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ANALYSIS OF HIGHER EDUCATION COSTS AND SOURCES OF THEIR FINANCING

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ABSTRACT

Since 2013 public and private universities have been statutorily obliged to record the costs of educational activity for the full-time studies and the part-time studies separately, even though the division into full-time and part-time studies was introduced in 2005. Due to the new amendment, financial flows are divided into categories with respect to their purpose, it is forbidden to finance by part-time studies' subsidies, but it is not pointed out that universities have certainly to conduct the subsidized activity cost account (of full-time studies). This engenders the need to expand the knowledge about the sources of financing costs of higher education. In order to investigate underfunding of costs of education in terms of type of ownership, (educational) profile and size of a university, this article aims to apply in practice an author's methodology for analysis of the sources of financing higher education costs. This methodology contains an assessment of adequacy of the cost-intensity of studies, used by Ministry of Science and Higher Education (*MSHE*), as well as a Least Squares estimation of determinants of financing the higher education costs level by grants from the state budget and fees charged for educational services with characteristics of education processes taken into account. Data for this study is based on results of interviews, expert opinions and the database purchased from the Polish Central Statistical Office (*CSO*) as part of "*Spoleczne i ekonomiczne uwarunkowania wyborów osób w wieku 19-30 lat dotyczących studiowania*" project. This project was a part of systemic project implemented by Educational Research Institute named "*Badanie jakości i efektywności edukacji oraz instytucjonalizacja zaplecza badawczego*", which was co-financed by European Union under European Social Fund.

Key words: higher education, education costs, finance sources, grants, educational activity

1. INTRODUCTION

The purpose of this article is to present a practical application of an original methodology for analyzing higher education costs and the sources of their financing in an attempt to investigate underfunding of these costs according to form of ownership (public and private) and type and educational profiles, the size of the university (by the number of students), focusing on the education of part-time and full-time studies. In particular, it concerns applying in practice an author's methodology for assessment of adequacy of the cost-intensity of studies, used by Ministry of Science and Higher Education (*MSHE*), as well as a Least Squares estimation of determinants of financing the higher education costs level by grants from the state budget and fees charged for educational services with characteristics of education processes taken into account. The analysis is based on data concerning the cost of education, collected at public statistics level, based on forms like the F-01 / S on revenues, costs and financial results of universities, the S-10 about higher education as at November 30th and the S-12 on scientific scholarships, postgraduate and doctoral studies and employment in universities. According to the law on higher education, a triggering factor of the process of evaluating education costs is the management decision of the university authorities concerning the development and adoption of a relevant methodology for this process. Thus, because of the autonomy of the university and the diversity of universities' approaches to determine the cost

of education, it seems to be more appropriate to analyse higher education costs level based on data retrieved from the public statistics system due to the uniform methodology. The solution proposed seems to perform better than collecting information from universities on their unit costs of education, in total or in the fields of education (per student or per teaching hour), calculated according to an individual methodology for the calculation of the costs of education, that was introduced and adopted by a management decision of the authorities of the university.

In the study conducted in this article I will attempt to determine characteristics of the teaching process influencing the level of education costs financed by grants from the state budget, as well as level of fees for educational services in relation to total revenues from teaching. These are the main research questions. It seems that the level of education costs covered by grants influences the decisions of public universities on conducting paid part-time studies. At the same time due to the demographic decline, it can be expected that the part-time studies are underfunded by fees charged by public universities.

The paper is structured as follows: the theoretical background and the literature review are presented in the initial section, followed by the presentation of empirical studies on diversification of the cost of education at public and private universities, unit cost of education by type and size of higher education institutions and the weighted average cost-intensity of education. Then findings of models estimation are interpreted and discussed with references to the law regulation of the subject. The paper ends with conclusions and a summary, that includes recommendations to increase the possibility of future analysis of the education costs at the system level. They could be used as a tool to propose the evidence-based policy.

2. RESEARCH ISSUE IN THE LIGHT OF LEGAL FRAMEWORK AND LITERATURE REVIEW

Since 2013 universities have to meet statutory requirements, due to which they are obliged to record education cost separately for full-time studies, part-time studies and other educational activity, despite the fact that division into part-time and full-time studies was introduced along with the act of 27 July 2005 Law on higher education (Dz. U. of 2005 No. 164, item 1365). In the aftermath of this 2005 amendment, full-time studies at public universities were fully government-funded and part-time studies were financed only by fees paid by students, while until 2005 part-time studies were being funded by MSHE's subsidies, with coefficient of 0.3 for part-time students (taken place during evenings as well as weekends). Moreover, for part-time doctoral students the coefficient of 2.0 was used, while for full-time doctoral students the coefficient was equal to 5.0 [Bieliński 2006].

