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Creation and Absorption of Human Capital by Academic Cities in Poland[1]

Human capital stock affects economic growth by raising the productivity of labour in a given area or by enhancing the ability of the regional economy to create and absorb innovations. From the perspective of an academic city, this process can be reinforced by attracting students and researchers to study and work at the local universities. To do this successfully, the city needs not only high quality academic institutions but also a wider labour market for educated individuals and, more generally, the ability to attract the creative class to settle down. The article provides a comparative analysis of the capacity of the largest Polish cities to attract and absorb human capital. The research is based on a unique dataset coming from the *nasza-klasa.pl* website (which allows users to contact their former classmates). The research concludes with the typology of Polish cities with respect to benefits from performing the academic function.

Human capital is considered to be an important factor in regional and local development. The theoretical foundations for such a view are provided both by the development models outlined in works on Regional Studies (Florida 2000; Porter 2001), as well as by the economic growth models developed by Lucas (1988) and Nelson-Phelps (1966). Although these particular economic theories were formulated mainly in reference to the development of national economies, the mechanisms they unveil can be observed – sometimes even more easily – at lower levels of aggregation.

The impact of human capital (and especially knowledge capital) on economic development is well documented both nationally and regionally. In their major work, published in the *American Economic Review*, Mankiw, Romer and Weil (1992) argue that the level of education can largely explain differences in per capita GDP between various countries. The model proposed by Mankiw, Romer and Weil, known as the 'augmented' Solow model (as, unlike the original, it takes into account the human capital factor), has considerably enhanced the quality of GDP per capita forecasts as compared to the model which only employed such factors as labour resources and physical capital to explain growth. The results obtained by Mankiw, Romer and Weil inspired many researchers

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who strived to verify the influence of human capital on economic growth in the subsequent years. The key works in this respect were published by Benhabib and Spiegel (1994), Barro (1999), Bils and Klenow (2000), and Bernanke and Gurkaynak (2001).

The role of human capital in development was also corroborated by many empirical studies conducted regionally. Using a panel dataset for the period from the 1960s to the 1990s, Di Liberto and Symons (2001) proved that, in the past, the level of education markedly influenced the regional rates of growth in Italy, even though this positive effect was primarily due to the popularisation of primary education in the poorly developed South of the country. In contrast, Badinger and Tondl (2002) argue that, contemporarily, in the whole of Europe (the study was carried out using the data from 128 regions in 10 EU Member States), economic growth is strongly correlated with education resources, mostly at the tertiary level. Furthermore, the significance of human capital for the pace of regional development was corroborated in a paper by de la Fuente (2002) focusing on Spain. In this study, de la Fuente proved that the equalising of the levels of education as well as the import of technological solutions have been two main factors responsible for the economic convergence of the Spanish regions. Another study, by Persson and Malmberg (1996), which analysed the drivers of economic growth in US regions in the period 1920-1990, shows that in the past the level of human capital (measured by the average number of schooling years) had a substantial and positive impact on regional rates of growth.

Similarly, post 1989 in Poland, regions with a high human capital potential reported faster growth. Studies carried out at the subregional level for 1995–2003 (Herbst 2007) (later extended till 2006 in draft versions) suggest a strong statistical correlation between the level of the residents' education, the regional per capita GDP and the rate of economic growth.

When comparing the pace of growth of regional economies, we in fact compare the potential of the regions' largest cities. Decades of accelerated metropolisation, an increasing share of services (including financial ones) in the GDP, and the growing role of tertiary education in the labour market, are factors which make regional metropolises the key actors determining development prospects of their regions.

According to the aforementioned theories formulated by Lucas and Nelson-Phelps, human capital influences regional development by improving labour productivity in a given area or by enhancing the capacity of a given economy to generate and absorb innovations in various fields. Seen from the perspective of an academic city, the necessary pre-condition for these two mechanisms to succeed is the ability to attract students and academic teachers to the local universities and colleges. To absorb human capital, a city not only needs to have top quality higher education institutions but also to offer a ready labour market for its graduates and an attractive place to live for well-educated people. If we limit our discussion to students and graduates (without taking academic teachers into account), we can say that the success of a city in building its human capital po-

tential through the strengthening of its academic function is in fact dependent on two issues:

- Can the city (its higher education institutions) attract students?
- Can the city retain the graduates in the local labour market?

Finding answers to these questions would make it possible to evaluate the city's efficiency in attracting and absorbing human capital which, according to the theory and results of empirical studies, considerably determines the capacity for fast development of both a given city and the surrounding region. Regrettably, the data provided by the public statistics system do not allow to attempt any in-depth analyses. Although they include information on the number of students and the higher education institutions that they choose, areas and modes of study, the official publications say nothing about the past of the students studying in various cities, namely what secondary schools they attended or what distance they are willing to travel in order to study in the city and at the university or college of their choice. Such data can be found in the USOS database, now being widely introduced by Polish universities, but access to the information is given rather reluctantly due to fears of infringing upon the personal data protection regulations and because of technical difficulties. However, even if such a set of data was compiled for one higher education institution, it would not be sufficient to evaluate the 'academic attractiveness' of the whole city, nor to make comparisons between different universities or cities. Of necessity, therefore, studies on the capacity to attract students published in Poland to date either have been monographs which analysed the situation at individual higher education institutions (Wasielewski 2004) or have relied on estimates based on very general data published by the Central Statistical Office, or GUS (Chojnicki, Czyż 1997).

