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Taxonomic methods in investigation of labour market influence on investment location

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**STUDIA I PRACE WYDZIAŁU NAUK EKONOMICZNYCH
I ZARZĄDZANIA NR 4**

KESRA NERMEND

**TAXONOMIC METHODS IN INVESTIGATION
OF LABOUR MARKET INFLUENCE ON INVESTMENT LOCATION**

Introduction

Investment attractiveness of particular counties depends on many different factors, on the type of investment as well. Factors unfavorable to small investors are potentially favourable to large investors who do not produce for a local market on which investment is made. High unemployment rate and low average earnings are the example of such factors as they reduce demand on local market yet guarantee low production costs. Producing for markets in the developed countries, large corporations locate their investments in under-developed countries and in this way reduce production costs.

As far as small investors are concerned, they look for areas located near their potential outlet markets and hence favourable to them. Once Poland had acceded to the European Union, it became such a potential investment area just as the remaining new Member States. Nevertheless, it should be borne in mind that unemployment rate and average earnings are not the only determinants of attractiveness of a particular area. Moreover, there are many other factors that provide a long-term profitability of investment and lower original costs. Simple analysis is not possible in this case because of diversity of factors. Multi-dimensional comparative analysis is necessary to carry out such research. It has been referred to in many papers (Gierałtowska, Putek, 2003), (Lewandowska, 2007), (Rozkrut, 2006), (Strahl, Markowska, 2006), (Witkowska, Witkowski,

2003). It is necessary to combine indexes examined and create synthetic measures.

The paper presents the analysis aimed at indicating counties that are the most attractive for making investment. This will be done with the use of Synthetic Vector Measure of Region Development.

The choice of diagnostic variables

Eleven variables were taken into consideration while construing the synthetic measure with reference to the best places for investment. The number of registered unemployed is the most significant variable. However, applying this variable in this form could have misrepresented the results as it is given for the entire county. In this sense, the number of unemployed may be the same in large and small counties. Nonetheless, in the case of large counties, it may turn out that very few unemployed live near the place of investment and transport from faraway places may be difficult or there may even be no transport connections at all. This could entail a necessity to make further investments, i.e. to provide employees with accommodation. High density of population implies that unemployed are accumulated and hence can commute to work from a larger area. Using population density as another variable, it is possible to give the number of registered unemployed to 100 population of working age. Variable given in this form guarantees a better comparability of counties as their surface areas are not taken into account.

As a matter of fact, surface area of any county must not be marked in the case of all variables used (and not only the number of registered unemployed). Otherwise, the problem that has already been discussed (i.e. with regard to the number of unemployed) will refer to these variables in a similar way.

Apart from people registered as professionally active, it is also necessary to take account of average gross earnings. In the case of investments oriented at producing for areas outside the place where investments are made, the value of this variable should be as low as possible. This variable may lower production costs considerably. The value of this variable is very often connected with the number of unemployed. This fact is of profound importance as investments planned may reduce unemployment rate to a great extent, which can result in increase in average earnings after some time. Areas in which the

number of unemployed is very large compared to numbers of population of working age are particularly threatened with such a situation. Therefore, numbers of population of working age should be adopted as another variable.

In the case of long-term investments, factors influencing the situation over a longer period of time must be taken into account as well. Numbers of population of pre-working age is one of these factors. A high value of this variable indicates that in the future employees who retire can be replaced with people who have just entered labour market. A low value of this variable indicates indirectly that the average age of people active professionally (hence unemployed as well) may be very advanced. This, in turn, may imply that there are no people who could take up jobs where ability to operate a computer is required.

In the case of investments requiring qualified labour force, the expenditure on education is a variable of profound importance. High value of this variable compared to the number of people of pre-working age may imply that the number of well-educated young people who have just entered labour market is great. High value of this variable compared to the number of people of working age may indicate that the expenditure on retraining the unemployed or already employed is considerable. It might be assumed that a greater part of unemployed is learning new professions and acquiring new abilities (ability to use a computer as well).

Apart from factors referring to human potential, factors reducing investment outlays should also be taken into consideration while looking for areas attractive for making investments. A well-developed technical infrastructure may considerably lower investment costs, provide people living far away with possibility of commuting to work, or with possibility of working at home from time to time. It might be difficult to determine the extent to which infrastructure is developed. Still, it could be estimated indirectly on the basis of variables measuring the length of working water supply system, the length of working sewage system, and the length of county roads.

