Location Factors of Non-public Higher Educational Institutions: The Evidence from Poland

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Abstract

The aim of the article is to find out the location factors of non-public higher education institutions in Poland after 1989. The logistic regression was used to meet this goal. Five sets of variables were selected for the initial stage of analysis. These were: population of the town and its hinterland, distance to the nearest academic centre, education level of inhabitants, local authority revenue and the existence nearby of other, potentially competing colleges. The analysis proved that the most important location factor of non-public higher education institutions was the existence of other, potentially competing colleges in the vicinity. This means that in the development of the network of non-public higher education institutions in Poland a key role was played by the „filling" of spatial niches on the education market.

Keywords: *location factors, non-public higher education, Poland, regression analysis, spatial market niches*

JEL Classification: I21, R39

Introduction

The second half of the 20th century was a period of unprecedented expansion of higher education in most countries in the western world (Aamodt, 1995; Hall, 1997; Altbach, 1999; Brockliss, 2000). In Western European countries, the main period of growth of higher schooling fell between the 1960s and 1980s. Many new colleges and universities were founded at this time, tertiary education was decentralised to a large extent, the number of students increased and the educational chances of young people from different social and regional backgrounds became significantly more even (see research on: *Finland* – Polomaki, 1997;

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Eliasson, 2006; Saarvita and Consoli, 2007; *Spain* – Quadrado, Loman and Folmer, 2001; *Netherlands* – Florax, 1992; *Norway* – Kyvik, 1983; Aamodt, 1995; *Sweden* – Premfors, 1984; Askling and Almen, 1997; Andersson, Quigley and Wilhelmson, 2004; *Great Britain* – Tight, 1987; 1996; 2007). In the post-socialist countries of Central and Eastern Europe, despite the expansion of the network of public educational institutions and growth in the number of students between 1946 – 1989, the real expansion of higher education took place alongside the democratic transformations after1989 (see Altbach, 1998; Bajerski, 2009b).

In the post-socialist countries of Eastern Europe after1989, education was seen as one of the major forces for modernising society. Higher education was to be more than just a vehicle for democratic and market values (see Kruszewski, 2000a; Galbraith, 2003), but was above all to fulfil a key role in creating a highly educated workforce (especially necessary in a time of intensive socio-economic transformation – see Klas, 2000; Woźnicki and Morawski, 2002; Buchner-Jeziorska, 2005; Bednarska, 2007) and was to satisfy to the fast growing educational aspirations of young people from the 70's and 80's second population boom generation.[1] The growing demand for higher education and the bad state of public finances of states in the region meant that in many of them there arose serious economic barriers to the expansion of public higher education offering free studies (Altbach, 1998; Galbraith, 2003; Bjarnason et al., 2009). In this situation, the governments of Central and Eastern European countries sooner or later began to seek opportunities for expanding tertiary education beyond the public sector. One effect of this search was the diffusion of a system of fee--paying non-day courses and permission to found non-public colleges and universities which charge fees (Dietl, 2001; Dąbrowa-Szefler and Jabłecka-Prysłopska, 2006; Kwiek, 2006; 2008; Bjarnason et al., 2009). The second process is particularly interesting – the formation and expansion of non-public higher education, a completely new structure of the higher education system which began to play an ever more important role in Central and Eastern Europe. The main conditions of the development of non-public education in countries in the region are presented in Figure 1.

The significance of non-public education in the socio-economic transformation processes is documented by the fact that all of the post-socialist countries in Central and Eastern Europe allowed the foundation of non-public colleges and universities after 1989, and in some of them the non-public sector today forms an important part of the whole higher education sector. Altogether in the

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[1] The growing educational aspirations of young people were closely connected with the ever stronger relation between education and earnings and the individual's economic situation (Simonová and Antonowicz, 2006).

post-socialist countries of Central and Eastern Europe more than 1,300 non-public higher educational establishments have appeared (the most in Russia – over 400, in Poland – over 300 and in Ukraine – over 200). In 2006 these were educating nearly 2 million of students (17.6% of the total). The non-public sector taught the largest proportions of students in Poland (31%), Latvia (28%), Romania (22%), Estonia (21%), Bulgaria (16%) and Belarus (16% – see UNESCO-CEPES, 2006). Analysing the above data, it is noticeable that due to the role played by non-public schooling in the countries of Central and Eastern Europe, some of these may serve as an excellent field of research for studies into the regularities of the development of non-public higher education in a period of introducing a market economy. Poland is a good example of this, distinguished by the second largest number of non-public colleges and universities (after Russia) and the greatest significance of these establishments in the higher education system among all the countries in the region. Due to the mainly similar conditions for development of non-public higher education in the countries of Central and Eastern Europe, some of the regularities in the expansion of this sector in Poland can be considered largely representative of the other countries in the region.