Data concerning the situation of university graduates are even more scanty. Research of this type is conducted almost exclusively at the level of individual higher education institutions, by the university career centres, promotion bureaus or alumni associations, such as for example the studies by the Socio-Economic Association 'Absolwent' (The Graduate) of the University of Information Technology and Management in Rzeszów (*Losy absolwentów – raport* 2008). These studies cover samples which are dissimilar in terms of numbers and methodologies used and therefore their results cannot be compared. Moreover, in many cases, the questionnaires used do not tackle at all the issue of the spatial mobility of graduates and focus on their career achievements instead.

The study discussed in this paper relies on a source of data lying outside the sphere of public statistics, and does not require statistics to be collected at higher education institutions. It is *nasza-klasa.pl*, a social networking website where users can register with their current or past class or student group in order to maintain or renew social contacts. The advantage of this mechanism in terms of its use for scientific research is the high probability that the information provided is reliable. In order to find classmates, the potential user needs to register online with real schools and classes he or she actually attended, and cases of

cheating (as a joke or for commercial purposes) are easy to uncover and can subsequently be omitted in research[2].

For those users who 'register' with their current or past student groups and at least one of the classes they attended at earlier stages in their education, it is possible to track the distribution of these educational establishments across Poland.

The *nasza-klasa.pl* website is also extremely valuable for scientific purposes because of its great popularity. At the end of 2008, the website had over 11 million registered users. If, from the total population of Poland, we deduct small children who do not as yet attend school and the oldest Poles who in their majority lack sufficient computer skills, we will see that over one third of Polish citizens are registered on *nasza-klasa.pl*. This rate will be much higher if we take into account only the population below a given age threshold (set e.g. at 50 years of age) because young people are considerably overrepresented among the website's users.

The problem of the representativeness of data (or rather lack of it) is frequently mentioned in connection with attempts to use information from social networking websites for scientific purposes. It should be noted that any evaluation of the usefulness of data depends on the research context. In a situation when – as in this particular study – the goal is to assess the current capacity of cities to attract students and retain graduates in the local labour market, even a considerable overrepresentation of young people in the research sample should not be regarded as an adverse feature. This is because, in terms of the objective of the study, the current state of things and the most recent changes in the phenomenon under analysis are more important than the situation and trends observable in a more distant past. The same applies to another feature of samples originating from social networking websites: the absence of people without Internet access. Even though this problem still affects a considerable part of Polish households (according to GUS data, in 2007 about 40% households did not use the Internet), it can be assumed that this is of no significance as far as the population of students and university graduates is concerned.

This study was carried out using a sample of around 2 000 000 users of the *nasza-klasa.pl* website, who registered as students or graduates of a higher education institution in Poland. The average age in this user group (taking into account only those users who revealed their age) was 28 years. Women accounted for as much as 62% of the sample. In December 2008, about 730 000 users (35%) were students, and the remaining 65% were university graduates. The regional distribution of the cities of study declared by users was similar to the actual distribution of students in the 2007/2008 academic year, as published by GUS (*Szkoły wyższe…* 2008), with the exception of the Mazowieckie voivod-

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[2] It should be added that the *nasza-klasa.pl* website has already been used for spatial analyses of higher education (although on a smaller scale), as for example in the PhD dissertation by A. Bajerski submitted at the Adam Mickiewicz University in Poznań (Bajerski 2009).

ship (region, or *województwo*). According to official statistics, students in this region accounted for over 18% of all students in Poland, and for merely 12% of the website's users (students and graduates jointly). Although Mazowieckie remained the voivodship with the largest number of students, it should be assumed that it is not sufficiently represented in the sample. A similar situation – albeit on a lower scale – can be observed with regard to the Łódzkie region. This consideration does not affect the results of the majority of analyses presented here; however, all situations where it could play a role are clearly marked as such. Naturally, the understated share of students from Mazowieckie (and, to a lesser extent, from Łódzkie) must be associated with an overstated (in relation to the actual) number of students studying in another region or other regions as compared to the total number of students in Poland. Table 1 shows how this 'surplus' is distributed more or less evenly between the 14 regions (voivodships) of Poland.

Table 1. Students in Poland by region according to the *nasza-klasa.pl* website and GUS data

Voivodship	Students and graduates according to *nasza-klasa.pl* (%)	Students and graduates according to GUS in 2007/2008 (%)
Dolnośląskie	10.3	8.7
Kujawsko-Pomorskie	5.9	4.3
Lubelskie	6.3	5.3
Lubuskie	2.0	1.5
Łódzkie	5.9	7.3
Małopolskie	10.1	10.7
Mazowieckie	11.7	18.8
Opolskie	2.8	1.9
Podkarpackie	4.3	3.6
Podlaskie	3.0	2.8
Pomorskie	5.9	5.2
Śląskie	10.5	9.7
Świętokrzyskie	3.1	2.9
Warmińsko-Mazurskie	3.6	2.9
Wielkopolskie	9.6	9.4
Zachodniopomorskie	5.0	4.1

Source: *nasza-klasa.p*l and GUS.

