

Article

Selected Meso-Economic Consequences of the Changing Number of Students in Academic Towns and Cities (A Case Study of Poland)

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Abstract: This article presents several selected economic consequences of the currently changing number of students in towns and cities in Poland, which has become an increasingly significant issue in view of the dramatic demographic transformations going on nowadays. The aim of the study is to analyze the impact of the changes on local enterprises operating in selected sectors of local economies of the academic towns and cities in the country. The results of the analysis confirm the assumption that selected academic towns can be affected not only by depopulation, but also by a decreasing number of students and—in consequence—a decreasing number of small trade and service enterprises. The authors conclude that co-occurrence of these issues can pose a serious threat to local economies, especially where rapid negative economic and demographic changes have already been observed. The changes presented can be treated as the major threat to further sustainable development of Poland.

Keywords: local economic development; students; academic towns and cities; demographic changes

1. Introduction

Nowadays discussions on higher education institutions frequently present them as playing an essential role in creating the sustainable development of towns, cities and regions, as well as bringing them a series of benefits [1–3]. Until recently, though, it was mainly educational functions related to creating human capital which were attributed to academic towns and cities [4]. However, a much broader approach to their role in social and economic environments can be noticed since centers of education are treated as important actors on the social and economic stage, creating intellectual potential and providing the valuable backup for innovation processes, which—at the same time—shape local economy based on knowledge [5]. In the literature, higher education institutions are also credited with a typically utilitarian role of economic units, on the one hand—acting as employers, and—on the other one—as a purchaser of goods and services from local enterprises [6]. It seems, however, that not less important function of institutions of higher education consists in attracting students to cities. Young people look for opportunities to achieve their educational goals, but also use other services offered by academic cities [7,8].

In this context, the literature indicates a number of possibilities arising when students live in academic towns and cities, concentrating on the consequences of their presence in the economic, socio-demographic and spatial perspectives [9,10]. The role of students in the local economic development is particularly interesting [7–9]. A topic rather scantily investigated in the literature is the impact of students on enterprises based in academic towns and cities, which seems extremely important, though [11,12]. This influence can be analyzed through the perspective of certain relationships.

First of all, students can be treated as a vital element of the functioning and development of enterprises through the prism of one of the most important factors in business location, meaning access to qualified labor resources. Location theories and research results indicate that the location of business production factors is determined by the availability of a broadly-understood academic base, including access to graduates from higher education [13,14]. It is also worth remembering that students who undertake to work during their studies, primarily in the private sector, also contribute to the functioning of many business entities, becoming “suppliers” of unqualified and cheap labor force for the local market. Second, students and graduates of universities can influence the development of local entrepreneurship because some of them establish companies and decide to launch their own businesses. Third, the local economic activity, the driving force of local development, may be influenced by the fact of students creating a greater consumer demand due to their presence in an academic center and their consumer spending.

Keeping in mind the aforementioned points, an influx of students to academic cities, their presence during studies and the scale of their retention may be important factors in the development of local enterprises. In this paper we will examine two key questions. First: Can students have a direct influence on business entities based in academic centers in Poland? Second: Does the scale of relationship differ in particular academic towns and cities in Poland?

The main goal of this article is to investigate the meso-economic consequences manifesting themselves in the changing number of companies, which is the effect of the changing number of students in Poland’s academic towns and cities. Accordingly, correlation and regression analyses were conducted to examine the relationship between the variables. There were used statistical data on both the number of students in selected academic centers in Poland, as well as the number of firms located and operating in the towns and cities in selected trade and service markets in the period 2006–2016. Though students and universities can have a significant impact on the entire business environment of an academic center, this study focuses only on seeking links between the number of students and the number of firms operating in two sectors: retail trade, as classified in Section G, Chapter 47 of the Polish Classification of Activities (PKD) as well as catering and hotel services as classified in Section I, Chapter 56 of the PKD. The choice of selected firms was dictated by the fact that trade and service businesses, as research results conducted worldwide show, are directly associated with students’ spending and students’ employment [15–17].

The paper is structured as follows: Section 2 presents recent history of the development of the higher education system in Poland, changes in the number of students in the country and in selected academic towns and cities. There are also shown briefly the local and regional development theories that can be useful while conducting the analysis. In the third section, the theoretical background of correlation and regression approach used in the analysis and description of material are presented. The fourth section concentrates on application of the models on empirical analyses between the number of businesses and the number of students in particular towns and cities in Poland. In Section 5, the results are discussed, followed by conclusions and implications.