F i g u r e 1

Influence of Social, Political and Economic Conditions on the Formation of Non-public Higher Education in Central and Eastern Europe
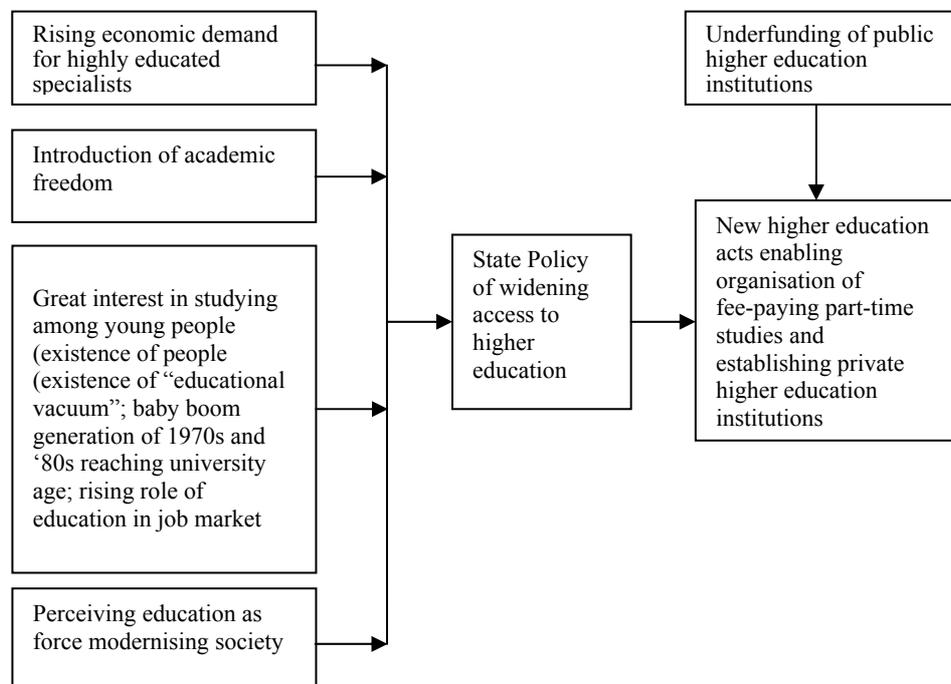
Source: Own compilation.

The aim of the article is to analyse the location factors of non-public higher education institutions in Poland between 1990 and 2007. This question is significant for two reasons: (1) non-public education was one of the „major forces" shaping Poland's educational landscape after 1989 – without understanding its spatial development it is impossible to understand the transformation of the whole higher education system, (2) despite the fact that non-public institutions are private enterprises motivated by profit, „private higher education addresses public needs, meets public purposes and remains a public concern" (Fried, Glass and Baumgartl, 2006, p. 3).

The Development of Non-public Higher Education in Poland

The possibility of founding non-public schools and universities in Poland was introduced as early as 1990 by the appropriate provisions of the first post-socialist higher education act. The first non-public colleges began operating in Poland in 1991. By the academic year 1996/1997 the number of non-public establishments (114) exceeded the number of public ones (99). By 2006 their number had risen to 318, i.e. to 71% of the total number. A major role in the dynamic increase in the number of non-public colleges and universities was played by significant deregulation in higher education, manifesting itself among other things in a lack of statutory control mechanisms regulating the functioning of non-public colleges (including the standard of teaching – the situation was quite different in, for example, the Czech Republic and Slovakia, where such bodies were appointed before the first non-public colleges – see Jaroszewska, 1999; Galbraith, 2003; Šebková and Svatoň, 2003; Bajerski, 2007). On the one hand the lack of such mechanisms significantly facilitated the foundation of more institutions, but on the other, combined with constant underfunding of public higher education, it led to employees of educational establishments working in several jobs – in addition to their posts at public colleges or universities they worked in the non-public sector or in public vocational colleges. An effect of this, particularly in the early 1990s, were problems with ensuring the appropriate quality of the education process. Similar problems occurred in most of the post-socialist countries of Central and Eastern Europe after 1989 (see Fried, Glass and Baumgartl, 2006; Kwiek, 2006).