To evaluate the attractiveness of academic cities, we need to start with analysing how secondary school leavers in various districts (or *powiats,* constituting the middle tier of local government) choose their future city of study. For each district, we identified all users of *nasza-klasa.pl* who completed their sec-

ondary education within the district and then went to university (irrespective of where it was located). Then, we determined the academic city which was most frequently chosen by secondary school leavers in a given district. Lastly, we calculated the share of students who went to study in the most popular city among all (studying) secondary school leavers in the district.

As a result of these calculations, we delimited the areas of dominance of different cities in terms of their attractiveness for students.
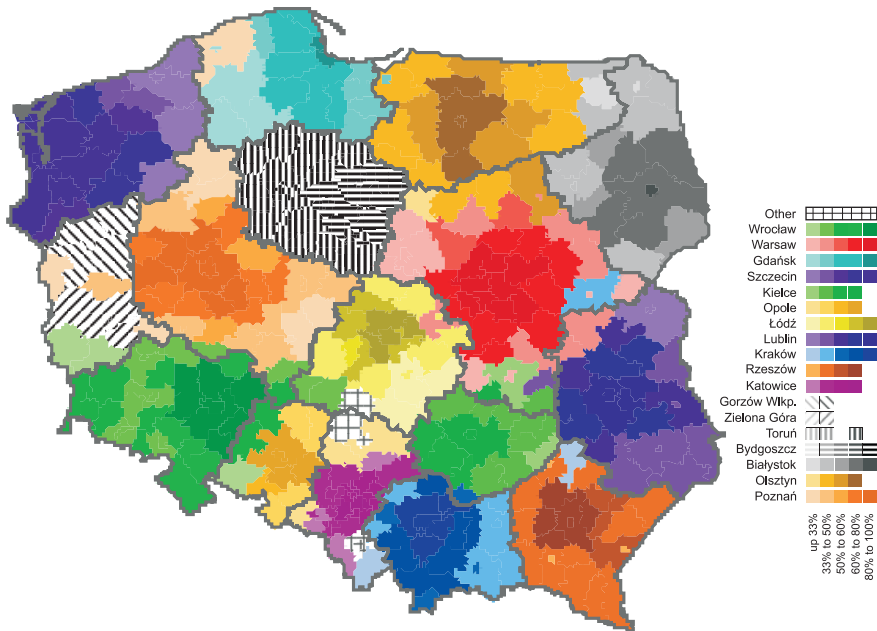

Figure 1. Regional capitals' areas of dominance as study destination.

Source of data: *nasza-klasa.pl*.

The map in Figure 1 shows such areas only for regional capitals as these cities are chosen most frequently as places of study by secondary school leavers in nearly all districts[3]. Each of the 18 academic cities (regional capitals) were assigned a different colour, with various shades indicating what share of secondary school leavers of a given district choose the most popular city (cf. legend to the Fig. 1).

The map facilitates making many observations relating to the mobility of university candidates. First of all, the areas of domination of individual cities overlap surprisingly strongly with the administrative division into voivodships. Even if the distance (in a direct line) between the location of the secondary

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[3] With the exception of two districts: one where secondary school leavers most frequently opted for higher education institutions in Częstochowa, and another where Bielsko-Biała played a prominent role.

school and the regional capital for a given district is longer than the distance to another academic city, secondary school leavers more frequently opt for studying in 'their own' voivodship (for instance the eastern part of Wielkopolskie voivodship)[4]. We can say therefore that, by and large, academic centres' areas of dominance are enclosed within the administrative boundaries of voivodships. However, there are exceptions to this rule. The universities and colleges located in Wrocław as well as in Białystok (but in the latter case only near the border with Warmińsko-Mazurskie voivodship) are drawing significant numbers of students from outside the region. In contrast, secondary school leavers from the northern and southern parts of Mazowieckie voivodship choose to study in Olsztyn (the districts of Żuromin, Mława, Przasnysz and Ostrołęka) and in Kielce (the districts of Szydłowiec, Radom and Lipsko) more frequently than in Warsaw. In this particular case, both the physical distance and the considerable costs of studying in Warsaw may prove insuperable barriers to studying in the capital city, owing to the fact that these districts are marked by a relatively low level of economic development and low incomes. The aforementioned under-representation of students studying in Warsaw among the users of *nasza-klasa. pl* can have some bearing on the area of dominance of Warsaw's higher education institutions visible in the map[5].

Even though choosing Warsaw as the study destination is neither a general, nor obvious trend even in some areas of Mazowieckie voivodship, this should not be interpreted as a manifestation of Warsaw's universities' poor capacity to attract students. Warsaw's students come from different regions of Poland, and its higher education institutions less depend on Mazowieckie voivodship in the context of recruitment than it is the case in other academic cities. There can be little doubt that recruitment to Warsaw's universities is much more selective in nature. Figure 2 shows the region of origin (i.e. secondary school location) of students of Warsaw and Łódź higher education institutions to allow a comparison. Quite noticeably, not only secondary school leavers from Mazowieckie voivodship but also from all of Poland's regions choose to study in Warsaw, although Warsaw enjoys much greater popularity in the central and eastern parts of Poland.

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[4] It should be noted, however, that measuring the distance in a direct line is an oversimplification as commuting to school within the same voivodship can be easier due to the accessibility of transport connections .