Small investors consider the extent to which investment is threatened with crime such as theft or armed robbery as a major factor. This makes investment more risky and increases costs as investor must hire guards. Expenditure on public safety may indirectly indicate that crime is a serious threat.

A large number of firms registered may entail a necessity to beat off intense competition and can be another factor that has a discouraging effect on

small investors producing for a local market. For large investors, a great number of firms registered may indicate that there is overstated unemployment. Small one-man firms can employ people illegally (in fact, these persons are registered as unemployed). In such a way, it is difficult to find employees despite high unemployment rate.

The multitude of variables analyzed leads to the fact that all variables cannot be treated in the same way. A potential investor may consider some variables as more important than other ones. This depends on the type of production, scale of investment, potential group of consumers, etc. Therefore, weights should be ascribed to variables in accordance with individual preferences of particular investors.

On the basis of weights (the range of which may be free) ascribed by an investor, it is possible to calculate w_i weights, namely

$$w_i = \frac{wi_i}{\sum_{j=1}^n wi_k} 100\%, \quad (1)$$

in which

wi_i – weight of i variable ascribed by an investor,

n – number of variables,

that are a percentage share of particular variables in creating synthetic measure.

In the case of the research conducted, the highest weight (i.e. 4) was ascribed to unemployment. This results from the fact that unemployment rate determines the recruitment of labour force and indirectly reduces costs connected with earnings. Weights equaling 2 were ascribed to variable connected with population density and to variable referring to monthly earnings. Weights equaling 1 were ascribed to the remaining variables.

In the end, the following nine stimulants were adopted (percentage share in creating the synthetic measure was given in brackets in each case):

- unemployed registered to 100 population of working age (25%),
- population density (12.5%),
- total expenditure on education and upbringing per 1000 population (6.25%),

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- total expenditure on public safety and fire safety per 1000 population (6.25%),
 - the length of working water supply system to 100 kilometres (6.25%),
 - the length of working sewage system to 100 kilometres (6.25%),
 - county hard surface roads to 100 square kilometres (6.25%),
 - population of pre-working age to 100 population of working age (6.25%),
 - population of working age to 100 population (6.25%),
 - and two destimulants, namely,
 - total average monthly gross earning (12.5%),
 - the number of firms to 1000 population (6.25%).

Apart from the place in which investment is made, potential outlet is another piece of information important to investor. If there are several investment places (having similar advantages) to choose from, investor ought to choose the one that is located the nearest to the outlet. Analyzing potential outlets, seven variables were taken into consideration.

Reasons underlying the process of seeking the best outlets are strikingly different than in the case of choosing investment places. The number of buyers and their affluence are main factors determining the sale of a particular product. There is a direct correlation between the number of buyers and population density the latter of which is one of the main criteria here. Nevertheless, if density is high and population is not wealthy, demand for products other than basic ones is very limited. Hence, average monthly gross earning is another variable of major importance. This earning reflects earnings of particular persons. The higher the earnings are, the greater the demand for more luxury products is. Tax on physical bodies is another factor that reflects the affluence of potential buyers. The higher this tax is, the greater probability that society is affluent.

In certain situations, it may turn out that purchasing power of population is too limited although population density and monthly earnings are high. Such a state of affairs takes place when a large number of elderly people live in a particular region and the number of employed is small (although their earnings are high). Small number of employed brings about the fact that purchasing power of society is limited. Thus, the number of people of working age should be another variable taken into account. Furthermore, unemployed should also be included in the analysis. Although they do not work and do not earn and so are

not taken into consideration while determining monthly earnings, they are of working age. Their income is very low or even none which limits purchasing power of persons who support them.

Floor surface of a flat per one occupant is another factor determining one's affluence and hence purchasing power. This variable is high in rich societies, and very low in the case of poor societies. As far as wider perspective is concerned, society should be prevented from ageing as retired persons will have limited purchasing power and therefore demand for goods may decline considerably. In order to prevent from such a situation, young people, who have just entered labour market, must replace people who retire. Hence, as high value as possible ought to be ascribed to variable referring to population of pre-working age.

In the end, the following six stimulants were adopted (percentage share in creating the synthetic measure was given in brackets in each case):

- population density (26.67%),
 - total average monthly gross earning (26.67%),
 - tax on physical bodies per 1000 population (13.33%),
 - population of working age to 100 population (13.33%),
 - average floor surface of a flat per one occupant (6.67%),
 - population of pre-working age to 100 population of working age (6.67%),
- one destimulant was also adopted, namely:
- unemployed registered to 100 population of working age (6.67%).

