 (the last current edition of the Olympic Games). An event, by The International Olympic Committee (IOC) definition, is a competition that leads to the award of medals [The Olympic Museum Lausanne 2013]. For the analysis, a panel was made considering the data from seven different periods: 1. 1989 to 1992, 2. 1993 to 1996, 3. 1997 to 2000, 4. 2001 to 2004, 5. 2005 to 2008, 6. 2009 to 2012 and 7. 2013 to 2016. Therefore, the final data contained 1099 dependent variables for each independent variable selected and presented below.

On dependent variables, all countries were analyzed considering their performance at the Olympic Games in 1992, 1996, 2000, 2004, 2008, 2012 and 2016. Olympic performance was assessed separately by the total number of medals and 'points' won by each country. The points were determined on a scoring system employed by other similar studies [De Bosscher *et al.* 2008; Condon *et al.* 1999] and the IJF World Ranking System 2009-2016 [Franchini, Julio 2015; Lascau, Rosu 2013]. In this scoring system, 10 points were assigned for each gold medal, 6 points for silver, 4 points for bronze,

2 points for the fifth place, and 1.6 points for the seventh place. With the points system, it is possible to measure how and what countries working to have athletes in the top eight in competitions. A total of 3057.6 points were shared among 98 gold, 98 silver, 196 bronze medals and 196 5th and 196 7th places. All places and tallies per country were collected from sources available from the Infostrada Sports Group B.V. [2013], International Judo Federation and International Olympic Committee.

Following the studies in this issue, as independent variables were decided to use data such as Population size, Land (km²), GDP PPP (Gross Domestic Product based on purchasing power parity), GDP/CAP PPP (Gross Domestic Product per capita based on purchasing power parity), These four independent variables were transformed into logarithms to account for non-linear effects. Urban population (% of total), Population density (% of total) and HDI were also used.

Other independent variables (but as dummies) were Religion, Pre/Post Host nation, Host Nation and planned economies/centralized political systems. Except for the Host nation, all data is available in World Bank and United Nations sources, which were collected for each participant country. It is important to mention that an average of each variable was used, corresponding to the previous four years of each Olympic Games addressed (1992 to 2016).

In addition to these socioeconomic variables, data relating to the historical past of sporting performance, specifically the medals achieved by each country in the Adults World Championships and Olympic Games, were also used. These data were placed in a dichotomous way, divided between medals in World Championships and medals in Olympic Games from past events, such as the 1950s one period, the 1960s second period, the 1970s third period and 1980s fourth period. These events from the past and the respective medals won were considered until before the 1990s, since the data for the dependent variables were established from 1992 onwards, with the results of the Barcelona Olympic Games. For athletes who belonged to a country that existed in the past, but that does not exist nowadays due to historical and geopolitical developments, the birthplace of the medalist athlete was raised and this result was attributed to the current nation or corresponding country. As an example, medals from Georgian athletes, who represented the former Soviet Union between 1950 and 1992, were attributed to today's Georgia. For these data, information was collected from sources available by the Infostrada Sports Group B.V. [2013].

For data analysis, Bernard and Busse [2004] study was followed as a parameter. Therefore, it was modelled a country's medals and points at the Olympic Games employing a random effects model. Recent information from the Forrest *et al.* [2017] study was also used, which recommended treating the data as a panel, rather

than pooling the observations, analyzing medals and points share across countries at the Olympic Games in longitudinal data. Furthermore, the authors suggest the “strong significance of ρ , the proportional contribution of the panel-level component to the total variance, validates the employment of a random effects estimator”. Our model was therefore:

$$Medals_{it} = f(\text{LogPop}_{it}, \text{LogLand}_{it}, \text{LogGDP}_{it}, \text{LogGDPCAP}_{it}, \text{UrbanPop}_{it}, \text{POPDensity}_{it}, \text{HDI}_{it}, \text{Religion}_{it}, \text{PrePosHost}_{it}, \text{Host}_{it}, \text{Political systems}_{it}, \text{Religion}_{it}, \text{WC1}_{it}, \text{WC2}_{it}, \text{WC3}_{it}, \text{WC4}_{it}, \text{OG1}_{it}, \text{OG2}_{it}, \text{OG3}_{it})$$