[5] This calls for further analyses, focusing on the specific conditions of studying in Warsaw. Interestingly, the underrepresentation of Warsaw in the sample mostly involves current students, and not university graduates registered with the *nasza-klasa.pl* website. Other issues which should be investigated include the fact (reported by GUS) that in Warsaw as many as 44% of students attend non-public higher education institutions (as compared to the national average of around 30%). The likely explanation is that non-public higher education institutions (mostly extramural or supplementary MA/MSc programmes) do not integrate their students successfully, hence their lower level of participation in *nasza-klasa.pl*.
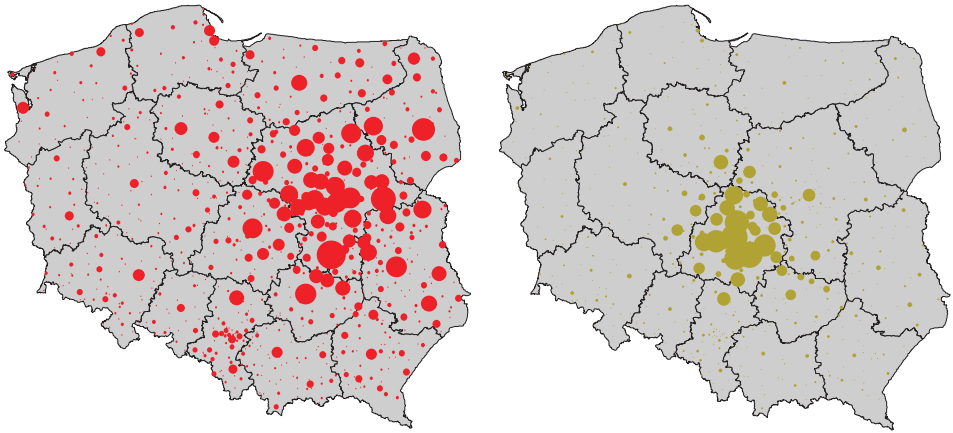
Figure 2. Location of secondary schools completed by students (graduates) of higher education institutions in Warsaw (left) and Łódź (right), irrespective of the city of study. The largest symbol on the left-hand side map, Radom = 3100 persons. The largest symbol on the right-hand side map, Pabianice = 2833 persons.

Source of data: *nasza-klasa.pl*.

To attempt a more precise evaluation of the capacity of individual cities to attract students, we need to apply specific measures. For each of the 18 academic cities, we calculated the share of local students who completed local (i.e. situated in the same city) secondary schools, the share of students coming from the same voivodship, and, finally, the share of students arriving from other regions. The greater the share of outside students, the higher the attractiveness of the local universities and colleges. In addition, for each of these cities, we calculated the average distance from the city of study to the location where the students completed their secondary education[6]. Greater average distance can be seen as a proof of academic potential that reaches beyond the local areas.

Gorzów Wielkopolski, Białystok, Łódź, Rzeszów and Katowice perform their academic function mostly regionally. About 80% students in the above cities come from secondary schools in the same voivodship. Nearly a half of students studying in higher education institutions in the first three of these cities completed their secondary school in the regional capital. When we look at the average distance between the secondary school and the city of study, we can see that Katowice, Łódź and Rzeszów are among the most locally-bound academic centres.

The highest share of university students from outside the region is found in Kraków (42%) and, rather unexpectedly, in Zielona Góra. The proportion

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[6] The distances were measured with the geographical coordinates of the cities using the formula for the great-circle distance, i.e. the shortest line between two locations on the surface of the sphere. For this reason, the measurement did not take into account either the road quality or other transport connections.

is also high for Warsaw, Olsztyn, Toruń and Wrocław, corresponding to their supraregional significance as academic centres. Warsaw has no match in terms of the average distance travelled by students from the location of their secondary school to their university or college (92 km); long distances must also be travelled by students studying in Szczecin, Wrocław, Poznań and Kraków (at least 80 km).

Table 2. Indicators of the attractiveness of regional capitals for students

City of study	Students who completed secondary education in the same city (%)	Students who come from the region, except the regional capital (%)	Students who come from the regional capital or the region (%)	Students arriving from outside the region (%)	Avarage distance between secondary school and university (km)
Białystok	44.5	36.9	81.5	18.5	53.9
Bydgoszcz	37.7	38.5	76.2	23.8	56.7
Gdańsk	27.5	40.9	68.4	31.6	73.6
Gorzów Wielkopolski	41.2	29.8	71.0	29.0	54.4
Katowice	13.6	70.9	84.5	15.5	38.3
Kielce	32.0	38.8	70.8	29.2	49.8
Kraków	27.3	30.5	57.7	42.3	79.7
Lublin	31.2	42.4	73.5	26.5	69.0
Łódź	45.7	33.8	79.5	20.5	46.6
Olsztyn	21.7	39.5	61.2	38.8	83.3
Opole	25.0	38.7	63.7	36.3	57.7
Poznań	30.7	36.6	67.3	32.7	85.5
Rzeszów	24.6	56.9	81.6	18.4	47.9
Szczecin	37.7	38.9	76.6	23.4	87.0
Toruń	24.3	38.0	62.3	37.7	79.6
Warsaw	35.8	26.2	62.0	38.0	92.4
Wrocław	29.7	34.9	64.6	35.4	82.0
Zielona Góra	24.1	33.4	57.5	42.5	67.2

Source of data: *nasza-klasa.pl*.