Between 1990 – 2007 the number of students in Poland rose from 300,000 to nearly 2 million of students in. The main influence on this unprecedented growth was the opening up of the public sector, where the number of students rose by 1 million. Another major role was played by the appearance and expansion of non-public higher education, with nearly 650,000 students in 2007. Non-public

institutions therefore account for 40% of the total growth of number of students in 1990 – 2007. Two major conditions are worthy of attention in explaining the blossoming and great popularity of non-public education in Poland. The first of these was the inadequate number of places available on courses at public educational institutions (particularly universities and economics colleges), which resulted in the existence of market niches, enabling the development of non-public institutions (Dietl, 2003). The second condition was the constant growth in the population's income during the transformation period, which greatly increased the possibility for households to finance tertiary education (Bednarska, 2007).

Studies on the Location Factors of Non-public Higher Educational Institutions

The spatial expansion of the network of non-public institutions is from the geographical point of view one of the most important issues concerning the development of higher education after 1989 in Poland and in Eastern and Central Europe. However, in the research undertaken so far, little attention has been paid to the localisation of non-public educational institutions, meaning that the issue is to a large extent unstudied. Such research is lacking not only in Poland and Central and Eastern Europe, but also in Western European countries. This is a reminder that so far only two factors in the localisation of non-public educational institutions have been properly described – the significance of a town or region's population, and its economic situation. Non-public colleges and universities, as enterprises motivated mainly by the opportunity to make a profit, have mostly been founded in the largest and richest conurbations and regions in which there are the greatest numbers of potential students (see studies on Czech Republic – Bajerski, 2007; Portugal – Amaral and Teixeira, 2000; 2001; Correia, Amaral and Magalhaes, 2002; Poland – Nowosielska, 2002; Bajerski, 2009a; 2009b).

Especially significant is the influence of the town or region's population. In Poland, too, this plays a fundamental role on the localisation of non-public colleges and universities. Its significance is confirmed by the existence of two thresholds in a town's population level, which are of importance from the point of view of the location of these institutions – 100,000 and 30,000 people. Firstly, during the period 1991 – 2007 non-public higher education establishments, with one exception,[2] were founded in all urban areas with over 100,000 inhabitants (on average the larger the town, the more non-public establishments). Secondly, non--public institutions were founded in 35% of towns with 30 to 40,000 inhabitants,

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[2] The only exception is Kalisz, where there is only a state vocational college and a branch of Poznan's Adam Mickiewicz University.

but in a mere 7% of towns with 20 to 30,000 inhabitants.[3] These thresholds formed over time, as initially non-public colleges were mainly founded in the largest towns. It was only as the years passed that they began to appear in smaller towns. This well documents the constant decrease in the average number of inhabitants of a town receiving its first non-public college (see Bajerski, 2009b).

Reference to the population factor is not enough to explain the foundation of non-public education in towns with populations of 30 to 100,000, in centres of mainly sub-regional importance. Distribution of non-public higher education institutions within this group of towns is relatively proportional (non-public education occurs in 39% of towns with 30 to 50,000 inhabitants and in 59% of towns with 80 to 100,000 inhabitants). This means that in their case, apart from the positive impact of population of the urban centre, other factors must also be of great significance. As can be expected, individual motivation and factors, which would be difficult to generalise and expand into parameters, were certainly important (such as an available local base, contact with academic staff, financial resources of those intending to found the institution, or belief in the possibility of founding it).[4] On the other hand, however, as can be suspected, the location of non-public education could also have been dependent on towns' different characteristics, as well as influenced by the transformations taking place in the spatial structure of higher education.

In the research a detailed analysis was made of 78 Polish towns with between 30 and 100,00 inhabitants. From among the total number of towns of this size, the analysis omitted those included in larger centres of higher education, and towns bordering the Upper Silesian conurbation. This was decided by the very strong functional relationships of particular towns, meaning that their urban rank or development factors in specific economic fields could deviate greatly from the rest of the country.

Characteristics of the Variables Used

In order to discover the factors influencing the localisation of non-public colleges in Polish cities with populations of 30 to 100,000, five sets of variables were selected for the initial stage of analysis, and treated as potential variables for the localisation of non-public colleges. The choice of variables has been done

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[3] This threshold corresponds to frequent fulfilling of a more than local role. The larger of the district centres have over 30,000 inhabitants

[4] The motivation for opening particular colleges in a specific place could be researched by interviews at non-public educational establishments. These would not, though, enable information to be gleaned about why such establishments were not founded in other towns, which would not allow full parameterisation of these variables.

on a basis of the previous research on the functioning of non-public higher education institutions in Poland and other European countries. The variables selected were: (1) population of the town and its hinterland; (2) distance to the nearest traditional centre of higher education; (3) education level of inhabitants; (4) local authority revenue and (5) the existence nearby of other, potentially competing colleges. Selected variables refer to geographical and socio-economic characteristic of individual towns being analysed. The justification of these variable sets as potential variables in the development of non-public higher education is given below.