and

$$Points_{it} = f(\text{LogPop}_{it}, \text{LogLand}_{it}, \text{LogGDP}_{it}, \text{LogGDPCAP}_{it}, \text{UrbanPop}_{it}, \text{POPDensity}_{it}, \text{HDI}_{it}, \text{Religion}_{it}, \text{PrePosHost}_{it}, \text{Host}_{it}, \text{Political systems}_{it}, \text{Religion}_{it}, \text{WC1}_{it}, \text{WC2}_{it}, \text{WC3}_{it}, \text{WC4}_{it}, \text{OG1}_{it}, \text{OG2}_{it}, \text{OG3}_{it})$$

Subscripts i and t index countries and time respectively. All statistical analyzes were performed using the software MATLAB® 2010 (The MathWorks Inc., Massachusetts, EUA) and the level of significance was 0.05.

Results

Table 1 is presented the model estimating for predicting medals. The coefficient estimates on Religion, Pre/Post Host, Host, WC1, WC3 and WC4 were positive and significant.

Table 1. Results from a random effects panel model for medals.

| Parameter | Estimate | Std. Error | df | t-value | p-value |
|-------------------|----------|------------|---------|---------|---------|
| Intercept | -0.542 | 0.572 | 348.669 | -0.947 | 0.344 |
| LnPop | 0.054 | 0.053 | 716.504 | 1.015 | 0.310 |
| LnLand | -0.020 | 0.039 | 204.439 | -0.511 | 0.610 |
| LnGDP | -0.013 | 0.045 | 768.001 | -0.288 | 0.774 |
| LnGDPCAP | 0.046 | 0.056 | 948.970 | 0.825 | 0.410 |
| UrbanPop | 0.005 | 0.003 | 259.294 | 1.818 | 0.070 |
| PopDensity | <0.001 | <0.001 | 206.625 | -1.020 | 0.309 |
| HDI | -0.845 | 0.549 | 504.626 | -1.539 | 0.124 |
| Religion | 0.198 | 0.083 | 149.266 | 2.373 | 0.019 |
| PrePosHost | 0.591 | 0.175 | 877.853 | 3.381 | 0.001 |
| Host | 0.996 | 0.234 | 860.789 | 4.260 | <0.001 |
| Political systems | 0.119 | 0.113 | 157.333 | 1.049 | 0.296 |
| WC1 | 3.338 | 0.396 | 138.244 | 8.430 | <0.001 |
| WC2 | 0.252 | 0.369 | 137.854 | 0.681 | 0.497 |
| WC3 | 0.919 | 0.322 | 146.012 | 2.851 | 0.005 |
| WC4 | 0.451 | 0.182 | 150.790 | 2.484 | 0.014 |
| OG1 | 0.275 | 0.330 | 139.521 | 0.833 | 0.406 |
| OG2 | 0.478 | 0.310 | 147.888 | 1.541 | 0.125 |
| OG3 | -0.154 | 0.225 | 139.479 | -0.687 | 0.493 |

Note: WC1 = Medals in World Championships of 1950s, WC2 = Medals in World Championships of 1960s, WC3 = Medals in World Championships of 1970s, WC4 = Medals in World Championships of 1980s, OG1 = Medals at the 1964 Olympic Games, OG2 = Medals in the 1972 and 1976 Olympic Games, OG3 = Medals in the 1980, 1984 and 1988 Olympic Games.

Table 2. is presented the model estimating for predicting points. The coefficient estimates on Religion, Host, WC1, WC3 and WC4 were positive and significant.

