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Socio-economic potential of Polish cities – a regional dimension

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Abstract. The main aim of the research presented in this paper was to construct and evaluate a synthetic index of socio-economic potential of Polish cities (IoEp) at the level of voivodships and also to examine relations between this potential and the economic development of regions. The index reflects the level of localisation advantages offered by a city. That is why an assumption was made that there is a positive relationship between the level of socio-economic potential of cities in a region (measured by the IoEP index) and its level of economic development. The obtained results show that there are significant and stable differences in the level of economic potential of Polish cities. One can also observe that the higher the level of IoEP was, the higher the value of regional GDP per capita. That gives some basis to positively verify the research hypothesis.

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1. Introduction

Cities have always played an important role in stimulating the economic development of regions. As Jane Jacobs, one of the pioneers in studying cities and their role in the economy, put it: cities are the 'mothers' of economic development, not because people who are living in cities are smarter, but because of density – density of needs, demand and solutions to satisfy them. Cities also offer better conditions for companies, especially those innovative ones. Axel Weber described these conditions as the agglomeration effect, Krugman as knowledge spillovers, while others pointed to the network effects generated by cities. Nevertheless, always, where there were cities, there was economic development.

An important role of cities in stimulating the economic development of regions results from the fact that the cities integrate and coordinate the functioning of other regional subsystems. They decide about

the localisation of economic activity in the region and have a great impact on the quality of life of its inhabitants (Skrzyp, 2002: 18). And as Korcelli suggests, a polycentric network of cities is a necessary condition of both, economic efficiency and social equality (Korcelli, 2007: 98).

As the results of many different studies show, in Poland we can observe quite a polycentric network of cities. Their distribution is nearly consistent with Zipf's law. However one can observe some differences, such as the density of cities is decreasing when moving from west to east and from the south to the north of Poland. But compared to other countries, cities in Poland are equally localised (see: Dziewoński, 1964; Jerczyński, 1977; Parysek, 2005; ESPON 1.1.1., 2004). On the other hand, the results of other studies (e.g. Bogdański, 2010) indicate that between Polish regions there are significant differences in the level of their economic development. These differences are larger than one could expect on the basis of analysis of the network of cities. These facts indicate the necessity of searching for other urbanisation determinants of economic development. Based on this the author indicates at the socio-economic potential of cities, as one of the factors determining economic development of regions.

2. Material and research methods: the aim, scope of research, methods, and hypothesis

In order to stimulate the dynamic development of a region, especially in a knowledge based economy, cities localised in a given region have to offer a desired climate for enterprises and a high level of localisation advantages. To achieve this goal it is essential to properly balance the level and the quality of localisation factors in the city – both hard and soft. But according to Gorzelak, recently soft localisation factors have gained in importance for modern and innovative entrepreneurs (Gorzelak, 2003: 45).

The aim of the research was to construct and evaluate a synthetic index of socio-economic potential of Polish cities (IoEP) in a regional dimension. This index allows us to judge the economic environment (or to put it another way: the level of localisation advantages) of a given city from the perspective of companies that are already functioning in this city or from the perspective of a potential investor. Referring the obtained results to the level of regional GDP per capita (as the most synthetic measure of the level of economic development) allowed the author to verify the research hypothesis, in which it was assumed-that there is a positive relation between the level of socio-economic potential of the cities in a region and its level of economic development. In other words, a high level of socio-economic potential of cities localised in a given region may stimulate its economic development. Numerical confirmation or exclusion of this relation may become a contribution to the still ongoing discussion on the determinants of regional development and also may allow the assessment of how these processes will develop in the future.

The research described in this work was divided into two stages. In the first stage, on the basis of the analysis of subject literature, a synthetic index of socio-economic potential of cities (IoEP) was constructed and calculated. The diversity of this index was described at the level of voivodships (administrative regions of the 1st order); however, its construction allows it to be used at different levels of data aggregation.