(1) One of the key factors in the foundation of non-public educational institutions is the number of potential candidates for places (see e.g. Amaral and Teixeira, 2000; 2001; Correia, Amaral and Magalhaes, 2002; Nowosielska, 2002; Bajerski, 2009a; 2009b). This number, in the case of non-public higher education which usually has a local effect, mainly consists of the inhabitants of the town in which it is located, and of its hinterland (Kruszewski, 2000b; Szabłowski, 2001; Dietl, 2003; Wojciechowski, 2006). Due to the fact that the Main Statistical Office in Warsaw does not conduct research on journeys to work or school, and because it is impossible to delimit (owing to a lack of data) the hinterland regions of individual towns, the variable „population" was defined in 5 different ways. These were: (I) the number of inhabitants of the town, (II) the number of inhabitants within 20 km, (III) the number of inhabitants within 30 km, (IV) the number of inhabitants within 20 km excluding major towns, (V) the number of inhabitants within 30 km excluding major towns. The last two variables (IV and V) are connected with the assumption that more people from small towns will take up studies in larger ones than vice versa. All five variables are potential stimulants. A further analysis was to lead to a verification of the thesis about the role of a town's population in the development of non-public educational institutions in towns of 30 to 100,000 inhabitants, and the selection of the most appropriate population-based measure. Population figures from 1998 were used, calculations were made using MapInfo 9.0 software.

(2) It was assumed that one of the factors in the founding of a non-public college or university may be the distance from traditional centres of higher education. This could have a double effect. On the one hand it could act as a destimulant to the foundation of a college, due to the fact that all non-public education is based on academic staff working simultaneously in the public system as their main place of employment (Jałowiecki, 2001; Woźnicki and Morawski, 2002; Bajerski, 2008; 2009b), so a greater distance from the location of the largest public colleges or universities (traditional centres of higher education) makes it more difficult to recruit academic staff. On the other hand, it could be

a stimulant to the foundation of a college – a greater distance from traditional centres of higher education increases the number of people who, for financial reasons, will be unable to study at these (cf. Kruszewski, 2000b; Szabłowski, 2001; Dietl, 2003). Distance was taken as the physical distance.

(3) It was assumed that one of the factors in the founding of a non-public college or university may be the proportion of a population with a higher education. A higher proportion may, on the one hand, increase the number of people proposing to open it, and on the other it increases the educational aspirations of the community and the chances for young people to take up studying (inc. Świerzbowska-Kowalik, 2000; Beblo and Lauer, 2004; Domański, 2004; Śle-szyński, 2004). Data was used on the proportion of people with a higher education among the population aged 15 and over in the towns and cities analysed in 1988. This variable takes the form of a stimulant.

(4) It was assumed that the foundation of a college or university could affect the revenues of local authority budgets per inhabitant. Richer areas have more possibility to support colleges financially. M. Geryk (2007) mentions that between1999 – 2004 10% of non-public colleges were subsidised by local authorities. The data on local authority areas' income is in PLN per inhabitant in 2000. In the case of towns which also constitute districts („powiaty“), these also include powiat's revenues per capita. Due to the fact that powiat towns usually have higher revenues than other towns, and that most of them are former provincial (voivodeship) capitals according to the administrative division of the country between 1975 – 1999, the amount of revenues per inhabitant can also be treated as a measure of the influence of a town's administrative status on the foundation of a college. This variable is considered a potential stimulant.

(5) It has been assumed that in the transformation of the spatial structure of non-public higher education the „filling" of spatial market niches could play an important role (Szabłowski, 2002). It was therefore assumed that along with the foundation of colleges in more towns, the probability of their foundation in nearby towns would decrease. In the research, due to the local influence of the majority of non-public colleges (Kruszewski, 2000b; Szabłowski, 2001; Dietl, 2003; Wojciechowski, 2006), the existence (foundation) of another college, university or multi-departmental branch of one of these within 30 km of the town being analysed was taken as a destimulant. This data is of a binary nature, assuming only the values 1 or 0. Data on the existence of competing institutions was presented in 2 ways: (I) taking into consideration all the higher education institutions within 30 km of the town being analysed, (II) only taking into consideration those institutions located in towns with a population larger than the town analysed and situated within 30 km of it. In the second case it was assumed that

the existence of a college or university in a nearby smaller town not only would not limit the chance of one being created in the larger town, but might actually provide motivation to create it. A list of the variables used and the assumed directions of their influence is presented in Table 1.[5]

