The Attractiveness for Investments of Urban Municipalities in the Warmińsko-Mazurskie Voivodship

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Abstract

This study has been carried out in order to identify determinants of potential investment attractiveness of urban municipalities. To this end, urban municipalities in the Warmińsko-Mazurskie Voivodship in Poland were submitted to analysis. The data, as of 2015, were obtained from the Bank of Local Data maintained by the Polish Central Statistical Office (GUS). For each of the five microclimates which are expected to shape the level of potential investment attractiveness, a synthetic index that manifests a degree of the development of a given microclimate was calculated. The calculations relied on Hellwig's development pattern method. A stepwise regression method was applied to identify the microclimates that most strongly influence potential investment attractiveness. The application of the above methods led to the construction of an equation which expresses the potential investment attractiveness of urban municipalities. The equation implicated that the level of potential investment attractiveness of an urban municipality depended significantly on the market of human resources, technical infrastructure, administration and market microclimates. The subsequent step was to determine the prospective development of the market microclimate. To achieve this purpose, a logistic function was applied. The results suggest that the level of development of market microclimate in most analyzed urban municipalities will be declining over the following six years.

Keywords: investment attractiveness, urban municipalities, Hellwig's development pattern method

JEL: O18, O43, R58

Introduction

This paper presents results of a study into the potential investment attractiveness of urban municipalities in the Warmińsko-Mazurskie Voivodship, Poland. By necessity, the analysis included numerous elements, reflecting the multi-dimensionality and complexity of the term "potential investment attractiveness." A multi-dimensional comparative analysis has proven to be a useful approach (Pawlas 2014, 163). The research also employed the taxonomic development pattern method developed by Hellwig, which enabled the ranking of the analyzed objects (urban municipalities) in respect of their potential investment attractiveness. The purpose was to identify the determinants of potential investment attractiveness of urban municipalities.

The study included urban municipalities situated in the Warmińsko-Mazurskie Voivodship. These communities cover 354 km^2 in total, which corresponds to 1,5% of the voivodship's area. They are inhabited by 629 977 people, that is nearly 44% of the voivodship's population.[1] Such a large population on a relatively small area means that the population density in these urban municipalities is much higher than the average population density for the whole voivodship, which

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1. [In the journal European practice of number notation is followed — for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). — Ed.]

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equals 60 people per km^2. The largest area and the highest population can be found in Olsztyn and Elbląg. Distinctly the smallest in area and with the lowest population is the municipality of Górowo Iławeckie. The municipality of Ełk has the highest population density, while the municipality of Lubawa is the least densely populated.[2]

1 Review of the literature

Investment attractiveness is understood as "the capacity to attract an investor via a combination of localization advantages that can be gained while conducting a business activity. Areas which offer an optimal combination of localization factors create the best conditions for business entities to operate and are therefore most attractive to investors" (Borowicz et al. 2016, 6). The literature dedicated to this issue distinguishes two types of investment attractiveness. One can be defined as a complex of localization assets which have an influence on the achievement of the goals set by the investor. In this case, indicators of potential investment attractiveness assess the localization values of regions. Another type of investment attractiveness is the actual, analytical ability of a region to create the investor's satisfaction as well as to absorb capital.[3]

The way potential investment attractiveness is measured depends on the statistical taxonomic rank of a unit (e.g., a municipality, district, province, sub-region, etc.).[4] Additionally, an analysis of investment attractiveness can be directed towards particular economic branches (i.e., an assessment of localization assets pertains to the branches that are in the core of regional economy). In an assessment of potential investment attractiveness that excludes the specific character of a localization needed for individual types of businesses, an objectivized set of diagnostic properties needs to be selected (Godlewska-Majkowska 2012, 8).

Differences exist among researchers in how they perceive major determinants of investment attractiveness, but they usually point to:
- infrastructure (Mengistu and Adams 2007),
- market size (Busse and Hefeker 2007),
- taxes (Owczarczuk 2013),
- labor costs (Bellak, Leibrecht, and Riedl 2008),
- quality of the institutional system (Bartels, Napolitano, and Tissi 2014),
- political risk (Asongu and Kodila-Tedika 2015),
- market openness (Anyanwu 2012), or
- corruption (Castro and Nunes 2013).