Empirical research

Synthetic vector measure was used in the research to classify counties according to their investment attractiveness. The description of the way in which this measure is construed may be found in (Nermend 2007a), (Nermend 2007b). Classification was carried out just as in the case of classical synthetic measure. Figure 1 shows the results of the classification. Analyzing the maps presented, it can be noticed that there are two areas particularly favourable to investments, namely counties situated on the border of Mazovia voivodship and Świętokrzyskie voivodship, as well as in southern part of Kujawy-Pomerania voivodship.

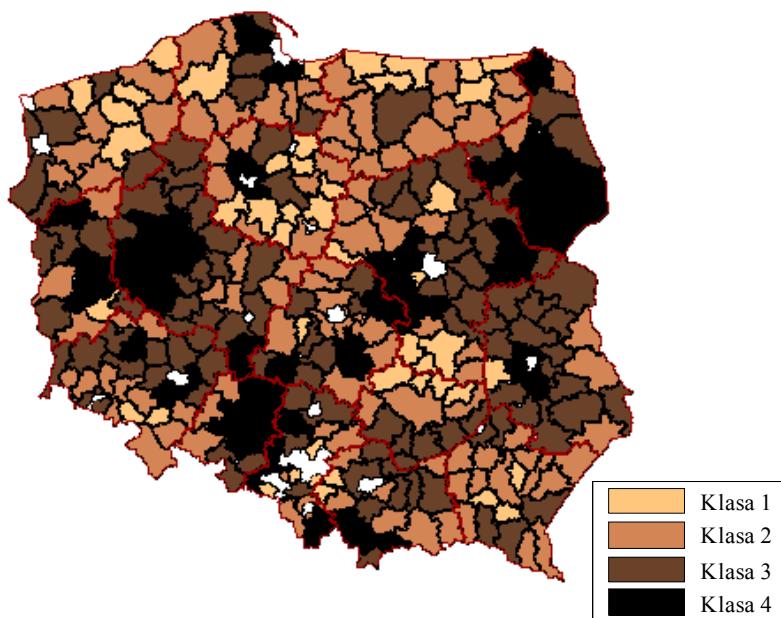


Fig. 1. Classification by means of synthetic vector measure with reference to the most optimum place for investment

Source: own compilation.

Counties situated in Mazovia voivodship, i.e. county of Przysusze, county of Radom, and county of Szydłowiec, as well as counties situated in Świętokrzyskie voivodship, i.e. county of Konieck, county of Skarżysko-Kamienna, county of Starachowice and county of Ostrów are located very attractively. They are situated nearby two areas that are also particularly attractive as potential outlets, namely near Warsaw and near Cracov (Figure 2).

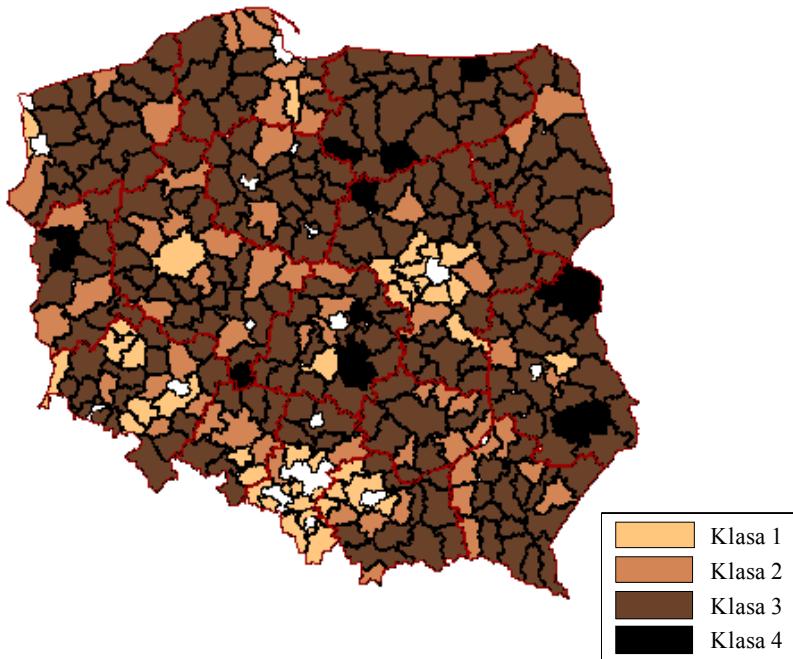


Fig. 2. Classification by means of synthetic vector measure with reference to the most optimum outlets

Source: own compilation.