T a b l e 1

Variables Used in Analysing the Factors in the Founding of a Non-public Educational Institution in Towns with 30 to 100 Thousand Inhabitants

Variable	Predicted Direction of Influence
Population in 1998 (in 100,000) (P)	+
Population within a radius of 20 km in 1998 (in 100,000) (P20a)	+
Population within a radius of 20 km without larger towns in 1998 (in 100,000) (P20b)	+
Population within a radius of 30 km in 1988 (in 100,000) (P30a)	+
Population within a radius of 30 km without larger towns in 1998 (in 100,000) (P30b)	+
Distance from traditional centres of higher education in km (D)	+, −
% of population with higher education in 1988 (H)	+
Local authority revenues per inhabitant (in 1,000 PLN) w 2000 (R)	+
Existence of another college or university within 30 km (U30a)	−
Existence of another college or university within 30 km excluding smaller towns (U30b)	−

Source: Own compilation.

Using Logistic Regression Analysis to Search the Location Factors of Non-public Higher Educational Institutions

By 2007, there were colleges and/or universities in 37 of the 78 towns analysed (see Appendix). Individual towns contained between 0 and 3. Due to the significant differences in the sizes of specific institutions and the number of courses offered, it was decided to simplify the data by taking the value 1 if a given town had a college or university, and 0 if not. The same was done for the existence or non-existence of another, potentially competing, college or university within 30 km.

Due to the use of binary variables, only taking the values 0 or 1, logistic regression was used. The logistic function assumes values ranging from 0 to 1. The result of a logistic regression analysis can therefore be interpreted as a measure of probability of a given event occurring, which is included in the same range.

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[5] Due to changes in Polish public statistics, it was impossible to acquire data characterizing whole 1990 – 2007 period. For those reasons the data for the middle of the analyzed period has been used (1998). In some cases, however, due to the lack of appropriate data, it was necessary to use data for different years. In the case of variable H (% of population with higher education) there are only census data for the years 1988 and 2002. In the case of variable R (Local authority revenues per inhabitant) the data has been accessible from the year 2000.

The logistic function is expressed by the formula:

$$y = \frac{1}{1 + e^{-b_0 - b_1 x_1 - b_2 x_2 - \ldots - b_n x_n}}$$

It was taken that logistic function values of 0.5 and more for a given centre mean that by 2007 a non-public institution of higher education should arise. A smaller value indicates that statistically non-public higher education institution should not appear. The regression analysis was conducted using the backstep method, which involves including in the initial stage of the model all the variables which may affect the value of the variable being explained, and then eliminating in turn all those variables which do not meet the criteria of statistical relevance.

The analysis conducted required 8 steps, i.e. the elimination of 7 initial variables originally included in the model. The following variables were removed in order: U30a, P30a, D, H, P30b, P20b and P. Variable P20a (population concentrated within 20 km of a town analysed) was considered statistically significant, as were R (revenues of a local authority per inhabitant) and U30b (the existence within 30 km of another college or university, except in places smaller than that analysed – Table 2). The extent to which the model fits the initial variables is calculated using the Cox-Snell and Negelkerke pseudo-measures. In the first case the value r^2 stood at 0.29, in the second 0.39. The final model took the form:[6]

$$y = \frac{1}{1 + e^{3,138 - 1,343*L20a - 1,593*D + 2,872*U30b}}$$

T a b l e 2

Results of the Estimation of the Logistic Regression Model

Independent variable	Estimation of B Parameter	Value of Wald Statistic	Significance Level p
P20a (Population within a radius of 20 km in 1998)	1.343	7.734	0.005
R (Local authority revenues per inhabitant in 2000)	1.593	4.739	0.029
U30b (Existence of another college or university within 30 km excluding smaller towns)	–2.872	15.701	0.000

Source: Own compilation.

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[6] Due to the large number of variables in comparison to the number of observation units (towns researched), the parameters of the model were also estimated with only 3 variables considered, not eliminated by the step method (P20a, R and U30b). The effect of estimating the parameters was the same in the case where step method analysis was used. The disadvantage of method applied in connection with the use of Wald statistics as the criterion for dropping out an independent variable is its relatively low reliability.

T a b l e 3

**Relationship between the Values Observed and the Values Estimated Based
on the Model**

Observed Values	Estimated Values		
	Towns where the NPHEI should not have been located (due to model)	Towns where the NPHEI should have been located (due to model)	% correct
Towns where NPHEI have not been located	31	10	75.6
Towns where NPHEI have been located	8	29	78.4
General			76.9

Source: Own compilation.