Investment attractiveness has special significance for both regional and local development. An area that possesses characteristics deemed valuable by investors attracts investments and with time creates an economic basis which stimulates development and enhances the area's social and economic potential. The arrival of investors, who bring in capital, stimulates the area's growth and strengthens its existing competitive advantages, whereas in areas where no growth has been observed previously, it enables local communities to overcome barriers to development (Godlewska-Majkowska 2012, 7).

2 Research sources and methods

The focus in this study was on analyzing localization assets in municipalities, which means that universal potential investment attractiveness was examined (dG). To this end, 5 sub-aggregates of variables (microclimates) describing locations were distinguished: human resources (HR), technical infrastructure (TI), social infrastructure (SI), administration (A), and market (M) (Godlewska-Majkowska 2012, 5).

Investment attractiveness has a multi-dimensional character. In order to achieve its most faithful reflection, 39 variables fundamental to the spatial differentiation of localization advantages

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2. According to data published by Central Statistical Office of Poland, in 2015.

3. See: Atrakcyjność Inwestycyjna Regionów 2017. Reports by H. Godlewska-Majkowska et. al., Instytut Przedsiębiorstwa SGH, Warszawa, listopad 2017.

4. Ibid.

were analyzed. The diagnostic features were selected so as to reflect in the best possible way the essential aspects of the analyzed research problem (Klosa and Widera 2017, 80). The variables were derived from a review of the literature, hence the selected indicators in the light of the available knowledge on potential investment attractiveness are its most important aspects. All the indicators were classified as stimulants or destimulants. Stimulants are characteristics whose higher value means a higher level of development, while destimulants are factors whose lower value translates into a higher level of development (Świdyńska 2017, 53).

In order to characterize labor resources, 11 partial indicators were distinguished, including 4 destimulants (share of the registered unemployed in the working age population, non-working age population per 100 working age people, post-working age population per 100 pre-working age persons, post-working age population per 100 working age persons). These data served to evaluate human resources through an analysis of the situation on the labor market (working persons per 1 000 persons, share of working persons in the working age population, share of registered unemployed persons in the working age population), level of migration (migration balance per 1 000 persons, foreign migration balance per 1 000 persons), demographic situation (share of the working age population in the total population, non-working age population per 100 working age persons, post-working age population per 100 pre-working age persons, pre-working age population per 100 working age persons) and, to emphasize the increasing importance of the ability to combine professional and private life, the expenditure into culture and national heritage preservation as well as education expressed per capita were included in our analysis.

In order to diagnose the condition of technical infrastructure, 9 indicators, all being stimulants, were defined. These indicators described the municipalities as being able to provide facilities and services classified as belonging to technical infrastructure (share of the population with access to waterworks, sewers, piped gas in the municipality's total population, length of waterworks, sewers and gas pipes per 100 km^2) as well as the state of transportation infrastructure (share of the road surface to the municipality's total surface, share of the surface area covered by railways to the municipality's total surface area, expenditure into transport and communication per head). Some authors believe that transportation infrastructure is the principal condition that determines the investment attractiveness of a given area.

The diagnosis of the social infrastructure condition was supported by 10 indicators, of which 2 were destimulants (children aged 3–5 years per 1 place in a preschool, number of residents per 1 library). Other circumstances determined included the housing situation in the municipalities (average useful floorspace of a house or flat, average useful floorspace per 1 resident, number of flats per 1 000 inhabitants of a municipality), accessibility of services and social infrastructure facilities (collections of books in libraries per 1 000 inhabitants number of inhabitants per 1 library, children aged 3 to 5 per 1 place in preschools, share of primary schools equipped with computers intended to be used by pupils, and ensuring access to the Internet), and the expenditure of the municipal authorities to contribute to such institutions (expenses on culture and protection of the national heritage and culture, health protection, education and upbringing of an inhabitant.)

Administration was evaluated through an analysis of 4 components: share of the municipality's own revenue in total revenue, share of the municipality's area covered by the spatial management plan in its total area, the EU funds allocated to financing EU programmes and projects per capita, and funds acquired from other sources to co-finance own tasks per capita.