In the second stage of the research, the obtained values of the index of socio-economic potential of cities in a given voivodship were confronted with its level of socio-economic development, measured by the value of regional GDP per inhabitant. It is the most synthetic measure used to evaluate the differences in the level of economic development and despite its defects, it is commonly used in scientific works and in documents prepared for the needs of regional policy. The main advantage of this measure is its simplicity and ease of interpretation. Also, despite a high level of aggregation, this measure allows the structure of regional production, the structure of production factors, price relations, and demographic processes to be taken into account (Strahl, 2009: 17).

In the paper the terms 'region' and 'voivodship' are used interchangeably. Taking into account the specificities of the functioning of economic regions, this is a simplification. The conducted analysis revealed, however, some characteristic relations between the investigated phenomena. That gave some grounds to draw more general and universal applications also in regard to voivodships treated as economic regions.

The time range of the research covers the years 2003, 2006 and 2008. On the one hand, it was dictated by the limited availability of statistical data relating only to urban centres in Poland, and on the other hand, it was the result of a desire to extend the analysis to the longest possible period.

The sources of data were the widely available statistical database of GUS (Główny Urząd Statystyczny – Central Statistical Office), including Bank Danych Lokalnych (Local Data Bank) (www.stat.gov.pl/bdl).

Also, the data were taken from the periodic elaborations of CSO entitled 'Miasta w liczbach' ('Cities in figures').

3. Theoretical aspects of the functioning of cities and ways to measure their socio-economic potential

Cities are considered to be an important determinant of regional development, both in exogenous and endogenous theories of regional development. The economic development of a city, according to the former theories can trigger multiply effects to the regional economy in a way described by, *inter alia*, the theory of growth poles. In the latter concepts of regional development it is emphasised that cities are an important part of an endogenous potential of the region, which is crucial to catalyse its economic development.

To put it another way, in order to stimulate the economic development of a region, cities localised in it, have to develop first. But to achieve this goal the city must be characterised by a high level of localisation advantages which would induce potential investors to invest their capital in a given city. These advantages can be described as the socio-economic potential of the city.

On the basis of literature studies (Harańczyk, 1998; Czornik, 2004) it was assumed that the level of socio-economic potential of a city depends on the balance of endogenous and exogenous functions of a city. Greater attention was paid to the internal functions because they most strongly influence the economic activity performed in a city. In other words the level, or quality of endogenous functions of a city decides on the quality of life and on the investment climate. A more detailed inquiry enabled four dimensions of the socio-economic potential of a city to be distinguished: (a) development level of economic infrastructure; (b) development level of social infrastructure; (c) quality of human and social capital; (d) economic development level. The constructed index of the socio-economic potential of cities by including these four dimensions allows the attractiveness of a city to potential investors to be measured.

The development level of economic infrastructure can be identified with the so-called hard localisation factors. Although the role of economic infrastructure is crucial in determining the effectiveness of production, it is no longer considered to be the most important factor of localisation. The level of economic infrastructure is described by measures reflecting the degree of provision in the city of grid infrastructure facilities (gas, sewerage, water supply), roads and telecommunication (World Development Report…, 1994: 2).

As was written, nowadays, the presence of economic infrastructure does not increase the attractiveness of a given space for investors, but on the other hand its absence is a major obstacle in attracting new investments (Przygodzki, 2007: 148). More important, from the perspective of entrepreneurs (especially those who are competing in the most innovative and advanced branches of the economy), seems to be the presence of soft localisation factors. By making some simplifications, soft localisation factors which, in a knowledge based economy, are considered to be the most important factor determining the attractiveness of places for companies, can be identified with the social infrastructure.