The relatively major relation of the model to reality was confirmed by comparing the group of towns where non-public colleges were founded with the group of towns where the probability of their founding as indicated by the model constructed was over 0.5 (Table 3). From among the 39 towns indicated by the model, non-public colleges were actually founded in 29 (74%). In total, 76% of the towns where colleges were opened were identified, and 78% of the towns where they were not founded. The significant adequacy of the model indicates that the three variables described may be considered as location factors of non-public institutions of higher education, and thus that they played an important role in the development of the spatial structure of non-public education in Poland.

Major Location Factors of Non-public Higher Educational Institutions in Medium-sized Polish Towns

In order to explain more fully the spatial development of non-public higher education it was necessary to indicate the factor which could be considered to play the statistically most important role in the creation of non-public colleges in towns with populations of 30 to 100,000. In the logistic models, the Wald statistic may be used to assess the significance of its individual parameters (Domagalska-Grędys, 2006). The higher its value, the stronger the basis for considering the estimate of a given coefficient as the proper solution. Using this measure and turning attention to the level of significance of the model's estimated parameters, the most important variable should be taken as U30b, i.e. the existence within 30 km of another college, university or multi-department branch of one of these (institutions located in towns smaller than that analysed were not taken into consideration). Variable P20a, i.e. the population concentrated within 20 km, was of less significance, as was R, namely the local authority budget's revenues per inhabitant (Table 2).

The results above mean that if, within 30 km, a higher education institution existed or was created in a large town, this significantly reduced the statistical probability of a non-public institution being founded in a smaller town nearby. This leads to the conclusion that the founding in a given town of a non-public college or university was less dependent statistically on the characteristics of that town, and to a greater extent on the development of higher education in neighbouring towns, and thus on the filling of a spatial niche on the higher education market. The rejection in the analysis of variable U30a, containing the potential influence of institutions in towns smaller then that analysed, also indicates that the relation is of a hierarchical nature – the creation of a non-public college in a given town was potentially influenced only by the existence of a college in a larger town.

With reference to the last two statistically significant variables, it can be seen that the population concentrated within 20 km of the town analysed (P20a) certainly shows a great correspondence with the number of inhabitants the functional micro-regions of the towns analysed, as defined by journeys to work or school. However the lack of such data makes this thesis impossible to verify. As far as the level of the local authorities' revenues per inhabitant (R) is concerned, this is where the measure of a town's administrative status should be sought, since the highest relative values of income are typical for towns of urban powiat status – these were mostly provincial capitals during 1975 – 1999.[7] Variable D can to a large extent be identified with a town's status as capital of a province (voivodeship) until 1999 and also usually with its sub-regional role in the settlement system.

Conclusions

In summarising the analysis carried out of the localisation of non-public higher education establishments, it should be stated that in the development of the network of non-public higher education institutions in Poland, besides universal factor already identified in previous research – the population of a town or region, a key role was played by the „filling" of spatial niches on the education market. This means that, outside the largest urban areas, non-public educational institutions most often appeared in places where previously there had been no other educational institutions. Non-public higher education institutions, being

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[7] Of the 78 towns used in the analysis, 19 are former provincial (voivodeship) capitals, and 16 of these have powiat (district) status (except Piła, Ciechanów and Sieradz). Świnoujście and Grudziądz are also powiat towns. Non-public colleges or universities had been founded in 14 of the 19 former provincial capitals.

basically private enterprises, is usually located in towns which had no competing educational institutions nearby. It is therefore justifiable to state that the development of non-public higher education has led to the emergence of a system of higher education which spatially complements the system of public higher education.

The process of non-public colleges filling gaps in the higher education market was to a great degree connected with the failure of the spatial structure of public higher education, inherited from the socialist period, to adapt to the growing educational aspirations of a society in transition. Research has confirmed the conclusions already reached that, in spite of the commercial orientation of most non-public colleges and their disposition towards teaching subjects which do not require great costs, such as economics and social sciences, (Jóźwiak, 2002; Woźnicki and Morawski, 2002; Geryk, 2007; Bajerski, 2009b), they have become a tool for equalizing educational opportunities in Poland both in social (see Jałowiecki, 2001; Kwiek, 2008), and spatial terms (see Kruszewski, 2000b; Szabłowski, 2001; Dietl, 2003; Wojciechowski, 2006).