The market was characterized with the help of 5 indicators, one of which, i.e. the share of legally protected natural areas in the municipality's total area, was considered to be a destimulant. However, it is worth adding that there are such enterprises—e.g., in the tourism and hospitality business, for which a higher share of protected land translates into their higher attractiveness, but our study did not involve any division of the potential investment attractiveness determinants into branches of business activity. Other properties characterized within this domain include population density, share of special economic zones in the municipality's total area, as well as the share in taxes constituting the state's budgetary revenue, income tax from natural persons and the share in taxes constituting the state's budgetary revenue, income tax from legal persons per one working person.

To avoid an excessive number of internal correlations between individual indicators, variability coefficients were calculated so as to exclude from further research the indicators that scored very low variability coefficient values ($V < 20$). Afterwards, a matrix of correlations was applied so as to exclude variables which were excessively correlated with each other.

Based on the collected data, originating from the Local Data Bank of the Central Statistical Office of Poland concerning the year 2015, the level of potential investment attractiveness was determined, in each of the microclimates and in total, after which, using a stepwise regression technique, an equation of the potential investment attractiveness of the municipalities in the Warmińsko-Mazurskie Voivodship was constructed.

The level of potential investment attractiveness of urban municipalities was determined using the taxonomic development measure proposed by Hellwig, which allowed the ranking of the analyzed objects (urban municipalities) with respect to the level of their potential investment attractiveness. This method, also known as the method of information capacity indicators or an optimal choice of predictors, is a method of selecting variables for a statistical model (Kopiński and Porębski 2014). A multi-dimensional comparative analysis is a coherent system of statistical methods dedicated to the purposeful selection of information regarding a certain community and detection of mutual relationships between them (Grabiński 1984, 11–15).

An application of this method necessitated certain standardization of the diagnostic characteristics that were adopted for the purpose of this study and classified as stimulants and destimulants:

$$(1) \qquad z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j},$$

where:
z_{ij} — standardised value of characteristic x_{ij},
x_{ij} — initial value of characteristic x_{ij},
$\bar{x}_j$ — arithmetic mean of characteristic x_{ij},
s_j — standard deviation of characteristic x_{ij}.

Next, a model pattern unit was constructed, that is a municipality attaining the maximum level of potential investment attractiveness in which the values of the variables which are stimulants assume the maximum level, while the values of destimulants are the lowest (Klosa and Widera 2017, 80):

$$(2) \qquad z_{oj} = \max_i z_{ij} \quad \text{for variables which are stimulants,}$$

$$(3) \qquad z_{oj} = \min_i z_{ij} \quad \text{for variables which are destimulants.}$$

The subsequent step was to determine with the Euclidean metric the distance of observation units from the pattern development unit:

$$(4) \qquad D_{oj} = \sqrt{\sum_{j=1}^{m} (z_{ij} - z_{oj})^2}.$$

Having taken these steps, it became possible to calculate the taxonomic development measure which would define the level of potential investment attractiveness from the formula:

$$(5) \qquad d_i = 1 - \frac{D_{io}}{D_0},$$

where:
$D_0 = \bar{D}_o + 2s_o$,
$\bar{D}_o$ —arithmetic mean for the series of values D_{io},
s_o —standard deviation for the series of values D_{io}.

The higher value of d_i the analyzed object achieves, the higher its degree of development. The multi-dimensional variable analyzed in this research was the level of potential investment attractiveness.

Hellwig's measure is a method for conducting a multi-dimensional comparative analysis which belongs to the group of methods based on the linear arrangement of objects based on a synthetic measure. Consequently, its application in this study led to the separation of the municipalities into four classes depending on the level of potential investment attractiveness (generally and within each of the five microclimates):

- municipalities characterized by a high potential investment attractiveness, when

$$(6) \qquad d_i \geq \bar{d}_l + s_{d_i}$$

- municipalities characterized by a medium potential investment attractiveness, when

$$(7) \qquad \bar{d}_l \leq d_i < \bar{d}_l + s_{d_i}$$

- municipalities characterized by an average potential investment attractiveness, when

$$(8) \qquad \bar{d}_l - s_{d_i} \leq d_i < \bar{d}_l$$

- municipalities characterized by a low potential investment attractiveness, when

$$(9) \qquad d_i < \bar{d}_l - s_{d_i}$$

where d_i is arithmetic mean, and s_{d_i} is standard deviation.