Social infrastructure decides on the quality of life in the city, it determines the possibility of satisfying intangible needs (education, health, social care but also culture and leisure) of entities operating in the city. It is rooted in the machines, devices, buildings and in people working in them along with their skills, qualifications (Juchnicka, Skibicka-Sokołowska, 2001: 147–148). To measure social infrastructure such indicators can be used like number of beds in hospital per 1,000 inhabitants, number of seats in cultural institutions or the variety of what they offer, number of schools, universities or research facilities.

The quality and number of soft localisation factors is also influenced by the quality of human and social capital. Without these kinds of capital it is impossible to discover and efficiently use resources of a region (Organiściak-Krzykowska, 2009: 376). The increase in human and social capital also improves the level of trust to the local actors (companies, local authorities, NGO's) which, for example, may decrease the level of transaction costs or improve diffusion of knowledge and innovation (Kukliński, 2003: 9).

Because there is a strong feedback between the level of the economic development of a place and its infrastructure (both economic and social) the author decided to include in the construction of the index of socio-economic potential indicators that describe the results of the economic performance of a city.

In order to construct the synthetic index of socio-economic potential of cities the author used one of the linear positioning methods – the Hellwig method. It allows the transforming of the studied spatial objects, described by many diagnostic variables, into one-dimensional space by constructing so-called synthetic variables. The interrelations between these

objects are measured with the use of the function of similarity or by using the distance function (in the research the distance was calculated with Euclid's measure). The main advantage of this method is that its interpretation is simple and that it allows positioning of the studied objects according to the value of the synthetic index (Wanat, Zeliaś, 2000: 75–82).

The specifics of this method requires, firstly, the construction of a hypothetic reference object (with the use of variables that have the highest values for stimuli and the lowest values for destimuli) and then the calculation of the distance between the real objects and the reference one. If the distance is smaller, then the synthetic index has higher values and the studied spatial object has a higher place in the linear positioning according to the intensity of the measured phenomena (Strahl, 2006: 161). Values of this index are between 0 and 1. A detailed algorithm of constructing the synthetic index according to the Hellwig method is described by Sokołowska-Woźniak (2008: 110–111).

In the research a total number of 38 diagnostic variables were used to construct the synthetic index of socio-economic potential of cities (IoEP). After elimination of variables which were highly correlated and were not diversified enough, 18 variables were left to conduct the analysis. They were the following variables: x_1 – percentage of city inhabitants using the water supply system; x_2 – percentage of city inhabitants using sewerage; x_3 – percentage of city inhabitants using the gas system; x_4 – length (in km) of the city roads with an improved and strengthened surface per 1,000 city inhabitants; x_6 – average usable floor space (in square metres) of flats per 1 inhabitant in the city; x_7 – number of flats built in the city per 1,000 married couples; x_{10} – average number of books in public libraries per 1,000 city inhabitants; x_{11} – number of seats in cinemas per 1,000 city inhabitants; x_{12} – number of research and development (R&D) facilities in the city per 1,000 inhabitants; x_{13} – number of employees in the research and development (R&D) facilities in the city per 1,000 inhabitants; x_{14} – number of medical doctors per 1,000 city inhabitants; x_{15} – number of nurseries per 100,000 city inhabitants; x_{18} – number of entrepreneurs operating in the sections K, L, M according to the Polish Classification of Activities (Polska Klasyfikacja Działalności – PKD) per 1,000 inhabitants; x_{22} – percentage of employed in the city; x_{26} – the average number of the audience in theatres and music institutions per 1,000 city inhabitants; x_{27} – number of registered entrepreneurs in the city per 1,000 inhabitants; x_{28} – number of infant deaths per 1,000 births in the city; x_{30} – total revenues (in millions of PLN) of the city budget per 1,000 inhabitants.

All variables had been given the same weighting coefficients. The author is aware that this might be a simplification of the real processes influencing the socio-economic potential of cities. However, proper identification of these coefficients would require much more advanced statistical analysis. Also, taking into account that every city is a different economic system the obtained results could vary depending on the city. In turn, assuming their values *a priori* by the author could lead to greater mistakes in the obtained results (Pociecha et al., 1998: 56). For this reason all variables were used with the same weighting coefficients.