2. Recent History of Higher Education in Poland

2.1. Poland’s System of Higher Education

The system of higher education in Poland has undergone significant changes in the period of transformation, dating back to the turn of the 1980s and the 1990s. At that time, as some authors point out, access to higher education became widespread, changing from an elite system to a typical mass system [18]. A few key factors determined that higher education in Poland opened up to the masses. The first was undoubtedly baby boomers of the nineties, turning fit for starting university education. The second key factor was the increase in the educational aspirations of Polish society, resulting mainly from the developmental trends that appeared at the beginning of the systemic transformation [18]. The third, yet not less important, reason for the massification of higher education in Poland were

systemic changes in higher education, allowing part-time studies and enabling establishment of non-public schools. The most important manifestations of the phenomenon described above were an increase in the number of universities, in particular private higher education institutions, and a sharp increase in the number of students—in the academic year 2009/2010, 33% of all the students in Poland studied at non-public (private) universities, of whom 28% undertook part-time studies (Figure 1).

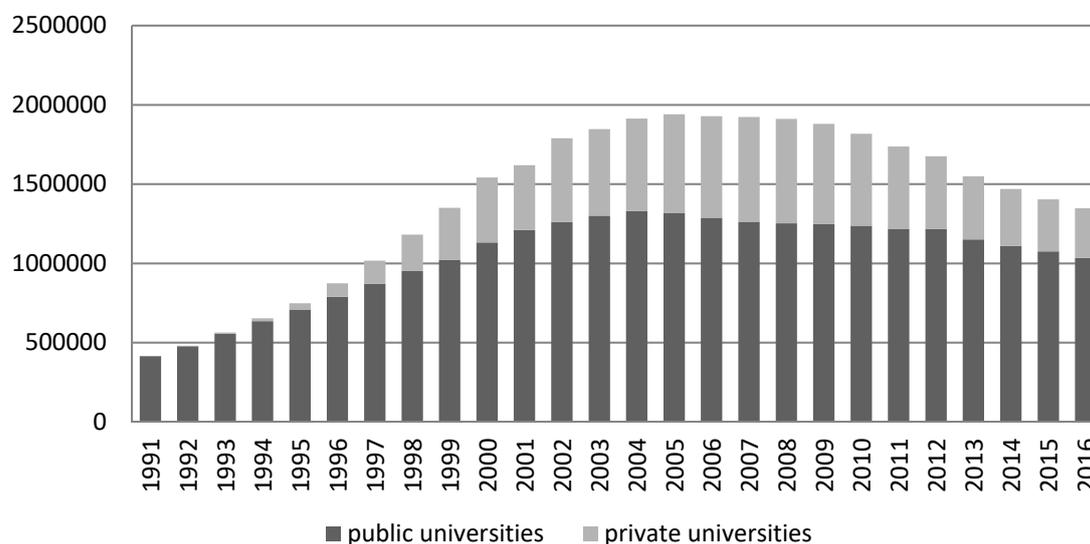


Figure 1. Changes in the number of students in Poland, divided into students at public and private institutions of higher education. Source: own study based on [19,20].

At the beginning of the period of transformations, there were about 100 higher education institutions in Poland, attended by circa 415,000 students. The following years saw an increase in the number of universities, especially non-public colleges of higher education, and consequently an increase in the number of students studying in Poland. The year 2005 was climactic in terms of the number of people pursuing studies, when about 2 million students were enrolled in higher education. All in all, there were 445 institutions of higher education, of which only 130 were public, the others being private. Afterwards, relative stabilization in terms of the number of students could be noticed. However, starting with 2009, the number of students as well as higher education institutions in Poland began to fall. In 2016, there were “only” 390 higher education institutions with 1.35 million students enrolled [19–21]. At least two key reasons for the decreasing number of students in Poland can be noted.

The first of these is the decline in the number of youths constituting the pool of potential students, resulting from a very sharp decline in the number of births, especially in the period of twenty years between 1984–2003 [22,23]. The decrease in the number of students was also influenced by the lower interest in gaining a degree in higher education than in the past, which resulted mainly from the earlier massive satisfaction of educational aspirations, leading to supply surpluses of graduates in many fields of study. The surplus of graduates in some areas of education made it difficult to find well-paying employment, even for highly qualified people, and thus encouraged them to choose a different career path, not always associated with higher education [24].

2.2. The Socioeconomic Characteristics of Selected Academic Centers in Poland and Changes in the Number of Students

The changes presented in the previous part of the article concerned not only the whole of the higher education system in Poland, but also the majority of towns and cities in which at least one higher education institutions were located. The analysis presented in this article refers to 18 selected voivodship centers in Poland: Białystok, Bydgoszcz-Toruń, Gorzów Wielkopolski, Katowice, Kielce, Kraków, Lublin, Łódź, Olsztyn, Opole, Poznań, Rzeszów, Szczecin, Tri-City, Warsaw, Wrocław,