For the sake of identifying the microclimate that shapes the potential investment attractiveness of a given municipality to the highest degree, a stepwise regression method was applied. Calculations were supported by the statistical and analytical software package Statistica. The results enabled the author to construct a model of potential investment attractiveness of urban municipalities.

The subsequent step in the research consisted of the determination of prospective development of the microclimate that had been identified to have the strongest influence on the level of potential attractiveness of urban municipalities in 2015. To this aim, the following logistic function was applied (Grzegorek and Wierzbicki 2009, 119):

$$(10) \qquad y = \frac{a}{1 + be^{-ct}},$$

where:
a, b, c — parameters selected via statistical estimation,
t — time.

In the study reported herein parameter a, which determined the natural saturation level, was assumed to be at a level of 1 (100%), because the maximum development level estimated with the Hellwig's method is 1. Based on the data from the years 2009–2015, and with the help of the statistical and analytical applications in the Statistica software program, parameters b and c of the logistic function were calculated, which in turn served as a basis for plotting a diagram illustrating prospective development of the microclimate which affects most strongly the potential investment attractiveness of the analyzed urban municipalities. The application of the logistic function, in conjunction with the time series, enabled the author to identify development trends over the following six years.

3 Results of the multidimensional analysis

Having verified statistically all 39 indicators, 26 were selected for further analysis (tab. 1). They were distinguished by a high variability coefficient value ($V > 20$) and were not mutually correlated. The application of the Hellwig's method enabled the author to classify the municipalities in accordance with investment attractiveness. The highest potential investment attractiveness was ascribed to the urban municipality of Olsztyn (which also scored the highest with regard to the market microclimate), while the lowest value was calculated for the municipality of Nowe Miasto Lubawskie. A cluster of other potentially investment attractive municipalities was observed around the municipality of Olsztyn, which itself was characterized by the highest level of potential investment attractiveness.

Tab. 1. Indicators shaping the potential investment attractiveness of urban municipalities

	Constituent indicators
LR	• working people per 1 000 residents (S) • share of working people in total working age population (S) • net migration rate per 1 000 inhabitants (S) • net foreign migration rate per 1 000 inhabitants (S) • expenditure into culture and national heritage protection per capita (S)
TI	• share of the surface area of roads in the total area of the municipality (S) • share of the surface area of railroads in the total area of the municipality (S) • share of the population in households connected to piped gas to the municipality's total population (S) • length of waterworks per 100 km^2 (S) • length of sewers per 100 km^2 (S) • length of gas pipes per 100 km^2 (S) • expenditure into transport and communication per capita (S)
SI	• expenditure into culture and national heritage protection per capita (S) • expenditure into health service per capita (S) • book collections in libraries per 1000 residents (S) • children aged 3–5 years per one place in pre-schools (D) • number of inhabitants per 1 library (D)
A	• share of the municipality's area covered by the spatial management plan in its total area (S) • the EU funds allocated to financing EU programmes and projects per capita (S) • funds acquired from other sources to co-finance own tasks per capita (S)
M	• population density (S) • share of special economic zones in the municipality's total area (S) • share in taxes constituting the state's budgetary revenue, income tax from physical persons (S) • share in taxes constituting the state's budgetary revenue, income tax from legal persons per one working person (S) • share of legally protected natural areas in the municipality's total area (D)

Note: (S)—stimulant, (D)—destimulant

Regarding the microclimate of human resources, most municipalities were classified as representing average or low investment attractiveness. The other three classes—high, moderate or very low potential investment attractiveness—contained one municipality each. With respect to the HR microclimate, the municipality of Lubawa scored the highest, while the least attractive in this regard was the municipality of Górowo Iławeckie. A large cluster of municipalities characterized by high potential investment attractiveness with respect to labor resources was observed in the vicinity of the municipality of Olsztyn, which itself was distinguished by high potential investment attractiveness in terms of this trait (the second highest score among the tested urban municipalities).