Although all the aforementioned counties belong to one and the same class, their attractiveness differ. County of Szydłowiec and county of Przysucha are particularly attractive and they occupy the second and the third positions determined by means of synthetic measure respectively (Table 1). Some counties are located near the border between different classes. In this case, slight annual fluctuations in variables may lead to the fact the these counties will belong to a particular class in a certain year, and to a different class in the following year. Thus, border was not a line the width of which was not specified but a strip the width of which was determined. It is for certain that all objects within this strip belong to a basic class which depends on the distance from the centre of the strip. A 100% certainty was ascribed to objects situated outside the strip, and a 50% certainty to objects located in the centre of the strip. In the case of the remaining objects, certainty ranged from 50% to 100%.

Taken counties analyzed into consideration, three of them, i.e. county of Ostrów, county of Koneck and county of Starachowice are situated within this strip. Nonetheless, in the case of county of Starachowice, there is a 54,51% certainty so the other half (almost a half) indicates that it is located in the second class. Therefore, it can be eliminated.

The other interesting group of counties included counties situated near the southern border of Kujawy-Pomerania voivodship, i.e. county of Żnin, county of Inowrocław, county of Radziejów, county of Aleksandrów, county of Lipno and county of Rypin. These counties are located near Warsaw and Wrocław. However, in this case values of synthetic measure are considerably lower compared to counties discussed previously. County of Inowrocław is the most attractive one.

Table 1
Values of synthetic vector measure for the first class

County	Region	2006				
		Measu-re	Class 1	Certainty	Class 2	Certainty
1	2	3	4	5	6	7
County of Wodzisław	2	0.34	1	100.00%	2	0.00%
County of Szydłowiec	1	0.30	1	100.00%	2	0.00%
County of Przysucha	1	0.27	1	100.00%	2	0.00%
County of Będzin	2	0.25	1	100.00%	2	0.00%
County of Wałbrzych	5	0.25	1	100.00%	2	0.00%
County of Pruszków –	1	0.25	1	100.00%	2	0.00%
County of Skarżysko-Kamien-na	3	0.24	1	100.00%	2	0.00%
County of Białogard	4	0.23	1	100.00%	2	0.00%
County of Mikołów	2	0.22	1	100.00%	2	0.00%
County of Radom	1	0.21	1	100.00%	2	0.00%
County of Oświęcim	2	0.20	1	100.00%	2	0.00%
County of Dzierżoniów	5	0.20	1	100.00%	2	0.00%
County of Węgorzewo	6	0.19	1	100.00%	2	0.00%
County of Inowrocław	6	0.19	1	100.00%	2	0.00%
County of Braniewo	6	0.19	1	100.00%	2	0.00%
County of Bartoszyce	6	0.18	1	100.00%	2	0.00%
County of Brzozów	3	0.18	1	100.00%	2	0.00%
County of Gołdap	6	0.18	1	100.00%	2	0.00%
County of Lidzbark	6	0.18	1	100.00%	2	0.00%
County of Bytów	6	0.18	1	100.00%	2	0.00%
County of Gryfice	4	0.17	1	100.00%	2	0.00%
County of Strzyżów	3	0.17	1	100.00%	2	0.00%

1	2	3	4	5	6	7
County of Nowy Dwór	6	0.17	1	100.00%	2	0.00%
County of Aleksandrów	6	0.17	1	100.00%	2	0.00%
County of Ostrów	3	0.16	1	95.98%	2	4.02%
County of Koneck	3	0.16	1	94.12%	2	5.88%
County of Łanicut	3	0.16	1	93.52%	2	6.48%
County of Świdwin	4	0.15	1	88.13%	2	11.87%
County of Lipno	6	0.14	1	81.35%	2	18.65%
County of Rypin	6	0.14	1	78.93%	2	21.07%
County of Chrzanów	2	0.14	1	76.01%	2	23.99%
County of Żnin	6	0.14	1	75.62%	2	24.38%
County of Grudziądz	6	0.13	1	74.07%	2	25.93%
County of Bieruń and Lędziny	2	0.13	1	71.25%	2	28.75%
County of Gostyń	1	0.13	1	71.09%	2	28.91%
County of Wąbrzeźno	6	0.13	1	67.11%	2	32.89%
County of Chełmno	6	0.12	1	65.46%	2	34.54%
County of Nowa Sól	4	0.12	1	65.29%	2	34.71%
County of Drawsko	4	0.12	1	64.65%	2	35.35%
County of Radziejów	6	0.12	1	61.24%	2	38.76%
County of Zduńska Wola	1	0.12	1	59.20%	2	40.80%
County of Giżycko	6	0.12	1	58.41%	2	41.59%
County of Opole	3	0.12	1	57.59%	2	42.41%
County of Starachowice	3	0.11	1	54.51%	2	45.49%
County of Maków	1	0.11	1	52.26%	2	47.74%
County of Sławno	4	0.11	1	50.65%	2	49.35%