Abolishing of the partial financing of part-time studies from the state budget aimed to create favourable conditions for development of competition among public and private universities in the field of fee-based studies. However, strengthening the regulations in 2013 is probably the results of rising concerns about the part-time studies' costs at public universities being treated as the marginal cost, not as the full cost, which suggests that there is an inequality between public and private universities, even on the part-time studies market. Non-public universities offering only part-time studies (universities concentrating on one product or bundle of products of the same kind – several

related part-time programmes) cannot take their decisions on the basis of incremental costs calculations but they should consider full costs instead. According to the 2013 amendment, statutory categories of separate records of part-time and full-time studies divide financial flows by their purpose, but do not require high-detail principles of recording at the level of university which conducts studies. Urbanek and Walińska (2013) pointed out that public universities, as public sector entities, are required to spend the raised funds for their intended purpose.

In practice, courses at some universities are conducted for full-time and part-time students together, e.g. at several programmes offered by University of Warsaw. It does not impose the absolute equality between education costs for full-time and part-time studies of the same programme, because of the aggregation level of part-time studies costs, which is sometimes even set at university-wide level or at the particular programme's education level.

The Regulation of the Council of Ministers on detailed principles of financial management of public universities does not specify the exact methodology for calculating higher education costs and thereby leaves to universities the choice of cost accounting method (methodology for cost accounting and methodology for recording part-time and full-time studies' cost separately). Public university settles costs by type of activity, with a separate funding by grants from the state budget and by own revenues, on the basis of records of costs by nature and by function, underlying the preparation of financial statements [Par. 16, ust. 1 Rozporządzenia Rady Ministrów (RRM)]. Higher education costs of public university consist of costs of teaching process at every level of studies as well as costs of faculty training activities, university maintenance's costs (including renovating costs, without dormitories and canteens [Par. 8 RRM]) and contributions to own scholarship fund [Par. 13, ust. 1-3 RRM]. The catalogue of costs is open and may include other costs of public university's educational activity which provides an income [Par. 8 RRM].

The main categories of costs of educational services provided by universities are personnel costs and costs of infrastructure usage (mostly use of classrooms/research rooms and equipment). Among direct costs there are mainly personnel costs of lecturers, indirect costs refer to costs supporting teaching process, e.g. library and administration costs. When it comes to direct costs, the main problem is the proper choice of their recording method and the lack of clear regulations regarding distribution of working time between teaching activities, research activities and organizational activities. Hence, the data collected by public statistical institutions reflects only the composite remuneration costs (including teaching, research and separate operating activities) and the composite overall costs of educational activity, without structure breakdown. It raises the basic problem on the ground of Smart Economy that comes down to question about the influence of asymmetric information on the decision-making process in terms of distribution of public funds and ensuring that those funds are going to be used only for their intended purpose, instead of being partly spend on subsidising fee-based educational services (teaching part-time students).

Since 2013, due to the accounting policy the head of university should issue an order regarding guidelines for calculation of educational costs, which precisely regulates recording and calculation of direct and indirect costs of educational activity among full-time, part-time and other types of study programmes [Par. 16, ust. 3, Par. 18 and 19 RRM]. Especially the rector shall establish the method for settlement of direct and indirect costs of teaching activity, including remuneration costs which

cannot be classified up-to-date as costs of full-time, part-time or other studies. It is permitted to calculate these costs proportionally to amount of teaching hours [Par. 19, ust. 1 RRM]. The calculation of education costs is done once a year, however the rector can arrange the settlement in shorter periods [Par. 20 RRM].

The most common cost methodologies used by universities are Activity-based costing (ABC), which has been implemented in several universities of technology, and it was also applied in famous *Educational Cost Calculator* by Henryk Miłosz, Cost-plus pricing or Full costing method, developed at University of Łódź. The essential aspects of the effective cost calculation are solid management software systems e.g. SAP (Jagiellonian University, The University of Silesia in Katowice, Częstochowa University of Technology), Simple (University of Łódź) as well as administrative and management staff with proper mentality and sufficient skills, who are capable of using management information generated by the system. It is difficult to benchmark educational costing because costs calculation is not carried out in the comparable way [On the basis of the expert consultation of dr M. Hulicka, prof. dr hab. I. Sobańska, prof. dr hab. E. Walińska and dr. H. Miłosz] and, as mentioned before, the Regulation of the Council of Ministers on detailed principles of financial management of public universities does not determine a detailed cost recording.

Results from previous studies on the higher education costs composition show the dominant share of personnel costs, including remuneration costs [e.g. Falcon 1973, Franco 1991]. Franco (1991) notices that educational costs of public universities per student are more than twice as high as those of private universities. Personnel costs account for more than half the overall operating costs, both at public and private universities. Balderston (1974) stresses that cost analysis in higher education can be the basis for justifying the assessment of educational and commercial costs to sources of their funding (public or private), as well as for assessment of resources to certain types of activities. Capaldi and Abeby (2011) point out the differentiation of educational costs among various scientific disciplines being taught. Lack of relevant cost analysis, that would eliminate such distortions, may likely result in fees being set at a level which is not equivalent to real educational cost incurred by universities. Providing only the overall educational costs enables hidden subsidizing of more cost-intensive (unprofitable) programmes by less cost-intensive ones. Disparity of costs exists also among different profiles and degree levels – in general educational cost of student graduating with Master's degree is, intuitively, higher than student with Bachelor's degree and lower than student graduating with PhD. Ossowski (2009) claims that the main higher education cost are labour costs, which may account even for 90% of overall costs. Academic teacher hourly rate is determined by *dividing the monthly rate base salary with additions and 156 hours a month* [Rozporządzenie MNiSW z dnia 11 grudnia 2013 r.]. Ossowski (2009) suggests calculating the teaching process costs based on number of study groups or students overall, while Toutkoushian (1999) includes in his regression such dependent variables as costs generated by universities per student, graduate and research grant, and such independent variables as costs of Students' Office activity, institutional support, remuneration costs, transfers of budget funds to students (e.g. financial assistance, scholarships).