and Zielona Góra. The selection of only these cities for analysis was dictated by several important factors. First of all, these are centers that are the capitals of all voivodships in Poland. The article refers to 18 centers that are the capitals of Poland's 16 provinces. In the case of two voivodships, two central cities can be indicated: in the case of the Lubuskie Voivodship, they are Zielona Góra and Gorzów Wielkopolski, and in the case of Kuyavia-Pomerania, they are Bydgoszcz and Toruń. Due to the fact that the last two cities constituting the capitals of the Kuyavian-Pomeranian Voivodship are located in close proximity to each other and within the range of direct interaction [25,26], these cities were combined into one center for the purposes of this article, calling it Bydgoszcz-Toruń. Similarly, the three cities of the Pomeranian Voivodship: Gdańsk, the capital of the Pomeranian Voivodship and two cities located in its immediate vicinity, Gdynia and Sopot, are treated as one center of the so-called Tri-City created by three different settlement units forming a polycentric conurbation in scale and functions [27]. In many publications of the Central Statistical Office in Poland (GUS), data for the entire center are presented, without the possibility of separating information for individual cities. Second, the choice of the 18 centers, the capitals of all voivodships in Poland, was conditioned by the availability of data. It is worth emphasizing that universities are also located in other smaller cities in Poland, although access to certain data in their case is significantly difficult. It is true that GUS publishes data on the number of students for smaller settlement units than the voivodship capitals, such as county (*powiat*) cities, although these data are available only as of 2012. However, taking into account the changes in the higher education system in Poland that occurred in preceding years, we decided to omit settlements smaller than the major cities in individual voivodships, for which there is no statistical data on the analyzed issue before 2012.

The centers can be characterized by some socioeconomic indicators contained in Table 1.

Table 1. Socioeconomic indicators of selected towns and cities in Poland.

Center/Indicators	Population	Average Gross Wages (PLN)	Unemployment Rate (%)	Number of Enterprises	Number of Enterprises in Section G, Chapter 47 of the PKD	Number of Enterprises in Section I, Chapter 56 of PKD
Białystok	296,628	3967.71	8.9	34,844	5354	609
Bydgoszcz-Toruń	556,459	4060.89	5.3	69,050	8569	1411
Gorzów Wielkopolski	123,995	3670.29	3.9	17,808	2347	417
Katowice	298,111	5274.86	2.8	47,342	5616	1164
Kielce	197,704	3920.24	7.6	28,901	4656	664
Kraków	765,320	4635.26	3.5	134,514	15,437	3690
Lublin	340,466	4169.46	7.2	44,474	5869	896
Łódź	696,503	4230.12	7.9	92,711	12,538	2121
Olsztyn	172,993	4254.72	5.1	23,187	2525	391
Opole	118,722	4378.37	4.9	20,743	2504	542
Poznań	540,372	4770.94	1.9	110,531	11,607	2352
Rzeszów	187,422	4319.48	6.6	26,489	3102	549
Szczecin	404,878	4539.15	4.7	68,839	7842	1619
Tri-City	747,594	5007.17	3.8	123,667	11,956	2965
Warszawa	1,753,977	5739.61	2.6	419,352	40,773	9431
Wrocław	637,683	4800.54	2.7	116,440	12,491	2666
Zielona Góra	139,330	3919.96	4.6	21,138	2777	417

Source: [20].

The cities selected for the analysis can be divided into at least two groups. The first includes large settlement units, the so-called leading cities in Poland—apart from Warsaw, the country's capital, other large cities, such as: The Tri-City, consisting of Gdańsk, Gdynia and Sopot, as well as Katowice, Kraków, Poznań, and Wrocław. The remaining cities identified as regional centers are peripheral or inter-metropolitan towns characterized by a worse socioeconomic situation, lower wages, worse labor market situation, smaller share in the creation of the nation's GDP and a higher rate of outmigration for permanent residents [28].

According to the aforementioned data, the changes in the number of students in selected academic centers in Poland are worthy of consideration. The relevant data are presented in Table 2.

Table 2. Number of students in the analyzed academic centers in 2006–2015 and related changes in the number of students in individual years as compared to 2006.

Center/Year	2006		2011		2016	
	Thous.	2006 = 100	Thous.	2006 = 100	Thous.	2006 = 100
Białystok	44.8	100	43.3	97	29.0	65
Bydgoszcz-Toruń	79.3	100	74.9	94	55.7	70
Gorzów Wielkopolski	11.2	100	3.9	35	2.8	26
Katowice	71.2	100	76.3	107	52.2	73
Kielce	50.9	100	41.3	81	22.9	45
Kraków	175.8	100	184.5	105	154.3	88
Lublin	83.5	100	80.8	97	64.3	77
Łódź	115.9	100	95.4	82	74.0	64
Olsztyn	44.9	100	38.1	85	23.4	52
Opole	31.6	100	34.0	107	20.2	64
Poznań	134.4	100	131.3	98	112.0	83
Rzeszów	49.2	100	54.0	110	41.8	85
Szczecin	63.8	100	52.3	82	37.2	58
Tri-City	89.1	100	95.8	108	87.5	98
Warsaw	279.5	100	258.9	93	239.5	86
Wrocław	138.0	100	137.4	100	119.6	87
Zielona Góra	19.3	100	15.4	80	11.0	57

Source: own calculations based on [19].

