

Effect of the affluence of society on the development of sport

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Abstract:

In this article we try to answer the question whether there is a relationship between the development of sport and the affluence of Polish society. Previous research (Müller-Frączek, 2020), which we conducted at the NUTS 2 level, did not show a strong relationship between the two phenomena, but showed an interesting trend in time. In this study, we considered the same period 2012-2018, but smaller spatial units (NUTS 4 regions called poviats). They were more homogeneous from the point of view of sport development. Due to the lack of other data, we focused on institutional sports related to sports clubs. We selected four indicators representing different aspects of sport. We used them to build the composite indicator (or synthetic variable). Thus, we achieved an intermediate goal, we constructed a synthetic measure of the institutional sport development in Polish poviats. This measure may be useful in issues other than those discussed in this article. We decided that all considered aspects of sport development are equally important, therefore we chose the Mazziotto-Pareto Index to aggregate indicators. There is a penalty for variable imbalance in this method. On the other hand, we represented the affluence of society with only one indicator, i.e. own revenue of NUTS 5 budgets per capita aggregated to the poviat level. The analysis did not show a correlation between the synthetic variable representing the development of sport and the indicator representing the affluence of society. Moreover, the trend over time at the NUTS 4 level was different than in the study carried out with the same method at the NUTS 2 level. After confronting the results with the previous ones, we rejected the initial hypothesis that the increase in the affluence of Polish society influences the development of institutional sport.

Key Words: sport development, polish sports clubs, composite indicator, Mazziotta-Pareto Index, MPI

Introduction

Nowadays we believe that physical education has a positive impact on the health condition of the society. There are many scientific studies on this subject (e.g. De Souza, De Carvalho, & Ferreira, 2018, Gaetano, 2016, Pabianek, Żołądkiewicz & Brzezińska, 2020, Piotrowska & Pabianek, 2019). As sport is more and more appreciated, we seek determinants of its development. From this point of view, it is interesting to know whether one of such determinants is the affluence of society. This article is devoted to this issue.

Research on the relationship between the development of sport (or more broadly physical education) and the affluence of society is not clear. For example, Metelski (2019) noted that in EU countries the richer a household is, the more physically active its members are. On the other hand, Kozma, Bács and Perényi (2015) showed that in Hungary, regions with low socio-economic status can present high sport participation. In turn, Central Statistical Office (CSO, 2009, 2013a, 2017a) showed that only for a small group of Poles (4.6% in 2016) finance was the main barrier to do sports.

The results presented in this article are an extension of previous research (compare Müller-Frączek, 2020). Those studies concerned the relationship between the development of institutional sport (related to sports clubs and Polish sports associations) and the affluence of the society. The studies were inspired, among others, by results Kościółek (2019), who showed that sports clubs largely support themselves from local subsidies. It was therefore expected that the richer the region is, the more its institutionalized sport should develop. We conducted previous research at the voivodeship level (NUTS 2 regions). They were not conclusive, but they were promising. In this study, we considered the lower level of spatial aggregation, i.e. NUTS 4 regions, called poviats. Societies in smaller administrative units are more homogeneous in terms of the access to practice sports in clubs. Therefore, lowering the level of aggregation should emphasize the relationship, if it exists. We hypothesized that the increase in the affluence of Polish society influences the development of institutional sport.

We chose poviats because they are the smallest regions for which the Central Statistical Office collects data on sport. Both the previous and the present studies concern only institutional sport, because data on individual sport in Poland is available only at the national level.

In the study, we represented affluence by only one variable, while for the characterization of sport we constructed a composite indicator (a synthetic variable). Thus, we achieved the intermediate goal, which was to create a synthetic measure of the institutional sport development in Poland at the poviat level. The synthetic

approach is very popular in social research (compare Bandura, 2011 or Greco, Ushizaca, Tasiou & Torrisi, 2019) also in research related to sport (e.g. De Bosscher, 2018). Basic rules for the construction of synthetic measures can be found e.g. in Casadio Tarabusi & Guarini (2013).

Material & methods

We conducted our analysis at the poviats level (NUTS 4 regions). There are 379 such regions in Poland. We used the data from reports submitted every two years by Polish sports clubs. The Central Statistical Office collects and publishes this data (CSO, 2013b, 2015, 2017b, 2019).

Since we wanted to compare the results with those obtained in the previous study (Müller-Frączek, 2020), we analyzed the same time period 2012-2018. Due to the lower level of aggregation, the number of available variables was smaller (we could not use the data from the reports of Polish sports associations because they are collected at the NUTS 2 level). Similarly to the previous study, we focused on people actively involved in sport (and not, for instance, on sports infrastructure). Previously, we considered 10 indicators that we classified into 4 different aspects (dimensions) of sport development: participants, staff, women and young. This time, each dimension was represented by only one indicator. Table 1 presents the considered indicators, and Table 2 shows their basic characteristics.