4. Research results: regional diversity in the socio-economic potential of cities

In Table 1 the values of the index of socio-economic potential of Polish cities (IoEP) in the years 2003, 2006 and 2008 are presented. In order to analyse the relation between the level of socio-economic potential of cities in the region and its level of economic development the data on the voivodships GDP per capita was also presented.

The differences in the socio-economic potential of Polish cities were significant. One can observe that, between other regions, there are two voivodships which were visibly standing out – Mazowieckie and Małopolskie. In each of the analysed periods the values of the index of socio-economic potential of cities localised in these regions were highest. But, while in Mazowieckie voivodship one can notice a clear increasing trend in the values of IoEP, in Małopolskie voivodship a reverse tendency can be observed.

The relatively high value of the index in Mazowieckie voivodship was the result of the fact that in the following years variables related with this region were used many times to construct the so-called reference object. In other words, it means that cities located in this voivodship were, relatively often, characterised by the highest values of observed variables. In 2003 there were 6 of these variables, in 2006, 7 and in 2008, 9 of them. What is even more important, in each of these years, cities of this region had high values of variables reflecting the presence of localisation factors important from the perspective of creating a competitive and innovative environment – a large number of entrepreneurs operating in the sections K, L, M of the Polish Classification of Activities

Table 1. The level of socio-economic potential of Polish cities in the years 2003, 2006 and 2008 and the values of GDP in the regional approach

Voivodship	A			B		
	2003	2006	2008	2003	2006	2008
Mazowieckie	0.628	0.662	0.700	34,284	44,381	52,770
Małopolskie	0.657	0.552	0.547	18,915	24,111	28,878
Wielkopolskie	0.365	0.348	0.360	23,096	29,279	34,934
Dolnośląskie	0.318	0.323	0.391	22,617	29,739	35,989
Podkarpackie	0.407	0.289	0.261	15,630	19,024	23,101
Pomorskie	0.285	0.284	0.351	21,675	27,373	31,754
Lubelskie	0.297	0.215	0.269	15,607	18,779	23,219
Łódzkie	0.252	0.277	0.250	20,398	25,521	31,140
Kujawsko-Pomorskie	0.226	0.222	0.255	19,784	24,301	28,926
Opolskie	0.277	0.241	0.170	17,555	22,374	28,379
Zachodniopomorskie	0.180	0.214	0.225	20,917	25,324	30,357
Śląskie	0.159	0.224	0.211	24,062	29,497	36,126
Świętokrzyskie	0.224	0.195	0.136	17,257	21,130	26,763
Lubuskie	0.165	0.160	0.215	19,086	24,733	28,709
Podlaskie	0.202	0.132	0.215	16,770	20,396	24,434
Warmińsko-Mazurskie	0.184	0.142	0.180	17,404	21,005	24,814
Poland	0.380	0.373	0.397	22,078	27,799	33,462

Explanation: A – The IoEP value; B – GDP per capita in PLN (current prices)

Source: Author's own calculations on the basis of GUS Bank Danych Lokalnych www.stat.gov.pl/bdl, GUS *Miasta w liczbach 2003–2004, Miasta w liczbach 2005–2006, Miasta w liczbach 2007–2008*

(PKD), a large number of research and development (R&D) facilities and relatively high employment in these facilities (also, relatively high values of variables connected with the knowledge economy were in the cities located in Wielkopolskie, Dolnośląskie and Pomorskie voivodships). One can also positively judge the fact that in Mazowieckie voivodship there was a high level of enterprise in the cities (this is represented by the variables on the number of registered entrepreneurs per 1,000 inhabitants). Of course, an important issue, which will have to be solved in further studies is to what extent the relatively high values of the index of socio-economic potential of cities in this region is a result of Warsaw, the capital city, being located there.