Although it only involves one country, Poland, the analysis conducted in the article may be treated as an indicator in analysing the localisation and expansion of the network of non-public higher education in other countries of Central and Eastern Europe. It can be assumed that in countries where, similarly to Poland, right at the threshold of the post-socialist transformation the possibility was introduced to found non-public educational institutions (e.g. Romania), the main factors in the localisation of non-public educational institutions would be similar to those in Poland. In countries where this process began later and proceeded less dynamically (e.g. the Czech Republic and Slovakia), the results of the analysis below may be useful in shaping an educational policy for those countries for subsequent years, which should be partly based on proper recognition of location factor of non-public higher education institutions.

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Appendix

List of Towns and Variables Used in the Regression Analysis

Town	NPHEI	P	P20a	P20b	P30a	P30b	D	H	R	U30a	U30b
Column	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Grudziądz	1	1.00	1.82	1.82	3.50	3.50	53	5.74	1.88	1	0
Jelenia Góra	0	0.88	1.77	1.77	3.13	3.13	93	9.36	2.17	1	1
Nowy Sącz	1	0.84	2.53	2.53	4.07	4.07	72	10.23	2.23	0	0
Konin	0	0.81	1.82	1.82	3.47	3.47	92	8.48	2.14	1	1
Piotrków Tryb.	1	0.80	1.60	1.60	3.93	3.93	45	7.60	1.98	1	1
Inowrocław	0	0.78	1.89	1.89	2.93	2.93	36	6.35	1.06	0	0
Lubin	1	0.78	1.61	1.61	4.05	2.96	65	6.83	1.34	1	1
Siedlce	1	0.77	1.49	1.49	2.84	2.84	86	9.96	2.04	1	1
Piła	1	0.75	1.31	1.31	2.44	2.44	83	9.99	1.13	0	0
Ostrowiec Św.	1	0.74	1.68	1.68	3.29	3.29	89	7.09	0.97	0	0
Ostrów Wlkp.	0	0.73	1.64	1.64	4.31	3.25	81	7.11	1.07	1	1
Stargard Szcz.	1	0.71	1.01	1.01	6.14	1.97	35	6.81	1.22	0	0
Gniezno	1	0.70	1.43	1.43	2.89	2.89	48	5.83	0.98	0	0
Głogów	0	0.69	1.42	1.42	2.77	2.77	89	6.29	1.23	1	1
Suwałki	1	0.69	0.98	0.98	1.79	1.79	108	8.81	2.05	0	0
Chełm	1	0.69	1.36	1.36	1.99	1.99	65	8.45	2.04	0	0
Przemyśl	1	0.68	1.42	1.42	2.60	2.60	62	9.47	2.13	0	0
Tomaszów Mazowiecki	0	0.67	1.32	1.32	3.40	2.58	48	5.23	0.93	1	1
Zamość	1	0.67	1.46	1.46	2.19	2.19	76	11.15	2.07	0	0
Stalowa Wola	1	0.66	1.64	1.64	3.55	2.83	59	10.56	1.02	0	0
Kędzierzyn-Koźle	0	0.66	1.91	1.91	4.61	4.61	58	6.53	1.29	1	1
Łomża	1	0.64	1.04	1.04	2.10	2.10	73	10.31	1.83	0	0
Leszno	1	0.64	1.74	1.74	2.73	2.73	67	8.51	2.11	0	0
Bełchatów	0	0.62	1.27	1.27	3.00	2.19	47	5.80	1.30	1	1
Mielec	1	0.61	1.61	1.61	3.84	3.84	48	10.90	1.04	0	0
Świdnica	1	0.61	3.83	2.46	5.36	3.99	47	7.15	1.40	1	1
Tczew	0	0.60	2.03	2.03	3.70	3.70	35	8.51	1.07	1	0
Biała Podlaska	0	0.58	0.96	0.98	1.74	1.74	97	9.56	1.88	1	1
Ełk	0	0.56	0.85	0.85	1.87	1.87	92	6.27	1.11	0	0
Ostrołęka	1	0.54	1.06	1.06	1.63	1.63	102	8.50	2.04	0	0
Starachowice	0	0.54	1.93	1.93	4.09	3.30	37	7.74	1.08	1	1
Puławy	1	0.50	1.51	1.51	2.79	2.79	45	10.64	1.33	0	0
Tarnobrzeg	0	0.50	1.86	1.86	3.63	2.92	64	9.29	1.85	1	1
Skarżysko-Kam.	0	0.50	2.31	1.74	3.68	3.11	31	8.12	0.94	0	0
Radomsko	0	0.49	1.23	1.23	2.09	2.09	38	5.59	1.09	0	0