According to the data presented in Table 2, all the voivodship academic centers in Poland have experienced a decrease in the number of students over a period of eleven years. In some of them, these changes were minor, which especially applies to such large cities as Warsaw, Kraków, Wrocław, and Poznań, which were characterized by relatively small, not exceeding 20% changes in the number of students. The common feature of the so-called leading cities in Poland, both in the initial and final periods, are the large numbers of students. The group of those cities also include two centers: Tri-City and Rzeszów, which are considered to have the largest development potential and to be the most attractive both in terms of residence and investment in Poland [29,30].

In the case of several other towns, an exceptionally sharp decline in the number of students was observed. This group includes the capital of one of the smallest voivodships, Gorzów Wielkopolski, the town located in western Poland. Throughout the 11 years there have been observed a 74% drop in the number of students. Smaller, yet significant, changes in the number of students occurred in other inter-metropolitan or peripheral towns including Kielce, Olsztyn, Szczecin, and Zielona Góra, where the relative decrease in the number of students oscillated around 50%.

The described changes in the number of students pursuing higher education in selected academic towns and cities in Poland should be interpreted in the light of their location, depopulation and functions. It is important to note that while there are increasingly fewer people at student age in Poland, there have been recorded a high concentration of students and—at the same time—the relatively smallest decrease in the number of students in strong academic growth poles, such as Warsaw, Krakow, Wrocław, Poznań, Tri-City, or Rzeszów. These centers accommodate the leading universities in the country and are characterized by a relatively good socioeconomic situation, which makes them attractive to young people from different regions of Poland. Students, therefore, resign from studying in smaller, weaker centers characterized by a low demographic and socioeconomic position. Smaller and weaker centers, characterized by a lower ability to absorb investments and, consequently, those providing a less favorable situation in the local labor market, naturally lose their polarization in this process in the academic sense as well, causing a serious drop in the number of students.

Changes in the number of students studying in academic cities may entail a number of economic consequences. In the period of growth in the number of students, they gave a development impulse to the local economy, but during the period of their number “shrinking”, it was quite on the contrary—they brought about an economic “collapse” of academic cities [31]. This mechanism can be presented using the following schema similar to the mechanism of a “vicious circle” (Figure 2).

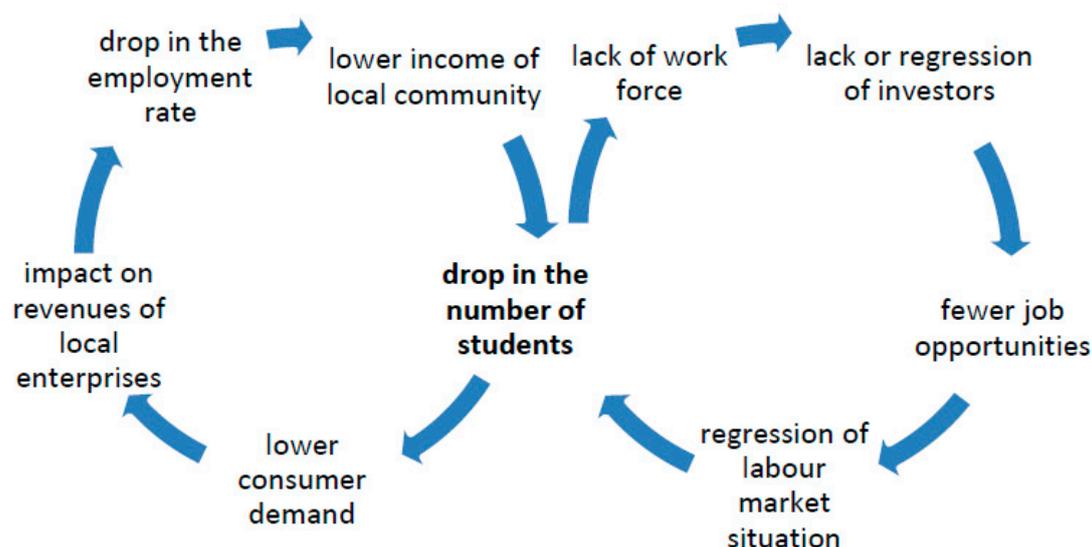


Figure 2. The vicious circle mechanism related to a decrease in the number of students. Source: own study based on the conducted research work and [32].