Table 2. Results from a random effects panel model for points.

| Parameter | Estimate | Std. Error | df | t-value | p-value |
|-------------------|----------|------------|---------|---------|---------|
| Intercept | -5.912 | 3.906 | 359.766 | -1.513 | 0.131 |
| LnPop | 0.297 | 0.345 | 782.797 | 0.863 | 0.389 |
| LnLand | -0.121 | 0.273 | 220.248 | -0.444 | 0.657 |
| LnGDP | 0.047 | 0.293 | 836.972 | 0.162 | 0.871 |
| LnGDPCAP | 0.389 | 0.357 | 951.332 | 1.091 | 0.276 |
| UrbanPop | 0.026 | 0.021 | 284.086 | 1.243 | 0.215 |
| PopDensity | -0.001 | 0.001 | 231.399 | -0.934 | 0.352 |
| HDI | -6.009 | 3.654 | 583.651 | -1.644 | 0.101 |
| Religion | 1.389 | 0.603 | 150.465 | 2.304 | 0.023 |
| PrePosHost | 1.809 | 1.088 | 862.942 | 1.662 | 0.097 |
| Host | 8.755 | 1.453 | 849.517 | 6.027 | <0.001 |
| Political systems | 0.761 | 0.814 | 159.967 | 0.936 | 0.351 |
| WC1 | 22.820 | 2.882 | 138.359 | 7.918 | <0.001 |
| WC2 | 2.109 | 2.689 | 137.862 | 0.784 | 0.434 |
| WC3 | 6.408 | 2.337 | 143.738 | 2.742 | 0.007 |
| WC4 | 4.088 | 1.314 | 149.542 | 3.11 | 0.002 |
| OG1 | 1.941 | 2.402 | 139.454 | 0.808 | 0.421 |
| OG2 | 3.765 | 2.245 | 145.716 | 1.677 | 0.096 |
| OG3 | -1.307 | 1.635 | 139.024 | -0.8 | 0.425 |

Note: WC1 = Medals in World Championships of 1950s, WC2 = Medals in World Championships of 1960s, WC3 = Medals in World Championships of 1970s, WC4 = Medals in World Championships of 1980s, OG1 = Medals at the 1964 Olympic Games, OG2 = Medals in the 1972 and 1976 Olympic Games, OG3 = Medals in the 1980, 1984 and 1988 Olympic Games.

Discussion

The aim of this study was to analyze the influence of socioeconomic variables on countries’ performance in judo events/competitions in the Olympic Games. In an innovative way, the influences of results of the World Championships and Olympic Games before the period considered (1992-2016) were also analyzed.

Unlike most studies that considered the results of all sports in their analysis, no statistical influences of socioeconomic variables were identified in the results of judo events at the Olympic Games in the editions held from 1992 to 2016. This finding is important, especially regarding the influence of the population, GDP or GDP per capita. Size of population, wealth and distribution of it in a country are generally identified as the main influencers in countries’ performance in all sports when considering the Olympic Games [Bernard, Busse 2004; De Bosscher *et al.* 2015; Forrest *et al.* 2017; Hoffmann *et al.* 2004; Johnson, Ali 2004; Wu *et al.* 2010]. However, as it was identified, these variables seem to have no or lower influence on the Olympic results at a sport-specific level, such as in judo.

In fact, such results confirm some studies that sought to analyze the influences of socioeconomic variables considering the Olympic results at a sport-specific

level. There are 'democratic' sports (which offer a realistic chance of Olympic medals for countries), which require less investment (have little need of investment in specific capital to be practiced compared to other sports) and bring more possibilities for achievements of athletes from different countries [Forrest *et al.*, 2017]. And this seems to be the case of judo. It is possible to identify in the judo Olympic results (between 1992-2016), medalists from countries / nations like Algeria, Argentina, Colombia, Cuba, Kosovo, Latvia, Portugal, North Korea, Slovenia, Tajikistan among other examples. Such findings are positive for the principles of the Olympic Movement [Thomas 2001], for the universalization of judo and for athletes from countries and nations that do not have a larger population and considerable values in terms of GDP (among other socioeconomic variables) compared to others. However, even this result should be considered with caution. Since 2009, to qualify for the Olympic Games, the International Judo Federation (IJF) implemented a world ranking system, where athletes compete for 'points' in a significant number of international events around the world and which are accredited by the IJF. To attain a higher world ranking, judo athletes have their own multidisciplinary teams for their preparation and receive support from governments, national federations, sponsors and other stakeholders [Breviglieri *et al.* 2018; Julio *et al.* 2013]. Thereby, the current context of international elite judo requires resources, favoring athletes from richer countries.