We can say therefore that, in addition to the greatest Polish metropolises whose strong academic importance should not be surprising, some smaller urban centres such as Olsztyn, Zielona Góra and Toruń also show a considerable potential in this regard.

As we noted earlier, if a city is to make a full use of the development opportunities which arise from the presence of higher education institutions, it must be able not only to successfully attract students but also to retain graduates in the local labour market. If this condition is not fulfilled, the city will become

a provider of human capital for cities in other regions where employees will find better living and working conditions.

Figure 3 offers a comparison of the mobility of graduates of universities and colleges in Warsaw and Łódź. In both cases (for the clarity of the picture), graduates who live in their city of study have not been included as they account for a significant share of the population (52.4% in Warsaw and 47.8% in Łódź).
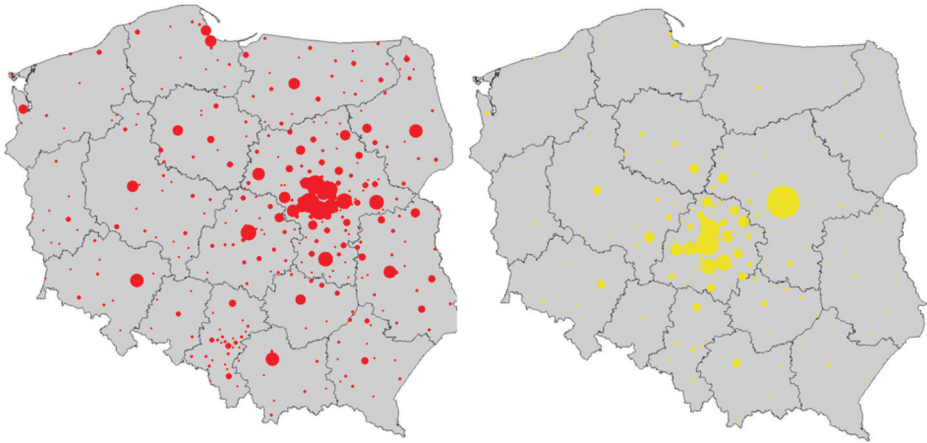

Figure 3. Current places of residence of university graduates from Warsaw (left) and Łódź (right), excluding the city of study. The largest symbol on the left-hand side map, Pruszków = 1500 persons. The largest symbol on the right-hand side map, Warsaw = 3622 persons.

Source of data: *nasza-klasa.pl*.

If we calculate a similar absorption rate for all 18 regional capitals, we will see (cf. Table 3) that Warsaw and Łódź manage to retain the largest portion of graduates from their higher education institutions, with Białystok, Kraków and Wrocław also reaching rates around 40%. The case of Łódź is unique because it is undoubtedly the proximity of Warsaw, making daily commuting possible, which is largely responsible for the high share of graduates who remain in the city. It should be noted that, notwithstanding the above, Warsaw is the city with the second largest concentration (after Łódź) of graduates from universities and colleges of Łódź. Łódź is declared as the place of residence by nearly 6% of the city's college or university graduates. Warsaw is also one of the main migration destinations for graduates from other cities. Poland's capital is in particular responsible for the 'brain drain' in respect of Lublin (8% graduates), Białystok (7%) and Kielce (6%).

The careers of those graduates who came from other regions of the country (i.e. from other voivodships) can be looked at as an important criterion for evaluating a city's capacity to absorb human capital. It can be assumed that these graduates do not have strong emotional ties with their city of study, and

therefore any decision to stay there will be underpinned mostly by pragmatic and market considerations: possibilities for finding a good job and quality of life in a given city. Unquestionably, Warsaw is by far the most attractive city to live in for graduates who came here to study from other areas of the country. Warsaw is chosen as the place of future residence by 35% students who came from outside Mazowieckie voivodship. No other Polish city is nearly as effective in attracting such volumes of outside students. Between 25% and 28% of outside students choose to stay in Kraków, Wrocław, Gdańsk and Poznań. At the other extreme, there are the cities of Kielce and Zielona Góra, which manage to retain only one in 12-13% of their graduates.

Table 3. Absorption rates of university graduates by regional capitals

	Graduates who settled in their city of study (%)	Graduates who settled in War-saw (%)	Graduates com-ing from outside the region who settled in the city of study (%)	Avarage dis-tance between residence and university (km)*
Białystok	44.2	6.7	15.7	64.4
Bydgoszcz	38.7	1.9	17.0	58.9
Gdańsk	37.2	2.7	26.0	57.6
Gorzów Wielkopolski	35.4	0.8	10.3	78.1
Katowice	14.9	1.9	9.5	43.7
Kielce	30.1	5.6	7.8	64.7
Kraków	42.5	2.7	28.3	63.4
Lublin	35.4	7.7	15.0	80.1
Łódź	47.8	5.5	20.3	45.7
Olsztyn	30.1	3.9	16.3	80.5
Opole	24.7	1.2	11.8	61.1
Poznań	39.6	2.8	24.8	71.5
Rzeszów	29.4	2.5	16.0	60.9
Szczecin	42.7	2.2	21.2	86.0
Toruń	29.3	4.7	17.2	78.3
Warszawa	52.4	52.4	35.4	58.2
Wrocław	42.5	2.1	27.7	66.1
Zielona Góra	24.5	1.5	8.7	77.3

* Excluding foreign migrants.