A quarter of the urban municipalities in the voivodship were characterized by high investment attractiveness regarding the technical infrastructure microclimate. The dominant level of attractiveness in terms of this microclimate among the analyzed municipalities was the average one. The microclimate of technical infrastructure was the most attractive to investment in the municipality of Kętrzyn, while the worst score was obtained by the municipality of Lubawa.

One in four of the analyzed municipalities was characterized by the high level of attractiveness of social infrastructure. Most of the municipalities were classified as being on the moderate level. The two lowest classes contained only one municipality each. With respect to the social infrastructure microclimate, the municipality of Braniewo proved to rank the highest, while the municipality of Ełk was the least attractive. Many of the urban municipalities in the Warmińsko-Mazurskie Voivodship were distinguished by excellent investment attractiveness regarding the microclimate of administration—over 31% scored very high. However, over 25% of the municipalities remained on a very low level of investment attractiveness in this microclimate, which is a worrying fact (tab. 2). The best administration microclimate was determined in the municipality of Kętrzyn, while the worst one appeared in the municipality of Nowe Miasto Lubawskie.

Tab. 2. Rankings of municipalities by the potential investment attractiveness

Municipality	dG	ZP	IT	IS	A	R
Bartoszyce	9	12	9	3	10	8
Braniewo	15	15	15	1	15	7
Działdowo	3	3	4	7	14	3
Elbląg	13	10	13	12	2	2
Ełk	8	9	5	16	4	16
Giżycko	10	8	10	11	11	6
Górowo Iławeckie	14	16	8	6	9	13
Iława	7	5	7	14	13	5
Kętrzyn	2	13	1	2	1	9
Lidzbark Warmiński	11	4	12	13	7	12
Lubawa	12	1	16	5	6	15
Mrągowo	5	6	11	15	3	4
Nowe Miasto Lubawskie	16	7	14	9	16	14
Olsztyn	1	2	6	4	8	1
Ostróda	4	11	3	8	5	10
Szczytno	6	14	2	10	12	11

Source: Author's calculations, based on data published by Central Statistical Office of Poland

The urban municipalities of the Warmińsko-Mazurskie Voivodship were mostly classified as presenting average investment attractiveness with respect to the market microclimate (50% of the municipalities). Two municipalities were classified in each of the extreme classes — a very high and very low level of attractiveness. With respect to the market microclimate, the municipality of Olsztyn scored the highest, while the municipality of Ełk ranked the lowest.

When assigning the analyzed municipalities situated in the Warmińsko-Mazurskie Voivodship to five classes depending on the achieved level of investment attractiveness, it was noticed that nearly 38% of the municipalities were characterized by a moderate level of the analyzed trait. There was only 1 municipality that demonstrated high potential investment attractiveness. The highest number of municipalities characterized by a high potential investment attractiveness appeared within the microclimate administration (31%), while the lowest one was in the microclimate human resources (6%). The latter also had the lowest number of municipalities on the low level (38%). Only 2 municipalities were characterized by a low investment attractiveness with respect to social infrastructure.

Tab. 3. Number of municipalities in particular development classes

	dG	ZP	IT	IS	A	R
Class I	1	1	4	4	5	2
Class II	4	2	5	6	3	2
Class III	6	7	3	4	5	8
Class IV	5	6	4	2	3	4

A stepwise regression method was applied in order to identify the microclimate that affected most strongly the potential investment attractiveness of urban municipalities. The model developed for all the urban municipalities in the Warmińsko-Mazurskie Voivodship explained 95% of the variability of potential investment attractiveness of the analyzed municipalities. The high value of adjusted R-squared (0,93) confirms strong relationships between potential investment attractiveness and four of the five analyzed microclimates. The regression coefficient for one variable — i.e., microclimate of social infrastructure, proved to be insignificant, hence it was not included in the construction of the model. The high value of the F statistics (41,197) and its corresponding test probability

level p verified the statistically significant linear relationship. The t statistics value showed that the intercept and regression coefficient differed significantly from zero. The microclimate of social infrastructure is not statistically significant.