Nevertheless, if socioeconomic variables do not have a higher influence on the success achieved by the countries in judo events at the Olympic Games, other variables can be considered. As already identified by different authors, including at a sport-specific level, specific characteristics related to sport management factors may be more important than socioeconomic variables in the development and pursuit of international sporting success [Andersen, Ronglan 2012; De Bosscher *et al.* 2015; Brouwers *et al.* 2015; Mazzei *et al.* 2020; Phillips, Newland 2014; Sotiriadou *et al.* 2013; Truyens *et al.* 2014; Winand *et al.* 2010]. Moreover, it is emphasized that issues related to the management of the sport and judo or until combat sports are uncommon [Franchini *et al.* 2018; Peset *et al.* 2013].

Despite the absence of most of the socioeconomic variables used, some variables had identified statistical significance, both for medals and points performance. These were the cases of the Religion of each country, the fact that an Olympic Games will be held in the country (Pre / Post Host and Host) and the existence of results in past sporting events (World Championships of 1950s, World Championships of 1970s and World Championships of 1980s).

Regarding the variable Religion being significant in the performance of countries in judo events at the Olympic Games, the explanation may be related to sports

for women and the cultural aspects of each country. According to Giddens [2001], Religion is a cultural aspect and varies from culture to culture, encompassing values from certain regions and nations. Most cultures on the planet were born and raised with their respective religions, which confirms that religion is intrinsically linked to the standards and moral values of nations and their population. Because most religions preach loyalty to it, it indirectly preaches loyalty to the values and moral standards of a certain society, in addition to providing coercive mechanisms and lettering for individuals who deviate from social standards, and rewards for individuals who act in accordance with socio-cultural paradigms, mechanisms that also contribute to the maintenance of social order [Giddens 2001]. Therefore, from country to country, their religious and cultural principles will allow greater or lesser access to women's sports practice, especially when we are considering a combat sport like judo. For example, it has been suggested in the literature that the different view on the roles of men and women in family life is one of the factors restricting young Muslim women's participation in sports [Strandbu *et al.* 2019].

The insertion of women in the practice of judo has been present since its beginnings, however, competitions for women only developed in the 1980s [Ueda 2017]. From the inclusion of women in the Olympic judo competitions in 1992 in Barcelona, countries that have and developed quality female athletes probably have a greater chance of success in judo at the Olympic Games. As stated by Zheng *et al.* [2019], the development of women's sports can be a competitive advantage for countries seeking international sporting success, including specifically in the Olympic Games. Future studies may be able to carry out statistical analysis separately considering male and female performance.

On the influence of variables Pre / Post Host (only for medals performance) and Host (both for medals and points performance), the 'host nation effect' has been widely confirmed in the literature. Hosting the Olympic Games generally provides an enhance strategic investment in elite sport; the right to contest more events, which increases the opportunity to win more medals; familiarity with venues and facilities; home crowd influences on both players and officials; positive effects on subjectively scored events; and travel/time difference benefits, in particular in relation to the training environment of the home athletes [Grix, Carmichael 2012; Mazzei *et al.* 2020; Pappous, Hayday 2016; Shibli *et al.* 2013]. In judo, such an influence seems to be positive for host nations also in pre-games and in post-games. The announcement about the host of the Olympic Games is made seven or eight years before, which allows the investment results to appear in an edition before the Games, while the influence on subsequent games appears to be a residual effect of the investments made for the performance in the games that the country hosted [Shibli *et al.* 2013].