Source of data: *nasza-klasa.pl*.

The average distance between the city of study and the graduate's current place of residence can also provide an important indication concerning the at-tractiveness of a given city for human capital. A considerable distance implies

a mass outflow of university graduates to other cities, while a small distance means that many graduates stay in the city or its immediate surroundings. An advantage of this indicator (in comparison with the share of graduates living in the city after they graduate) is the fact that it takes into account suburbanisation processes, as a result of which some graduates, despite formally leaving the city after graduation, in fact remain in the local labour market. The smallest average distance between city of study and place of residence after graduation is observable in the case of Łódź (45.7 km). However, it should be borne in mind that this is largely due to the proximity of Warsaw, which gives the residents of Łódź access to the capital city's labour market without having to change their place of residence.

Characteristically, the smallest average distances between the place of residence and the city of study were identified in the case of graduates from Katowice and Gdańsk, that is cities which are themselves parts of larger agglomerations. In this case, we should concentrate on the ability to absorb human capital by these urban systems as a whole, and not by individual cities. Table 3 shows that although Katowice and Gdańsk are not regarded as cities with the highest potential to retain graduates within their administrative boundaries, in both cases over 80% of those who study in these cities settle down in the same voivodship after graduation, which means that they remain within the sphere of influence of the city that they studied in.

Among the cities which do not benefit from the proximity of a large labour market and which do not form parts of agglomerations, Warsaw has the smallest average distance between the place of residence and the place of study of its graduates (58.2 km).

To attempt an overall evaluation of the cities' potential to generate and absorb human capital, we need to create synthetic measures which will incorporate the two aspects of a city's attractiveness, i.e. the ability to attract candidates for university and the ability to retain university graduates in the local labour market. The first of these measures can be expressed as:

$$W_{1,i} = \frac{\overline{d}p_{wi}}{dz_{wi}}$$

where dp_{wi} denotes the average distance (in km) between the secondary school and the current place of residence of graduates from city i, and dz_{wi} denotes the average distance (in km) between the city of study and the current place of residence of graduates from city i. The lower the value of the W_1 indicator, the lower the overall attractiveness of a given city in terms of human capital.

The results of such calculations for 18 academic cities are shown in Figure 4. As we can see, the cities leading in the ranking developed on the basis of the W_1 indicator include Warsaw, Gdańsk, Kraków, Wrocław and Poznań, with the capital city clearly in the lead over the remaining 4 metropolises. The average distance covered by secondary school leavers to start studies in Warsaw is

over 1.5 times longer than the average distance between the place of residence of Warsaw graduates and their *alma mater*. The lowest respective values were reported for Gorzów Wielkopolski, Kielce and Rzeszów. After graduation, an average graduate of higher education institutions in these cities travels a greater distance than the average distance between his or her secondary school and his or her university or college (with the *W1* indicator lower than 1). The intuitive interpretation might be that the power of attraction of the local universities and colleges is unable to outweigh the determination of their graduates to flee from these cities.
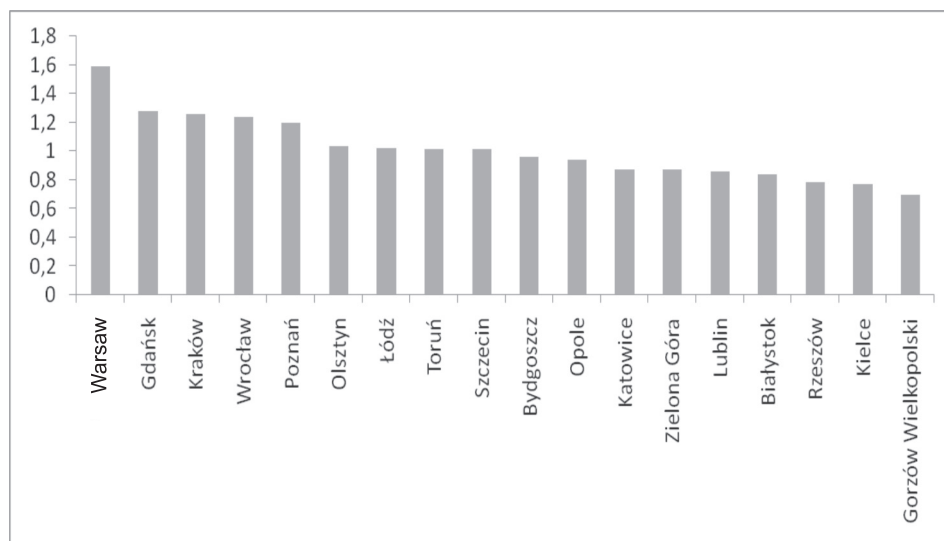

Figure 4. Potential gains for cities generated by their academic role (W_1 synthetic indicator)

Source of data: *nasza-klasa.pl*.