Source: own compilation.

Some counties appeared in both classifications in the first class, namely county of Pruszków in Mazovia voivodship, county of Dzierżoniów in Lower Silesia voivodship, county of Oświęcim and county of Chrzanów in Małopolska voivodship, and finally county of Wodzisław, county of Mikołów, county of Bieruń and Lędziny in Silesia voivodship. The aforementioned counties are situated very near large urban districts and hence they are profoundly influenced by these districts. The vicinity of these districts brings about the fact that many people work in large cities where earnings are relatively high, hence average monthly earning is considerable, and, on the other hand, the number of unemployed may be considerable as well. Enlarging the city limits and creating so-called “estates–bedrooms” can bring about the fact that unemployment will be reduced and average earning may increase even more. Taken a longer perspective into consideration, this situation may lead to increase in production

costs. Therefore, these counties are not always the most attractive places for making investments despite high values of synthetic measure.

Values of synthetic measure obtained might be combined with a distance from optimum outlets. On the basis of Figure 2, three such areas were chosen, namely regions nearby Warsaw, Cracov, and Wroclaw. Distance between every point on the map of Poland and the nearest point given on the map has been determined. In this way, map showing the distances from these points was obtained (Figure 3).



Fig. 3. Optimum outlets and lines outlining areas situated at equal distance from these outlets

Source: own compilation.

The map showing distances was combined with map showing the value of synthetic measure in such a way so that in the case of points distant from optimum outlets, the value of the measure was reduced, and in the case of points situated near these outlets, this value increased. As a result, a map presenting the most optimum places for making investments was created. Figure 4 shows these places (they are marked with white colour). After eliminating places

situated too close optimum outlets, county of Przysucha, county of Radom and county of Szydłowiec turned out to be optimum areas.

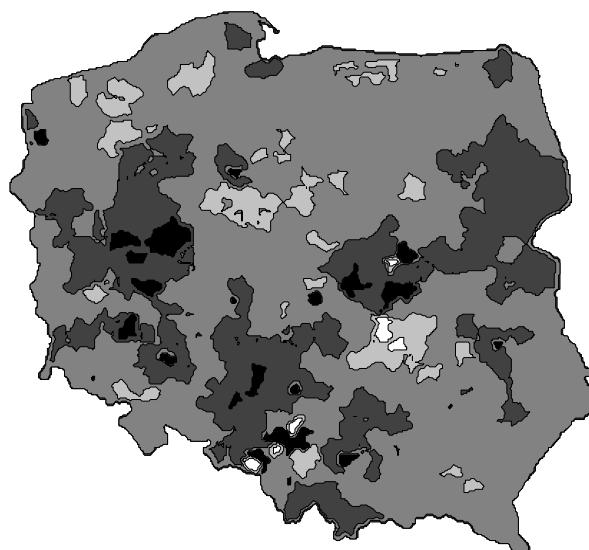


Fig. 4. Optimum places of investments once distances from optimum outlets had been taken into account

Source: own compilation.

Conclusion

Synthetic measure allows for determining optimum places of investments. It was assumed that optimum locations should be characterized mainly by high unemployment rate, low average gross earnings, and high population density. The research conducted showed that county of Przysucha, county of Radom and county of Szydłowiec were the most optimum regions (taken the assumptions made into consideration). Such research may be useful to local and foreign investors.

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**TAXONOMIC METHODS IN INVESTIGATION
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Summary

The paper is a presentation of the research on investment attractiveness of particular Polish counties (i.e. the second level of local government administration in Poland) depending on chosen diagnostic variables by means of multidimensional comparative analysis.