Table 1 Indicators of sport development

Dimension	Symbol and description
Participants	x_1 Persons practising sports in sports clubs per 100 inhabitants
Staff	x_2 Members of coaching staff in sports clubs per 100 persons practising sports in sports clubs
Women	x_3 Females practising sports in sports clubs per 1000 population
Young	x_4 Youth aged up to 18 practising sports in sports clubs per 100 inhabitants

Table 2 Basic characteristics of sport development indicators

Characteristic	Year	x_1	x_2	x_3	x_4	Characteristic	Year	x_1	x_2	x_3	x_4
Mean	2012	2.36	5.50	0.57	1.67	Minimum	2012	0.44	3.06	0.05	0.21
	2014	2.36	5.42	0.57	1.67		2014	0.75	3.10	0.07	0.33
	2016	2.63	5.32	0.64	1.87		2016	0.53	3.37	0.11	0.53
	2018	2.63	5.39	0.65	1.88		2018	0.64	3.10	0.05	0.40
Standard deviation	2012	0.73	0.86	0.25	0.56	Maximum	2012	4.75	9.55	1.50	3.78
	2014	0.72	0.84	0.24	0.55		2014	4.60	8.18	1.46	3.54
	2016	0.78	0.79	0.27	0.58		2016	4.68	8.24	1.83	3.61
	2018	0.84	0.87	0.29	0.65		2018	5.51	9.00	2.15	5.08

Due to the smaller number of indicators compared to the previous approach, we had to change the method of composite indicator construction. We assumed that all the considered aspects of sport development are equally important and should be balanced. Therefore, we chose the Mazziotta and Pareto method (the so-called Mazziotta-Pareto Index, MPI) for the construction of a synthetic measure of sport development (Mazziotta & Pareto, 2016). This method which favors the balance of variables.

In the first step, we normalized indicators to bring them to comparability. We used standardization expressed by the formula:

$$z_{ij} = 100 + \frac{x_{ij} - M_{x_j}}{S_{x_j}} \cdot 10,$$

where i numbers regions ($i = 1, \dots, 379$), j numbers indicators ($j = 1, \dots, 4$), M_{x_j} is the mean value of the j -th indicator, i.e.

$$M_{x_j} = \frac{1}{379} \sum_{i=1}^{379} x_{ij}$$

and S_{x_j} is the standard deviation of the j -th indicator, i.e.

$$S_{x_j} = \sqrt{\frac{1}{379} \sum_{i=1}^{379} (x_{ij} - M_{x_j})^2}.$$

It should be emphasized that the values of the indicators after such standardization are not comparable over time. It doesn't matter to our study. However, when comparability over time is necessary, you should use another form of the method (Mazziotta & Pareto, 2015, 2018).

In the next step, for each year (2012, 2014, 2016, 2018) we calculated the Mazziotta-Pareto Indices:

$$MPI_i = M_{z_i} - P_{z_i}$$

where M_{z_i} is the mean value of normalized indicators:

$$M_{z_i} = \frac{1}{4} \sum_{j=1}^4 z_{ij},$$

P_{z_i} is the penalty for the imbalance of indicators in the form:

$$P_{z_i} = S_{z_i}^2 / M_{z_i},$$

where

$$S_{z_i}^2 = \frac{1}{4} \sum_{j=1}^4 (z_{ij} - M_{z_i})^2.$$

In the previous study, we used the average monthly available income per capita to describe the affluence of the society, but such data is not available for poviats (NUTS 4 regions). We considered other indicators instead, which reflect the affluence of the society and are available at the appropriate level of aggregation. We chose the aggregated own revenue of NUTS 5 budgets per capita. This indicator aggregated to NUTS 4 was the most strongly correlated with available income in the analyzed period. Table 3 presents its basic characteristics for entire Poland and 16 voivodeships (NUT2 regions).