The drop in the number of students currently observed in Poland’s academic cities can be treated as an impulse generating a successive series of consequences operating on the “domino effect” principle. On the one hand, a drop in the number of students affects the local goods and services market. This may lead to fewer consumers, which in the long run may mean a deterioration in the financial performance of enterprises meeting students’ demands and a reduction in commercial and service sales in towns and cities. Due to this process, one can observe a decrease in employment and income among the local society. On the other hand, a loss of students causes a loss of potential human capital for work and employees for local businesses. As a result, access to a specific group of unskilled workers declaring their willingness to work flexible hours and having reasonable financial expectations is now limited. This can be particularly severe in the situation of a deficit in employees currently observed in the majority of cities in Poland. In the longer run, a drop in the number of students can also limit our access to qualified university graduates and hamper cities’ ability to attract and absorb investors, resulting in negative trends in the local labor market [12–14,31]. The above-mentioned consequences can trigger off further demographic problems in the regions and cities.

2.3. Theoretical Framework

There are theories that explain economic development at local and regional levels, which can be taken as the starting point for the presented analysis. At least four of them are worth mentioning: the concept of economic base, the concept of growth poles, circular cumulative causation and the core and peripheries model.

The main assumption behind Douglas C. North’s economic base theory is the development supported on the external demand for goods and services produced in the region. Therefore, the entities producing for export constitute the economic base of the region, which is the most important source of its development, initiating the creation of multiplier effects in related sectors [33].

Another theory which deserves attention is the concept of growth poles proposed by François Perroux. It explains that the growth and development are concentrated only in certain industries or

regions and cities, the so-called growth poles. This process may lead in a natural way to regional inequalities, because economic entities that create growth poles can become a magnet attracting new types of activity, thus expanding the local or regional development gap towards the periphery. However, some authors have postulated that growth poles can stimulate the development of other related industries, regions and towns and cities by existence of linkages [34].

Another theory focused on regional polarization is the concept of Gunnar Myrdal—the theory of cumulative causation. He explained the economic development as a circular causation process which leads to a dynamic growth of developed areas and a slower growth of weaker areas. Due to the mobile factors of production, the capital drained from periphery to growth poles causes a cumulative effect of regress in weaker areas. As a result, strong regions and cities become ever stronger, and weaker regions and cities become even weaker [35].

One more theory to be mentioned here is Friedmann's core and periphery model which claims that a flow of technological and cultural innovations is the factor in unequal development. The theorist defines the core regions and cities as areas with a high potential for growth, where the factors of production, research, innovations are concentrated. This polarization leads to core regions' dynamic domination on the peripheries and high inequalities [36].

3. Materials and Methods

Taking into account the presented background of the analyzed phenomenon, this study focuses on presenting our statistical analyses. The article draws on data from the Local Data Bank of the Central Statistical Office (GUS) in Poland [19]. The first is treated as an independent variable, already presented in this study in connection with the number of students in selected academic centers in Poland. The statistical analyses also used data on the number of registered business entities in selected towns and cities, treated as a dependent variable. We decided to select only entities operating in retail trade classified in Section G, Chapter 47 of the PKD (Polish Classification of Economic Activities), and in catering and hotel services classified in Section I, Chapter 56 of PKD. The selection of these economic sectors was dictated primarily by the results of empirical research conducted among students attending academic centers [15–17]. The results of these studies showed that the largest part of student expenses goes to local commercial and service companies, mainly those providing catering services [37,38]. Conclusions from the research have also proved that if students find jobs in the place where they study, they are employed mainly in trade as well as catering and hotel services [15,16]. Based on that result of the research we can assume that students directly influence these two business categories operating on the local market in academic centers. We should be aware, however, that students not only impact these types of local sectors. On the one hand, the presence of students and graduates attracts huge investors to towns and cities, which could exert a significant influence on local economic activity. On the other hand, the presence of student consumers is also important to businesses that are not directly involved in employing students and satisfying their needs. This is mainly due to the overall mechanism of the linkages between business entities when one type of economic activity affects another [39]. In this situation, the impulse of additional demand created by an inflow of students may lead to an increase in demand, income and employment in other businesses operating on the local market.

In the statistical analysis, the correlation coefficient was used to assess the strength of the relationship of the variables studied:

$$r_{XY} = \frac{SS_{XY}}{\sqrt{SS_X SS_Y}} \quad (1)$$

where:

$SS_{XY} = \sum (x - \bar{x})(y - \bar{y})$, the sum of the squares of X and Y ,

$SS_X = \sum (x - \bar{x})^2$, the sum of the squares of variable X ,

$SS_Y = \sum (y - \bar{y})^2$, the sum of the squares of variable Y ,

It was assumed that the correlation coefficient is unknown and should be estimated on the basis of a sample observation of the X and Y pair's variables. The correlation coefficient r_{XY} calculated from

the sample is the estimate of the correlation coefficient ρ in the general population, and its numerical value is the point score of the relationship strength in the entire population. The assumption adopted above shows the necessity to test the significance of the correlation coefficient calculated on the basis of a random sample. We therefore verify the following hypotheses:

$$H_0: \rho = 0;$$

$$H_1: \rho \neq 0.$$

Verifying the null hypothesis will help in assessing whether the existing relationship between X and Y in the sample is only accidental or whether it is a regularity in the population. The test statistic has a Student's t distribution with $n - 2$ degrees of freedom and was calculated using the formula:

$$t = \frac{r_{XY}}{\sqrt{\frac{1-r_{XY}^2}{n-2}}} \quad (2)$$

The p -value determined on the basis of the test statistic is comparable to the significance level of $\alpha = 0.05$. If $p \leq \alpha$, then we reject H_0 for an alternative H_1 hypothesis, but if $p > \alpha$, then we have no reason to reject H_0 . A detailed methodological record can be found, among others, in the works of Anderson et al. [40], Aczel and Sounderpandian [41], and Witte and Witte [42].

At the next stage of the analysis, when examining the functional relations between the studied phenomena, it was assumed that the considered dependencies are linear in nature, thus:

$$y = \alpha_0 + \alpha_1 x_1 + \varepsilon, \quad (3)$$

where:

α_0, α_1 —the value of the regression function parameters,

ε —a random component.

Assessments of the structural parameters of the model (realizations of sample estimators) were calculated using the least-squares method (*LSM*) according to the formula:

$$a = (X^T X)^{-1} X^T y \quad (4)$$

It should be noted that if the assumptions of the linear regression model are met, the estimators of the regression equation's parameters obtained by the *LSM* are consistent, unweighted and most effective in the class of linear estimators. The significance of the calculated structural parameters for checking the structural parameters were estimated with sufficient precision and verified by the hypothesis system:

$$H_0: a_i = 0,$$

$$H_1: a_i \neq 0.$$

The t test statistic follows a Student's t distribution with $l-s-m$ degrees of freedom and is written as:

$$t_i = \frac{a_i}{S(a_i)} \quad (5)$$

where:

n —number of observations in the sample,

k —number of model parameters,

$S(a_i)$ —a standard evaluation error of parameter a_i .

The p -value determined on the basis of the test statistic is compared with the significance level $\alpha = 0.05$. If $p \leq \alpha$, then we reject H_0 for an alternative H_1 , but if $p > \alpha$, then we have no reason to

reject H_0 . To evaluate the variability of the explained variable Y caused by the changeability of the explanatory variable X , the corrected coefficients of determination were used:

$$\bar{R}^2 = 1 - \frac{SSE / (n - (k - 1))}{SST / (n - 1)}, \quad (6)$$

where:

$SSE = \sum (y - \hat{y})^2$; the sum of square errors,

$SST = \sum (y - \bar{y})^2$; the total sum of squares,

\hat{y} —theoretical value calculated on the basis of the estimated regression model,

\bar{y} —the average value calculated for variable Y ,

n —the number of observations in the sample,

k —the number of model parameters.

It should also be emphasized that the presented methodology has some limitations. In the process of building correlation and regression models, the assumption of a linear interaction of the examined features was adopted. The assumption about the use of a linear functional relationship results from the theoretical assumptions necessary to determine the dependencies studied and is commonly used in modelling economic relationships. A detailed methodological record regarding regression model and the common limitation can be found, among others, in the works of Aczel and Sounderpandian [40], Darlington [43], Pardoe [44], and Weisberg [45].

4. Results: The Number of Students and the Number of Businesses in Selected Academic Cities in Poland

The analysis of Pearson's correlation coefficient between the number of students (marked as X) and the number of entities (marked as Y) that qualified for the Polish Classification of Economic Activities (PKD) sections proved (see Table 3) that in selected centers—mainly towns which recorded significant percentage decreases in the number of students, there was a strong correlation between selected variables. Here, particular attention should be paid to towns such as Kielce, Szczecin, Bydgoszcz-Toruń, Opole, Olsztyn, and Gorzów Wielkopolski, which experienced a significant drop in the number of students in the analyzed period and for which the Pearson correlation coefficient for both variables fluctuated around 0.95.

Statistically speaking, when taking into account the significance of the obtained coefficients, it can be concluded that in these towns, the obtained results prove that depending on the decreasing or increasing number of students, the number of local businesses decreases or increases. The evident feature of the mentioned centers is that due to their location and economic delays, their academic function becomes a key aspect determining their functioning and development. In their case, it is difficult to imagine a lack of universities and students, because without an academic foundation, the towns will become even more peripheral, not only economically, but also in the intellectual and demographic sense.

Table 3. Correlation coefficients for the variables: number of businesses, number of students.

City	Correlation Coefficient
Białystok	0.62
Bydgoszcz-Toruń	0.97*
Gorzów	0.91*
Katowice	0.98*
Kielce	0.98*
Kraków	0.88*
Lublin	0.90*
Łódź	0.57
Olsztyn	0.95*
Opole	0.97*
Poznań	0.62
Rzeszów	0.74*
Szczecin	0.98*
Tri-City	0.78*
Warszawa	−0.56
Wrocław	0.64
Zielona Góra	−0.86*

Source: own study based on our calculations. * statistically significant correlation relationships.