Another synthetic indicators can be described as a measure of the "net influx' of human capital:

$$W_{2,i} = \frac{S_{so,wi,zi} - S_{si,wi,zo}}{S_{so,wi,zi} + S_{si,wi,zo}}$$

where $S_{so,wi,zi}$ denotes the number of students who complete secondary education outside the voivodship in which a given city is located and who nevertheless remain there after they graduate from university; while $S_{si,wi,zo}$ denotes the number of students who completed secondary school in a given city and also studied there, but, following graduation, left both the city and their home region. Such a measure is extremely selective in character as it allows to identify very strong academic cities, in whose case maintaining higher education institutions may provide a substantial pro-growth stimulus, as well as cities from which human

capital is 'backwashed', a problem that is worsened rather than alleviated by the universities and colleges located in the city. The first city type should reach W_2 values close to 1, and the second – negative values.
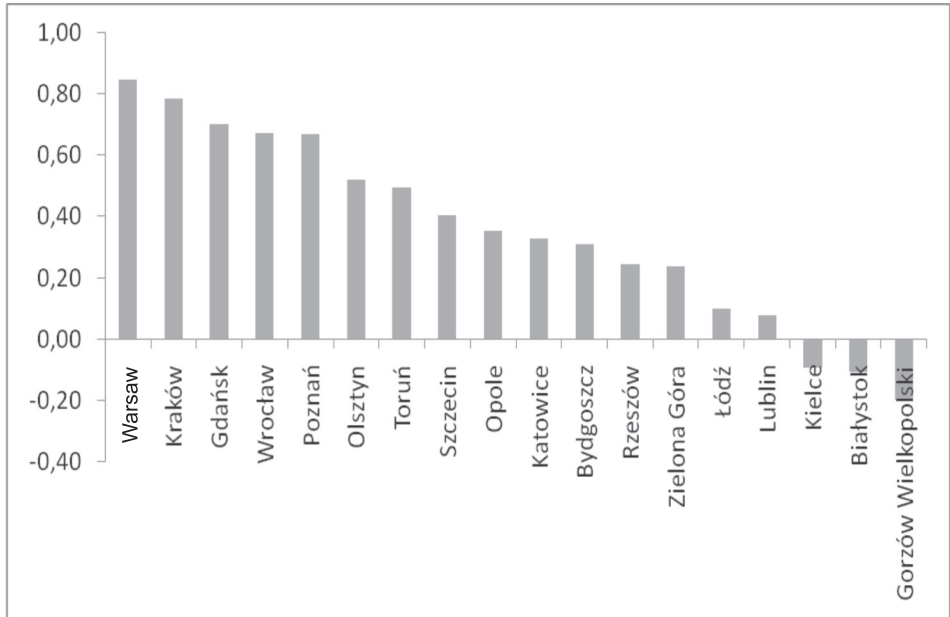

Figure 5. Potential gains for cities generated by their academic role (W_2 synthetic indicator)

Source of data: *nasza-klasa.pl*.

As we can see from Figure 5, five large metropolitan cities (Warsaw, Kraków, Gdańsk, Wrocław and Poznań) had high values of the W_2 indicator. In the case of Warsaw and Kraków, the value approximated 0.8. Among the largest cities, Łódź is absent from the upper part of the table as the benefits it derives from its academic function are close to zero, based on the measure in question. On the other hand, Toruń and Olsztyn stand a relatively good chance to make a fuller use of their academic potential. Last but not least, the outcomes of the mobility of university students and graduates in Kielce, Gorzów Wielkopolski and Białystok can be described as a 'net loss'. The number of university graduates who leave the region after they graduate is greater than the number of people who come to these cities to study from outside the region. It should be added that the net influx of human capital to Lublin seems only slightly bigger. The low competitiveness of Lublin, which is visible mostly in the context of graduate mobility, is quite surprising in view of the city's long–established academic traditions and possessing two major universities. Its weaker standing may be related to the recent rapid development of other academic centres in eastern Poland, for instance Białystok and Rzeszów.

On the basis of our analyses, we would like to propose an overall typology of academic cities in terms of their potential to attract and absorb human capital. To do this we will place the cities on a diagram, showing both of these aspects on a system of coordinates. Figure 6 shows two such illustrations. In the first one, the first pair of variables (shown, respectively, on x and y axes) is made up of the percentage of students (or university graduates) from a given city who completed their secondary education in a different voivodship as well as the percentage of university graduates from a given city who have remained there after completing their studies in the total number who have come to study there from other voivodships. In the second (lower) illustration, the pair of variables is made up of the average distance between students' secondary school and their city of study as well as the average distance between the city of study of university graduates and their current place of residence. Since interpretation of all these variables has been offered earlier in the paper, now we would only like to attempt an analysis of the illustrations.

Warsaw emerges as the city with the greatest potential to attract and absorb human capital. Students are willing to cover the longest distance (calculated from their secondary school) to continue education in the capital city. Several cities attract more students from outside their region than Warsaw, but when interpreting this particular indicator we should take into account the differences in the size of the regions and the more or less central location occupied by the major city in a given the region. Warsaw has no match also in terms of graduate absorption. Other leading cities (marked in green in Fig. 6) in terms of the two analysed aspects of the academic function include Kraków, Wrocław, Gdańsk and somewhat lagging Poznań. The illustrations also show a group of cities with a strong academic role but lacking the potential to retain many graduates in the local labour market. This group (black lining in Fig. 6) is made up of Toruń and Olsztyn, and, though less obviously, of Szczecin and Zielona Góra. By contrast, Rzeszów, Kielce, Białystok and Gorzów Wielkopolski manifest a limited capacity for attracting students but also have rather modest chances to use university graduates for their development.