Table 3 The own revenue of NUTS 5 budgets per capita (aggregated to NUTS 4)

Region	Mean				Standard deviation			
	2012	2014	2016	2018	2012	2014	2016	2018
Dolnośląskie	1877.84	2101.32	2252.90	2503.20	844.83	730.40	697.23	768.62
Kujawsko-pomorskie	1438.27	1658.67	1776.86	1991.87	471.74	543.83	523.01	559.50
Lubelskie	1091.97	1275.44	1406.23	1565.49	393.22	428.08	479.24	511.33
Lubuskie	1575.56	1817.88	1970.72	2252.38	267.06	273.04	371.93	462.10
Łódzkie	1524.28	1761.27	1928.71	2178.02	605.27	655.75	725.85	691.70
Małopolskie	1345.33	1535.90	1700.28	1906.02	529.99	611.36	710.14	805.68
Mazowieckie	1577.23	1805.36	1985.79	2212.53	863.84	977.86	1037.81	1148.67
Opolskie	1528.76	1746.67	1906.46	2128.58	427.94	486.09	590.12	699.23
Podkarpackie	1239.45	1429.96	1507.60	1740.45	446.98	501.49	510.06	547.25
Podlaskie	1302.82	1560.63	1629.70	1808.16	427.80	601.27	515.23	540.44
Pomorskie	1874.26	2069.70	2283.53	2564.08	901.42	972.30	1038.63	1223.38
Śląskie	1980.22	2236.44	2422.38	2668.99	523.67	614.97	619.49	672.98
Świętokrzyskie	1234.42	1367.61	1520.23	1610.53	404.93	410.67	454.75	501.87
Warmińsko-mazurskie	1433.60	1547.00	1673.31	1834.87	336.05	387.97	433.78	473.80
Wielkopolskie	1514.98	1689.92	1889.54	2135.26	485.41	475.54	532.40	584.12
Zachodniopomorskie	1866.60	2095.47	2430.18	2645.90	492.44	531.46	877.21	975.41
Poland	1551.69	1759.80	1924.48	2145.59	643.08	695.25	758.50	834.87

Results

We have preceded the actual research with a preliminary examination. Its purpose was to compare the methods used in this and the previous approach. Let us recall that we previously constructed 2 types of composite indicators, differing in normalization method. We used popular scaling (max-min normalization) and an anti-pattern normalization (Müller-Frączek, 2018, 2019a, 2019b). We aggregated the normalized indicators inside dimensions using an arithmetic mean, which resulted in the creation of 4 measures, one for each aspect of sport development. Then we used the geometric mean to combine the dimensions into one general synthetic measure of sport development.

In order to compare the two approaches, we determined the MPI for voivodeships (NUTS 2) and confronted them with the previous results. First, we compared the general synthetic measures of sport development and the corresponding components of these measures related to each of the aspects (dimensions) of sport development considered. As already mentioned, in MPI we characterize dimensions using a single indicator, while in previous approaches we constructed appropriate composite indicators. Table 4 contains the correlations that were obtained.

Table 4 Correlations between synthetic measures of sport development at the NUTS 2 level

Composite indicator	MPI vs. Min-max method				MPI vs. Anti-pattern method			
	2012	2014	2016	2018	2012	2014	2016	2018
General	0.86	0.87	0.92	0.90	0.84	0.85	0.89	0.85
Participants	0.92	0.91	0.94	0.93	0.89	0.89	0.92	0.91
Staff	-0.05	0.04	0.02	0.04	-0.05	0.06	0.02	-0.01
Women	0.68	0.60	0.60	0.71	0.66	0.53	0.48	0.53
Young	0.80	0.77	0.89	0.90	0.75	0.78	0.88	0.87

The correlation coefficients for various aspects of sport development were varied: very strong between x_1 and the Participants dimension, also strong for x_4 and Young, moderate for x_3 and Women, but no relationship was found between x_2 and Staff. It seems that these differences are a consequence of the lack of data on competitors, female competitors and sports judges, which were captured in the previous research (no data from Polish sports associations at NUTS 2 level). On the other hand, there is an obvious similarity between the general composite indicators (linear correlation above 0.8 in each year). Therefore, we assumed that from the point of view of characterizing the development of sport, the results of all approaches can be compared with each other.

In the next step, we analyzed the relationship between the MPI for voivodeships and the affluence of the society represented by two different indicators: the average monthly available income and the aggregated own revenue of NUTS 5 budgets (both per capita). Table 5 presents the results.

Table 5 Correlations between synthetic measures of sport development and affluence indicators (NUTS 2 level)

Synthetic measure of sport development	Average monthly available income				Aggregated own revenue of NUTS 5			
	2012	2014	2016	2018	2012	2014	2016	2018
Min-max method	-0.32	-0.27	-0.07	0.06	-0.20	-0.09	0.11	0.25
Anti-pattern method	-0.30	-0.26	-0.03	0.12	-0.17	-0.08	0.14	0.30
MPI	-0.51	-0.43	-0.25	-0.21	-0.34	-0.22	-0.06	-0.04

At NUTS 2 level, the relationship between sport development and affluence represented by the two indicators under consideration is slightly different but similar. The correlation was mostly weak regardless of how sport development and welfare were represented. For different models of sport development, the strength of the relationship differed, but the trend in time for both indicators of well-being was similar, i.e. for the earlier models, the correlation from negative evolved to positive, while for the MPI the correlation was negative but weakened over time. Additionally, it can be noticed that for the MPI the correlation is stronger for the average monthly available income than for the aggregated own revenue of NUTS 5 budgets.