On the other hand, the correlation dependence of the studied variables in the cities of Białystok, Łódź, Poznań, and Wrocław has not been confirmed statistically. It can be assumed that these towns and cities, mainly Poznań and Wrocław, which are treated as cores of development of Poland, use not only the inflow of students as factors which are an important source of their development. We can evidently point to such factors of development as: capacity of the market and the supply market, polarization of international corporations, attractiveness for foreign direct investments, promising prospects of the further development of these cities not only in the economic sense, but also regarding the demographic perspective.

Analyzing the data presented in Table 3, the correlation coefficient calculated for Zielona Góra and Warsaw is worth noting. This coefficient, in contrast to the coefficients calculated for other towns and cities, is characterized by a negative correlation dependence. In this case, however, we must omit the case of Warsaw, as we could assume even before this analysis that the relationship between the two variables is statistically insignificant. This is most likely due to the fact that Warsaw as the country's capital receives so many other economic benefits from being the center of the country—plays an important role as an administrative center and a hub of economic, social and cultural activities [46]. It is due to this function that Warsaw attracts a lot of physical and human capital, especially workers, commuters and tourists, which has a great impact on the concentration of the companies involved in meeting customers' needs. This means that its academic activity is only a small element of the local economy which to a small extent affects the capital's local businesses.

It seems, however, that the correlation for Zielona Góra was disrupted by the city's enlargement that took place in 2015, when the nearby villages were incorporated into the city. This resulted in a significant increase in the number of businesses registered in thus enlarged Zielona Góra, while at the same time there was a drop in the number of students observed throughout Poland.

In the next step of the analysis, additional calculations were made, consisting in an attempt to estimate regression relationships of the changes between the number of businesses (marked as Y) and the number of students (marked as X) (see Table 4).

Table 4. Parameters of the estimated regression models.

City	f. Trend Equation	Adjusted R ²
Białystok	$y = 0.009x + 5770$	0.39
Bydgoszcz-Toruń	$y = 0.075x + 4509^*$	0.95*
Gorzów Wielkopolski	$y = 0.213x + 2197^*$	0.84*
Katowice	$y = 0.040x + 4655^*$	0.96*
Kielce	$y = 0.040x + 4434^*$	0.97*
Kraków	$y = 0.04x + 13424^*$	0.77*
Lublin	$y = 0.044x + 4151^*$	0.81*
Łódź	$y = 0.01x + 14134$	0.32
Olsztyn	$y = 0.025x + 2316^*$	0.91*
Opole	$y = 0.027x + 2517^*$	0.94*
Poznań	$y = 0.02x + 12255$	0.39
Rzeszów	$y = 0.010x + 3254^*$	0.55*
Szczecin	$y = 0.055x + 7481^*$	0.96*
Tri-City	$y = 0.090x + 4194^*$	0.62*
Warszawa	$y = -0.04x + 58789$	0.31
Wrocław	$y = 0.02x + 13225$	0.41
Zielona Góra	$y = -0.095x + 4210^*$	0.74*

Source: own study based on our calculations. * statistically significant regression models and adjusted co-variable determinants.

Analysing the statistically significant impact of the number of students on the number of businesses, we can note that Gorzów Wielkopolski had the highest numbers (1000 students contribute to the creation of 213 businesses on average), while the lowest was in Rzeszów (1000 students on average contribute to the creation of only 10 businesses). It is worth noting here that Gorzów Wielkopolski represents the group of peripheral towns in Poland, which can be characterized by a slower rate of development and—the same time—by a huge drop in the number of students (75%). It can therefore be assumed that in the case of this town, but also in the case of a few other academic centers, students are a significant “engine” enhancing the development of local enterprises, while their significant decline may lead to a fall of local businesses on an unimaginable scale.

As the presented data show, the situation looks much different in Rzeszów—a dynamically developing growth pole of south-eastern Poland, where a relatively small drop in the number of students was observed. The results prove that local enterprises only to a small extent are associated with the presence of students due to the contribution of huge groups of other city users, like commuters, new residents, labor resources who are attracted to the center by the good situation on the local labor market and prospects for its further development. Similarly, in Białystok, we can observe an even smaller impact of students on the number of businesses (1000 students, on average, contribute to the creation of only 9 businesses), however, we should remember that the estimated regression model is statistically irrelevant for this city.

At this point, it is also worth noting that, like in the correlation analysis, a different regression model from the nationwide tendency occurs in the cases of Zielona Góra and Warsaw. The regression model estimated for these cities is characterized by a negative value of the α_1 parameter located at variable x_1 . In the case of Warsaw, the country’s capital, this especially means that businesses operating in trade and in the hotel and catering industries depend on other customers than students. Here we mainly mean other city users, such as commuters and participants of the tourist trade, including business tourism.