The remaining cities should be placed somewhere in between the above categories, whilst Łódź and Katowice could be regarded as special. In the former case, this is because of the 'double locality' concerning both the territorial origin of Łódź's students (who predominantly come from Łódź and the Łódź voivodship), and the place where graduates choose to stay (mainly in Łódź), even though it has to be borne in mind that their taking residence in Łódź is often accompanied by working in Warsaw. By contrast, Katowice can hardly be discussed in isolation from the entire Upper Silesian agglomeration. The high urbanisation level in the whole of the region in a way invalidates the territorial origin of students and encourages graduates to settle down near the regional capital, though not necessarily in the capital itself.
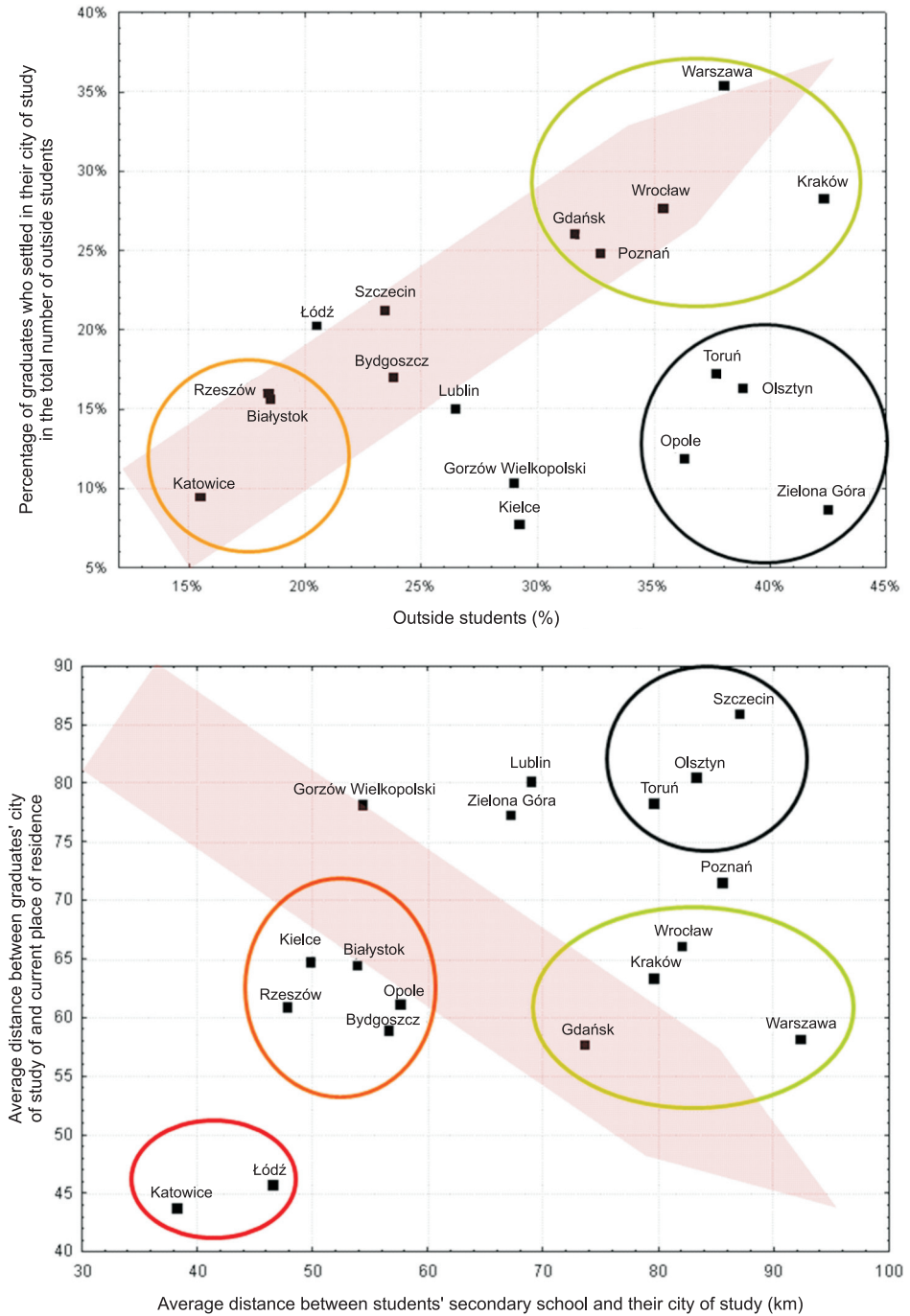
Figure 6. Typology of academic cities by their capacity to attract and absorb human capital.

Source of data: nasza-klasa.pl.

Łódź, the Upper Silesian agglomeration and Tricity (Gdańsk, Gdynia and Sopot) should be discussed as separate cases, with the analytic tools adjusted to their unique features. The lack of such an adjustment quite naturally restricts the scope of this paper and we will strive to make up for it in our future studies. In addition to that, the data gathered for the purpose of this study will make it possible to continue research which will cover other cities than regional capitals. In particular, the issue of academic potential (and its impact on local development) seems to be of special interest in small and medium-sized cities which make substantial investments in the development of higher education (e.g. Nowy Sącz). Lastly, the data will also make it possible to carry out similar studies on the structure of the admission process and future careers of graduates for selected higher education institutions in specific categories (for instance universities or universities of technology).

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