In the main study, we calculated synthetic measures of sport development at the NUTS 4 level. Consequently, we have achieved an intermediate research goal. Due to the large number of poviats, Table 6 presents only the average results for the entirety of Poland and for voivodeships (NUTS 2 regions).

Table 6 Mazziotta-Pareto Index of sport development in Polish poviats (NUTS 4 regions)

Region	Mean				Standard deviation			
	2012	2014	2016	2018	2012	2014	2016	2018
Dolnośląskie	97.88	99.44	100.49	99.52	5.31	5.63	5.34	5.12
Kujawsko-pomorskie	100.38	100.19	100.53	100.07	5.97	6.65	7.47	6.12
Lubelskie	100.21	99.19	96.79	98.58	9.88	9.44	8.74	9.03
Lubuskie	98.91	99.55	100.30	101.19	5.49	5.92	7.22	6.88
Łódzkie	97.36	97.89	97.97	98.14	4.85	6.20	5.27	4.83
Małopolskie	103.24	102.18	102.10	101.14	8.17	6.90	6.69	5.92
Mazowieckie	97.54	96.73	96.56	96.29	6.34	6.21	7.13	5.85
Opolskie	100.84	100.84	101.57	101.58	3.91	2.14	4.81	5.01
Podkarpackie	106.93	107.12	106.74	105.70	9.02	6.94	7.68	7.85
Podlaskie	101.49	99.97	97.56	98.24	6.12	6.38	7.09	7.13
Pomorskie	97.84	97.08	99.92	99.61	6.64	9.19	8.87	6.41
Śląskie	96.66	97.36	99.56	100.33	5.65	5.19	5.66	6.21
Świętokrzyskie	93.74	92.47	92.20	91.24	6.69	5.72	4.11	4.16
Warmińsko-mazurskie	99.46	100.23	98.42	98.19	5.03	6.77	6.15	5.45
Wielkopolskie	100.46	100.95	100.95	101.28	7.03	6.13	5.97	6.01
Zachodniopomorskie	101.18	101.50	100.24	99.79	6.63	5.85	7.06	7.12
Poland	99.55	99.53	99.55	99.50	7.24	7.15	7.30	6.87

Such measure can be used to analyze the spatial differentiation of sport development in Poland, to create rankings of poviats, to designate regions with similar sports development, etc. For example, we divided poviats into 7 groups according to the level of sport development, using the average MPI value in a given year (marked as M) and the standard deviation (marked as S). Table 7 presents the limits of the ranges, while Table 8 presents the results of the division into groups for the extreme years of the study.

Table 7 Groups of poviats with a similar level of sport development

Symbol	Description	Range of MPI
I	Excellent	$> M+3S$
II	Very good	$(M+2S; M+3S]$
III	Good	$(M+S; M+2S]$
IV	Typical	$[M-S; M+S]$
V	Bad	$[M-2S; M-S)$
VI	Very bad	$[M-3S; M-2S)$
VII	Extremely bad	$< M-3S$

Table 8 The percentage structure of groups with a similar level of sports development

Region	2012							2018						
	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
Dolnośląskie	0	0	8	86	3	3	0	0	0	7	83	10	0	0
Kujawsko-pomorskie	0	0	13	78	9	0	0	0	9	0	82	9	0	0
Lubelskie	4	4	13	58	17	4	0	0	13	4	54	25	4	0
Lubuskie	0	0	7	79	14	0	0	0	0	29	64	7	0	0

Łódzkie	0	0	4	83	13	0	0	0	0	8	84	8	0	0
Małopolskie	0	9	18	68	0	5	0	0	0	18	73	9	0	0
Mazowieckie	0	0	10	69	21	0	0	0	0	10	64	21	5	0
Opolskie	0	0	8	92	0	0	0	0	0	17	83	0	0	0
Podkarpackie	4	28	12	48	8	0	0	8	8	20	64	0	0	0
Podlaskie	0	0	24	70	6	0	0	0	0	12	64	24	0	0
Pomorskie	0	5	5	80	10	0	0	0	5	10	70	15	0	0
Śląskie	0	0	6	74	17	3	0	0	3	11	75	11	0	0
Świętokrzyskie	0	0	7	50	36	7	0	0	0	0	29	71	0	0
Warmińsko-mazurskie	0	0	5	85	10	0	0	0	0	14	67	19	0	0
Wielkopolskie	0	3	11	77	9	0	0	0	0	20	74	6	0	0
Zachodniopomorskie	0	5	14	76	5	0	0	0	5	14	62	19	0	0
Poland	1	3	10	74	11	1	0	1	3	12	68	15	1	0

The percentage structure of groups with a similar level of sports development in entire Poland changed only slightly. However, major changes took place in some voivodeships (e.g. in Świętokrzyskie).