5. Discussion and Conclusions

This article only indicates the most important, in the authors’ opinion, economic consequences of a changing number of students for academic towns and cities in Poland. It concerns only one parameter, that is the measure of the economic situation of towns and cities, meaning the functioning of local

businesses. This influence should be considered on at least two dimensions. First and foremost, as students consume goods and services offered on the local market, their demands impact the sphere of local entrepreneurship, influencing income, production and employment. In the case of the second dimension, the relationship between the number of students and the number of businesses should be analyzed from the perspective of the availability of labor resources which local entrepreneurs search for, because students are a cheaper and more flexible substitute than local labor resources [47]. The availability of student labor resources in particular allows employers to sustain and generate the growth in the face of the lack of local labor resources or in the face of higher pay expectations observed in groups of regular employees.

The shrinking number of students may cause circular causation consequences and become a big threat to many business entities in terms of making profit or finding workforce. Therefore, a decrease in the number of students could pose a threat to local economies, especially those mainly relying on their academic capacity [35]. The analyses presented in the article confirmed that the impact of students on local enterprises depends to a large extent on the size of a town or a city, and on its functions. We noticed a positive correlation between the number of students and the number of selected businesses in the majority of smaller towns located outside of a metropolis. Thus, we can conclude that the development of the enterprises in smaller centers is supported by external demand created by the influx of students [33]. In turn, in the large cities included among Poland's leading urban centers, students have a smaller noticeable short-term impact on the number of business entities, which is directly related to other factors upon which large metropolitan centers base their development. For these cities, students are just one of many local developmental factors. One can wonder how the results of the paper could be pertinent in terms of sustainable development. The issue analyzed in our research study seems to be extremely important in the ongoing debate on changes in the system of higher education, especially in Poland. Some voices in the discussion on the changes have seen them as a threat to Poland's sustainable development, because they can lead to even greater polarization of leading cities, which are widely recognized as growth poles [34,36]. On the other hand, smaller and weaker regional academic centers, which are struggling with demographic and socio-economic problems, can lose not only universities, but also students and potential population. Yet both elements of the puzzle are considered to be key elements and often the only ones for achieving sustainability in non-metropolitan towns and regions, not only in Poland but also in similar countries [48–51]. Regions, towns and cities without students and universities are regarded as areas without the proper potential to survive and develop. A large body of empirical research shows that "success of universities depends fundamentally on the quality of the urban environments in which they are situated" [52,53]. Therefore, the local authorities, local policymakers, local business leaders and the authorities of universities have to make joint efforts to prevent the further outflow of students who are considered the crucial factor of economic and demographic development of towns.

Concluding, it is also worth noting that we are fully aware of the limitation of the presented model and the analysis. First, we are aware of limitation of the public data. Second, as indicated in an existing literature many other internal and external factors affecting the number of businesses exist, which were not included in this model [54–56]. Third, it should be emphasized that the interpretation of the presented data omits the presence of extremely important multiplier effects that are important for the functioning of local businesses. Expenditures made by students directly affect the revenues of analyzed business entities, but they can also lead to an increase in income and employment in many other enterprises, not always included in the presented analysis [39]. Fourth, since part-time study courses are available, some groups of students are often not compelled to move to the academic towns/cities. Keeping in mind the aforementioned arguments, one has to be aware that some groups of students are engaged neither in the process of consumption nor in production in academic towns and cities [57]. Fifth, it should be also emphasized that students' employment during studies depends, among other factors, on the majors of their studies. As public data show that most of the students take up majors connected with business and administration, teaching and education, social

and behavior sciences [19], the occupational categories of the students' employment can appear in many other types of enterprises—not only operating in retail trade and hotel and catering services. Sixth, the analysis is of a short-term nature, and the presented relationships may turn out to be quite different in the same centers in the long run. It can be assumed that in the case of smaller centers, there is a smaller percentage of those who would like to live in towns after graduation and a lower impact of students on local businesses there can be observed in the long term [58]. In the case of larger centers, the strong long-term consequences of the accumulation of human capital represented by students and graduates of higher education institutions may have impact on the demographic situation, consumer and investment demands and the creation of labor resources at the local labor market level [25,59]. These assumptions, however, require much more detailed research and analysis. The formulation of more universe conclusions requires wider range of factors affected the local businesses be introduced in the model. Another issue that need to be examined is the correlation between the number of students and the number of larger enterprises in academic towns and cities. Furthermore, research focuses on the long run impact of the academic function of centers would be very beneficial.

Finally, despite the abovementioned limitations and the fact, that this study concerns the situation of academic towns and cities in Poland, it can contribute to the literature on local development not only in Poland but also in other towns and cities facing similar situation.

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