In regard to Małopolskie voivodship, there were only two variables that were used to construct the reference object. In 2003 it was the case of variable x_{27} – number of registered entrepreneurs in the city per 1,000 inhabitants, and in 2008 – variable x_{11} – number of seats in cinemas per 1,000 city inhabitants. The relatively high level of socio-economic potential of cities in this region was decided by the fact that in the case of the other variables their distance from the reference object was comparatively small.

Definitely the lowest socio-economic potential is characteristic of the cities of Świętokrzyskie, Lubuskie, Podlaskie, and Warmińsko-Mazurskie voivodships. In fact, only in relation to the variables reflecting the development level of economic infrastructure located in urban centres, were their values not significantly different from the national average. For other variables, the distances calculated in relation to the reference object were significant, which in turn resulted in low values of the calculated index. One should particularly negatively assess that the urban centres in these voivodships were characterised by very low values of variables describing social infrastructure, as well as social and human capital. These factors are nowadays of utmost importance in building the socio-economic potential of spatial units. Three of the four regions discussed here (Warmińsko-Mazurskie, Podlaskie and Świętokrzyskie), as is well known, are among the least developed voivodships in the country. Taking into account that relatively well-developed economic infrastructure is only a necessary, but not a sufficient condition to boost economic development, it is expected that in the future these regions will remain at a relatively low level of development.

Analysing the values of the index of socio-economic potential of cities in other regions, one can see that generally the higher the values of IoEP, the higher the level of economic development. If we consider only four of the most developed regions of Poland (in consecutive years it was always the same voivodships: Mazowieckie, Śląskie, Dolnośląskie, and Wielkopolskie) the average value of this indicator in 2003 was 0.367, in 2006 already 0.389 and in 2008 over 0.41. In turn, for the five least developed regions of Poland (Świętokrzyskie, Podlaskie, Warmińsko-Mazurskie, Lubelskie, and Podkarpackie) the average values were only 0.263; 0.195 and 0.212 respectively. In the remaining seven voivodships, the average values of IoEP were as follows: 0.292 in 2003, 0.274 in 2006 and 2.88 in 2008.

So it is quite clearly visible, that with the increase in the socio-economic potential of the cities in a region there is also an increase in the level of economic development, measured by the value of regional GDP per 1 inhabitant. From this list, however, breaks Podkarpackie and Lubelskie voivodships, which were characterised by a relatively high level of IoEP and, at the same time a comparatively low level of economic development; and Śląskie voivodship, where despite the low level of socio-economic potential of cities one could observe high values of regional GDP per capita. In this context, it can be assumed that high values of IoEP in Lubelskie and Świętokrzyskie voivodships have been somewhat overstated due to the relatively higher rates of socio-economic potential of their capitals, what is natural in the case of regions with a weakly developed network of cities with only one, large urban centre. That could also be the case of Małopolskie voivodship. However in Śląskie voivodship, the index was probably slightly underestimated due to the high share of the urban population in the total population of the region. This could underestimate the value of most variables included in the study due to the fact that they were converted into a large number of urban residents. Verification of this hypothesis requires testing with the observations at a lower level of data aggregation.

In order to more precisely capture the relation between the level of socio-economic potential in the cities of a given voivodship and the level of its economic development in each of the years, regression functions were estimated. In these functions the dependent variable was the value of GDP per capita in a voivodship, as the measure of the level of economic development. The independent variable was the value of the index of socio-economic potential of cities. Estimated functions are as follows (all estimated variables are statistically significant at the p level $p<0.05$):

In 2003:
$Y = 12\,955x + 16\,406 \quad R^2 = 0.18$
In 2006:
$Y = 32\,808x + 16\,313 \quad R^2 = 0.54$
In 2008:
$Y = 35\,475x + 20\,144 \quad R^2 = 0.53$

where: Y – is the value of the voivodship's GDP per capita in PLN; x – is the value of IoEP.