Finally, on the results related to historical sporting events, interesting considerations can be made and in an unprecedented way could be confirmed. These results possibly confirm the 'virtuous-cycle-of-sport' the virtual hypothesis in judo. The 'virtuous-cycle-of-sport' concept is the existence of role models that inspire individuals to dedicate themselves to elite sports. Idols from the past inspire later generations and this cycle contributes to the international sporting performance tradition in a sport and in a country [Andersen, Ronglan 2012; Van Bottenburg 2002; Grix, Carmichael 2012].^[1]

Thereby, countries that had the results in the sports events cited below seem to have taken advantage of their idols to maintain investments and the development of judo in their countries, in addition to the existence of individuals who were possibly inspired by athletes of the past. The events and possible explanations for having been identified as statically significant in the results were: the first judo World Championships (only for men) in 1956 and 1958; in 1971, 1973, 1975, 1979 judo World Championships (when the number of seven weight categories existing until today was established and the first official Olympic judo competitions were held in 1972); and in the judo World Championships of 1980s (as already mentioned, the decade of the first world judo championships for women). Interestingly, athletes who won a medal in the statistically identified moments managed to stay on top for more than one Olympic cycle, probably eight or even ten years (mostly women) ranking their countries in both World Championships and Olympic Games. After all, there were not many international championships in the sport and the winning athletes became true legends, such as Anton Geesink, Willem Ruska and Irene De Kok (Netherlands), Chiaki Ishii (Brazil), Jean-Luc Rouge (France), Ezio Gamba and Emanuela Pierantozzi (Italy), Neil Adams and Karen Briggs (Great Britain), Robert Van De Walle and Ingrid Berghmans (Belgium), Vladimir Nevzerov (Russia), Estela Rodríguez Villanueva (Cuba), Gao Fenglian (China), among many other athletes who started their idol history in the 1950s, 1970s (men) and 1980s (women). Currently, world championships take place year by year, with the exception of the Olympic Games years, and there is a greater alternation of athletes at the top, or a greater competitiveness of athletes seeking international success in the current elite judo [Franchini *et al.* 2020].

This influence of the results of the past on the results achieved by the countries in the judo competitions in the Olympic Games from 1992 to 2016 can be considered the main finding of this study. Unfortunately, access to historical data, complete results, names of athletes, their birth places among others are not information that is easily available. That requires immeasurable time to be identified, organized and double-checked. However, in agreement with other authors, it is a fact that the presence of idols will be enhanced with long-term man-

agement actions, although this tradition of results and its influence on the existence of future idols is difficult to measure [Grix, Carmichael 2012; Pappous, Hayday 2016; Syed 2012].

Therefore, each country can develop their role models, by investing in the development of judo athletes, and planning sustainable and long-term performances. Positive milestones and stories diffuse knowledge that is generally adopted by new generations and is legitimized as time passes by [Hofstede 1991; Schein 1984]. Another important strategic and managerial action for countries that want to have international success in judo is the development of more efficient systems. Each country generally has a sports system in which the elite sports policies are implemented, athletes are developed, and multiple elements are managed by sport organisations to achieve international elite sporting success [Mazzei *et al.* 2020]. Therefore, countries that have established a system, distributing training centers across the country, offering judo to the population and the opportunity for athletes the development in the elite judo with good coaches [such as in France 2021], probably will be able to establish themselves in the international judo scenario, including a great Olympic performance. Obviously, this possibility must be analyzed relatively, according to the realities and the wealth and considerable population size, or taking into account the cultural context and history of each country.

Conclusions

In conclusion, this study's findings may open new possibilities for research dedicated to the investigation of the relationship between socioeconomic variables and the performance in the Olympic Games, especially considering the sport-specific level. In contrast to studies that considered the results of sports in general at the Olympic Games, where the influences of socioeconomic variables were identified, the specificities and characteristics existing in each sport can inhibit the influence of some socioeconomic variables on the performance of countries at the Olympic Games.