In order to resolve the main research problem, whether there is a relationship between the level of sport development and the affluence of the society, we analyzed correlations between the MPI and the aggregated own revenue of NUTS 5 budgets per capita (both at NUTS 4 level). Additionally, we analyzed the correlations between these values for all voivodships. Table 9 presents the correlation coefficients.

Table 9 Correlations between MPI of sport development and affluence indicator (NUTS 4 level)

Region	2012	2014	2016	2018
Dolnośląskie	0.33	0.31	0.41	0.43
Kujawsko-pomorskie	0.63	0.63	0.58	0.68
Lubelskie	0.31	0.31	0.34	0.35
Lubuskie	0.58	0.54	0.78	0.68
Łódzkie	0.08	0.09	0.16	0.09
Małopolskie	0.28	0.43	0.51	0.54
Mazowieckie	0.19	0.22	0.38	0.51
Opolskie	0.67	0.71	0.75	0.55
Podkarpackie	0.38	0.40	0.69	0.80
Podlaskie	0.35	0.52	0.53	0.75
Pomorskie	0.65	0.58	0.55	0.47
Śląskie	0.10	0.45	0.40	0.26
Świętokrzyskie	0.07	0.25	0.55	0.77
Warmińsko-mazurskie	0.32	0.22	0.26	0.54
Wielkopolskie	0.26	0.34	0.40	0.53
Zachodniopomorskie	-0.49	-0.27	-0.32	-0.27
Poland	0.14	0.22	0.32	0.35

The research did not show any relationship between the development of sport and the welfare of society. In each year of the study, the correlation for the entirety of Poland was small. On the other hand, at the voivodeship level, the results were very diverse, ranging from no correlation, through moderate and strong positive correlation, and one negative result (Zachodniopomorskie).

Discussion

Let us recall that in the previous study, which we conducted based on a larger number of variables, the relationship between sport development and affluence of the society was also weak. However, we observed a certain tendency, the correlation turned from clearly negative to very weakly positive. This trend seemed promising and prompted us to conduct further research.

Before further observations over time are available for a more detailed study of the trends, we examined the relationship at a lower level of aggregation. The idea seemed justified, since we only studied institutional sport, thus smaller unit should be more homogeneous and the synthetic variable more reliable.

Changing the level of aggregation mattered. The results for poviats differed from those obtained for voivodeships. For voivodeships the correlation was negative and weakening, while for poviats the correlation was positive and growing. However, in no case the correlation was strong, most often weak or very weak (for the whole of Poland).

It seems that the research results were not influenced by the method of constructing the synthetic measure of sport development or the way of representing affluence, because the analyzed relation was not strong in the previous approach as well. Therefore, the hypothesis that the development of institutional sport in Poland is related to the affluence of the society should be rejected. However, it should be emphasized that this conclusion does not concern the development of sport in general, because some aspects of it have not been studied due to the lack of data. Furthermore, we also did not consider all aspects of affluence. Instead of limiting ourselves to one indicator, we could consider the overall economic development of the regions, as in, for example, Pietrzak & Balcerzak, 2017.

Conclusions

We analyzed the relationship between the affluence of Polish society and the development of sport in 2012-2018. We conducted the research at the NUTS 4 level, as these are the smallest, and therefore the most homogeneous, regions for which sport data is collected.

We used the own revenue of NUTS 5 budgets per capita (aggregated to NUTS 4 level) to describe affluence, while to reflect the development of sport we constructed a composite indicator that combined four indicators representing various aspects of sport development. Since we believed that all the considered aspects of sport development are equally important, we used the Mazziotta and Pareto method for the construction of the synthetic variable, because it rewards the balance of variables.

We did not detect any significant relationship between sport development and affluence of society at either NUTS 4 or NUTS 2 level. Moreover, the trend over time at different levels of aggregation was different. These results, as well as the results of the previous analysis (Müller-Frączek, 2020), led us to reject the initial hypothesis that the increase in the affluence of Polish society influences the development of institutional sport.

Conflicts of interest - The author declares that there is no conflict of interest.

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