Estimated functions of regression indicate a positive relation between the socio-economic potential of cities in the region and the level of its economic development, which gives some basis for positive verification of the assumed research hypothesis. In each of the analysed years, their slope was positive, which means that with increasing potential of cities, the level of economic development of the region, in which these cities are located is also increasing. Also the increasing value of the coefficient standing by the covariate indicates the growing importance of this potential in stimulating the development of regions. On the other hand, low values of the adjusted coefficient of determination R^2 (especially in 2003) raise some doubts about the obtained results.

Of course, this rough analysis is unable to provide decisive conclusions about the nature of the relation between these values but it can provide a platform for further study, taking into account other factors. The author is aware, that the socio-economic potential of cities is not the only factor determining the process of economic development of regions, but on the other hand, such partial analysis and models can be the basis for drawing more general conclusions and for extrapolation of future trends.

5. Conclusions

The aim of the study whose results are presented in this paper was to construct and evaluate a synthetic index of socio-economic potential of Polish cities (IoEP) and also to examine relations between this factor and the economic development of regions. In this work socio-economic potential was defined as the ability of urban centres to maintain existing or to attract new entrepreneurs. It is influenced mainly by the resources of cities which can be identified with the localisation advantages offered by urban centres.

It is their presence, or relative scarcity, that is the cause of spatial concentration of economic activity, and what is involved with it, of the growing disparities in the level of economic development of regions. So, in opposition to the R. O`Brien`s theses about the 'end of geography', that a place of business still has significant impact on business location decisions.

An important limitation in the construction of the index was the scarcity of comparable data relating to Polish cities. Especially in the case of measuring the quality of social and human capital their scarcity poses the need to use data that indirectly determine their level. Another problem was obtaining data on a level lower than the country level of aggregation. While the data in publications of CSO 'Cities in numbers' are published even in relation to individual urban centres, in the database Local Data Bank, only some of them refer to cities. In addition, the major problem was of course the selection of variables describing this multi-dimensional phenomenon.

Nevertheless, the obtained results give some reasons to draw more general conclusions.

In Poland one can observe large regional differences in the socio-economic potential of cities. For example, the index value for Mazowieckie voivodship in 2008 amounted to 0.7 and was the highest observed value, not only in this year, but in the whole study period. At the same time, the value of IoEP in the weakest region in this respect (Warmińsko-Mazurskie) was only 0.18. It is nearly a fourfold difference. In previous years, these relations were similar (2003) or even slightly higher (2006). Similarly, there was also a relatively constant composition of groups of voivodships with comparatively high and low levels of socio-economic potential of cities. The first of these groups includes Mazowieckie, Małopolskie, Wielkopolskie, and Dolnośląskie, while the second, Warmińsko-Mazurskie, Podlaskie, Świętokrzyskie, and Lubuskie.

Even a fairly cursory analysis of the composition of the above groups indicates that there may be a positive relation between the level of socio-economic potential of cities in the region and its level of economic development. Voivodships with a high level of GDP per capita are usually characterised by a higher level of IoEP and *vice versa*. However, some of the regions (Lubelskie, Podkarpackie) broke away from this tendency and a relatively high level of socio-economic potential of cities was accompanied by low values of GDP per 1 inhabitant. But in this case one can suspect that the relatively high values of IoEP were primarily affected by the dominance of the regional capital city over the other urban centres. Verification of this thesis in relation to all, not only to the voivodships mentioned above, will set the future direction of the author's research.

Taking into account the relative stability of the regional differences in the socio-economic potential of cities and sustainability of urban development processes in general, one can expect that the imbalance in the level of economic development of regions in the future will probably increase. Thus, these objective conditions (after all, it is difficult to control the urbanisation process and all efforts in this matter have their effects rather in the long term) can significantly reduce the effectiveness of any action taken under regional policy aimed at reducing existing development disparities.

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