Even though in the elite sport context there are few winners and many losers and the medal table and the best eight athletes in Olympic Games were dominated by few countries, in sports like judo there are possibilities for success for different countries. This does not mean that any country can be a performance leader in judo competitions at the Olympic Games, and also does not mean that for the achievement of good performance (including winning medals), athletes must necessarily be from a country that has higher socioeconomics rates. Considering the existing cultural characteristics, each country will be able to develop specific plans in search of considerable performances in competitions of a sport like judo that seems to be more democratic than others

at the Olympic Games. Including, the existence of elite women athletes can be different for the country that seeks Olympic success in judo.

This study was based on the literature and choices were made regarding its statistical options, which subsequently provided its presented results. However, it is important to mention that it was observed that different studies use different statistical options, which obviously can cause divergences in the respective results. Further research can be dedicated to the use of other statistical methods or models related to the dependent and independent variables used, in addition to analyzing the performance of genders separately. The authors are available to share their databases and to be partners for future productions that consider future time periods and the next Olympic Games.

List of the 157 countries that participated in at least in one Olympic judo event between 1992 and 2016: Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Barbados, Belarus, Belgium, Belize, Benin, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Chinese Taipei, Colombia, Congo, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Djibouti, Dominican Republic, DPR Korea, DR Congo, Ecuador, Egypt, El Salvador, Equatorial Guinea, Estonia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Great Britain, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, China, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Japan, Jordan, Kazakhstan, Kenya, Korea, Kosovo, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Mali, Malta, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Romania, Russia, Rwanda, Samoa, Saudi Arabia, Senegal, Serbia, Seychelles, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Sudam, Surinam, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad & Tobago, Tunisia, Turkey, Turkmenistan, Ukraine, United Arab Emirates, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

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Zmienne społeczno-ekonomiczne a wyniki historyczne, wpływy na sukcesy olimpijskie na poziomie konkretnego sportu, przypadek judo

Słowa kluczowe: Igrzyska Olimpijskie, medale, wyniki, judo

Streszczenie

Tło. Wpływ zmiennych socjo-ekonomicznych w sukcesie sportowym był często prezentowany w literaturze. Jednak większość opracowań na ten temat łączyła je wszystkie z pominięciem specyfiki poszczególnych dyscyplin sportowych.

Problem i cel. Przeanalizowanie wpływu społeczno-ekonomicznych i historycznych wyników minionych Mistrzostw

Świata i Igrzysk Olimpijskich wybranych krajów na występy na Igrzyskach Olimpijskich, ale z uwzględnieniem danego poziomu sportowego w judo.

Metody. Próba składała się z wyników (medale i punkty – zmienne zależne) 157 krajów, które uczestniczyły w imprezach/konkursach olimpijskich w judo w latach 1992–2016. Jako zmienne niezależne wykorzystano dane socjo-ekonomiczne oraz dane dotyczące wyników z przeszłości na Mistrzostwach Świata i Igrzyskach Olimpijskich. Do analizy danych modelowano punkt kraju na Igrzyskach Olimpijskich stosując model efektów losowych i dane jako panel. Do analizy wykorzystano oprogramowanie MATLAB® 2010 oraz poziom istotności 0,05. Wyniki. Zmienne takie jak Religia, Gospodarz wydarzenia sportowego przed/po (tylko dla medali), WC1, WC3 i WC4 były pozytywne i istotne dla wyników w olimpijskich zawodach judo w latach 1992–2016.

Wnioski. W przeciwieństwie do badań, które rozpatrywały wyniki sportów w ogóle, specyfika i cechy istniejące w każdym sporcie (takim jak judo) mogą hamować wpływ zmiennych socjoekonomicznych na wyniki krajów na igrzyskach olimpijskich. Większy wpływ mogą mieć zmienne kulturowe i zmienne dotyczące wyników z przeszłości.