Tab. 1. Results of the regression of potential investment attractiveness of the urban municipalities in the Warmińsko-Mazurskie Voivodship

Variable	b	se	t	p
Constant	−0,16	0,02	−6,36	< 0,001
ZP	0,28	0,03	8,49	< 0,001
IT	0,36	0,04	9,57	< 0,001
A	0,20	0,06	3,15	0,010
R	0,76	0,18	4,25	0,002
IS	0,03	0,02	1,41	0,188

$$R = 0,98 \quad R^2 = 0,95 \quad \text{adj. } R^2 = 0,93$$
$$F_{(5,10)} = 41,197; \ p < 0,00001$$
standard error of estimation: 0,01985
$$N = 16$$

The above formula means that when the microclimate of the market improves by 1, then the potential investment attractiveness of the municipality will rise by 0,76 ceteris paribus; if the microclimate of technical infrastructure goes up by 1, the level of the municipality's potential investment attractiveness will increase by 0,36 ceteris paribus; if the microclimate of human resources increases by 1, then the municipality's potential investment attractiveness will be higher by 0,28 ceteris paribus; and if the microclimate of administration rises by 1, then the level of potential investment attractiveness will go up by 0,20 ceteris paribus.

Predicting with the logistic model future changes in the microclimate assigned the greatest power to shape potential investment attractiveness of urban municipalities, i.e. the microclimate market, it could be observed from the values of the indicator scored in the years 2009–2015, that some improvement in this regard is foreseen in just one of the analyzed municipalities over the following 6 years. In the remaining administrative units, the attractiveness of the microclimate market will be decreasing gradually. It is worth noting that the municipality which was the leader in 2015 in terms of the market microclimate (Olsztyn) is losing its position. Moreover, at the end of the analyzed time period the current state of the market microclimate will be better in as many as 7 municipalities analyzed.

Conclusions

Following an application of multi-dimensional comparative analysis, the urban municipalities in the Warmińsko-Mazurskie Voivodship were classified in terms of their potential investment attractiveness and the microclimates which create it. The analysis covered the years 2009–2015 and the results have demonstrated considerable differentiation among the analyzed municipalities with respect to the examined multidimensional aspects.

The results suggest that the level of potential investment attractiveness of the urban municipalities in the Warmińsko-Mazurskie Voivodship is affected by four of the five analyzed microclimates (i.e., human resources, technical infrastructure, market and administration). It is not affected by the microclimate of social infrastructure. The strongest influence is evidently generated by the microclimate of the market, being nearly twice as strong as the second most influential factor, which was the microclimate of technical infrastructure.

Recapitulating, to improve the level of potential investment attractiveness of the urban municipalities in the Warmińsko-Mazurskie Voivodship, the municipal authorities should take measures within the four microclimates mentioned above. Each of the actions which enhance any of these microclimates will contribute to an increase in potential investment attractiveness. A positive outcome will be achieved most readily when these measures improve the market microclimate. Emphasis

should be laid on actions aiming to increase the number of inhabitants, the share of special economic zones in the municipality's total area, share of state budgetary tax revenues from income taxation of physical persons and from legal persons calculated per 1 employee and — reversely — to decrease the share of legally protected natural areas in the total area of a given municipality. These targets will not be easy to achieve, although they seem attainable in the long term.

While analyzing the prospective development of the microclimate which affected most strongly the level of potential investment attractiveness in the analyzed urban municipalities, which was the market microclimate, it was concluded that in 15 of these administrative units this level will be steadily declining. Consequently, over the six years to come the situation in the urban municipalities regarding the market microclimate, and therefore the level of potential investment attractiveness, will decline due to a fall in the population density, a decrease in the percentage of the municipalities' area covered by special economic zones and the contribution of the municipalities' share in taxes constituting the state's budgetary revenue, income tax from natural persons and from legal persons per 1 working person, and an increase in the percentage of legally protected areas in the municipality's total area.

It is worth highlighting that investment policy, whose main targets include improvement of investment attractiveness, is an element of a broader scale policy of regional or local development. Creating investment attractiveness is not an end in itself. Actually, it is supposed to focus on implementing the vision of development and therefore it needs to be analyzed from this perspective. Furthermore, investment policy itself cannot create all location-specific characteristics, whose level is often a result of complex and long-term social and economic processes.

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