Continued

Skierniewice	1	0.49	1.19	1.19	3.04	3.04	53	9.87	1.83	1	0
Starogard Gdański	1	0.48	1.39	1.39	2.79	2.18	47	4.85	1.18	0	0
Kutno	1	0.48	1.26	1.26	2.47	2.47	51	6.26	1.08	0	0
Krosno	0	0.48	2.06	2.06	3.89	3.89	42	12.18	2.39	1	1
Nysa	0	0.48	1.34	1.34	2.63	2.63	75	8.25	1.22	1	1
Dębica	0	0.47	1.98	1.98	4.08	3.44	42	9.99	1.13	1	1
Ciechanów	1	0.46	0.92	0.92	1.92	1.92	77	8.76	1.13	0	0
Kołobrzeg	0	0.45	0.73	0.74	1.18	1.18	107	8.81	1.22	0	0
Zduńska Wola	0	0.45	1.77	1.77	3.43	2.68	40	5.61	0.99	1	1
Wejherowo	1	0.45	4.58	1.62	5.81	2.43	27	6.31	1.07	1	1
Sieradz	1	0.44	1.67	1.22	2.46	2.00	53	8.89	1.04	0	0
Żyrardów	1	0.41	1.84	1.84	4.27	3.63	44	5.74	1.18	0	0
Bolesławiec	0	0.41	1.09	1.09	2.43	2.43	77	6.82	1.21	0	0
Świnoujście	0	0.41	0.50	0.50	0.70	0.70	80	7.60	2.06	0	0
Nowa Sól	0	0.41	1.03	1.03	3.79	1.87	21	5.96	1.14	1	1
Jarosław	0	0.41	1.72	1.72	3.78	3.10	48	8.10	1.15	1	1
Chojnice	1	0.40	0.92	0.92	1.85	1.85	71	5.13	1.22	0	0
Sanok	0	0.40	1.37	1.37	2.26	2.26	54	10.28	1.06	1	1
Żary	1	0.39	1.36	1.36	1.82	1.82	43	6.01	1.26	0	0
Szczecinek	0	0.39	0.73	0.73	1.09	1.09	64	6.95	1.24	0	0
Malbork	0	0.39	1.74	1.13	2.95	2.34	49	6.74	1.06	1	1
Brzeg	1	0.39	1.61	1.61	3.06	3.06	40	7.46	1.12	0	0
Sochaczew	1	0.38	1.15	1.15	2.95	2.51	52	5.86	1.10	1	0
Kwidzyn	1	0.38	1.01	1.01	2.13	2.13	76	6.11	1.36	0	0
Jasło	1	0.38	2.07	2.07	4.28	3.79	50	9.60	1.34	1	1
Olkusz	0	0.38	3.37	2.06	9.82	4.11	40	8.47	1.15	1	1
Mińsk Mazow.	0	0.37	1.95	1.51	4.52	3.15	38	7.75	1.11	1	1
Oleśnica	0	0.37	1.19	1.19	9.01	2.63	28	6.89	1.09	1	1
Kraśnik	0	0.36	1.05	1.05	2.33	2.33	43	7.29	0.96	0	0
Cieszyn	0	0.36	1.39	1.39	5.54	2.72	63	8.58	1.21	1	1
Lębork	0	0.35	0.78	0.78	1.42	1.42	59	5.70	1.11	0	0
Dzierżoniów	1	0.35	2.44	1.79	5.31	3.29	50	5.72	0.99	1	1
Ostróda	0	0.34	0.60	0.60	1.92	1.92	36	6.27	1.02	0	0
Nowy Targ	0	0.33	1.64	1.64	3.11	3.11	64	7.85	1.07	1	1
Zgorzelec	0	0.33	0.95	0.95	1.74	1.74	96	6.43	1.07	0	0
Myszków	0	0.33	1.81	1.25	7.29	2.84	42	5.50	1.05	1	1
Iława	0	0.32	1.02	1.02	2.08	1.73	63	5.80	1.24	0	0
Żywiec	1	0.32	3.69	1.89	6.63	4.47	65	8.37	1.49	1	1
Bielawa	0	0.32	2.77	1.74	5.95	3.55	57	3.96	1.21	1	1
Oława	0	0.31	1.54	1.14	9.21	2.44	26	5.88	1.04	1	1
Łuków	1	0.31	0.94	0.94	3.08	2.32	78	6.15	0.97	1	1
Łowicz	1	0.30	1.07	1.07	3.07	2.19	49	6.64	1.05	0	0
Śrem	0	0.30	1.12	1.12	2.99	2.99	37	5.69	1.06	0	0

Note: NPHEI – non-public higher education institution; in the variables for table 1, for columns 2, 10, 11 the number 1 denotes the existence of a college or university, 0 – the lack of one.

Source: Own compilation based on the data of Central Statistical Office in Warsaw.