Studies on Polish higher education development stress the growing importance of diversification of financing sources, targeted subsidies and procedures based on competition and the increase in tuition fees that charge students and their households [Dąbrowa-Szeffler and Jabłocka-Pryśłowska 2007]. The most recent literature provides the analysis of Polish higher education entities' financial

situation, using CSO's data covering the 1997-2009 period, based on average unit values (per student) for: costs, revenue and income on educational activity its profitability, depending on the type of university [Dawidziuk 2010]. Distinctions in costs structure between public and private (non-public) universities are most often the result of differentiation in size of universities, mode of studies or the form of employment of lecturers beyond faculty minimum. Over the 1997-2009 period private universities, despite generating lower revenues (in terms of unit values) than public universities, shown higher profitability (21-28%) between 1997 and 2001, while between 2003 and 2009 it was only 4.6-7.4% [Dawidziuk 2010].

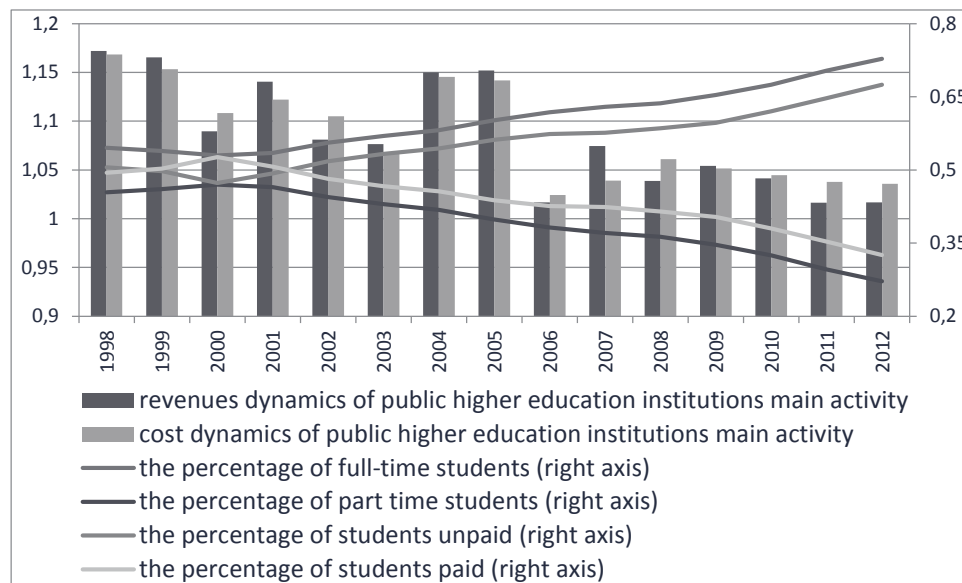
While analyzing higher education costs, it is important to notice that the financial management's purpose of public universities is mainly to maintain its liquidity rather than generate an income. In the conditions of recent demographic decline and with prevailing "grant algorithm" public universities have a limited impact on revenues. This situation makes them focus mainly on evaluating educational cost of full-time and part-time studies with regard to relevant employment policy and carrying out a teaching process: number of students in each group, assessment of teaching hours according to form of educational classes and working position or wage, monitoring the fulfilling of teaching hours and limiting overtime when those hours are not fulfilled by other co-workers, as well as fulfilling teaching obligations by doctoral students [On the basis of the expert consultation of dr H. Miłosz].

3. DETERMINANTS OF DIVERSIFICATION OF THE COST OF EDUCATION AT PUBLIC AND PRIVATE UNIVERSITIES. PREELIMINARY ANALYSIS OF SECONDARY DATA (CSO)

Since 2010 public universities have not been able to counteract the process of greater growth of the teaching cost than the increase in revenues from educational services, as a result of significant decline in state funding and a sharp decline in the number and percentage of students paying fees. The resignation of taking paid studies also favours the increasing number of free-of-charge studies offered due to the impact of the number of full-time students on the amount of grant from the state budget based on the algorithm (student-doctoral component). Although the legislature inhibits the growth of the number of students enrolled free of charge by the reduction of algorithm-based subsidies paid to public universities who provide full-time studies, if the overall number of students increases annually by more than 2%, there is also a similar increase in the number of students studying for free with in some universities. For some specific fields of study that growth can be much larger, because the limit applies to the number of students in the whole university. The percentage of students paying for education has been declining since 2001, also considering postgraduate students and part-time doctoral students. The dynamics of the cost of education at public universities exceeded the growth rate of revenues from educational activities during 6 out of 15 years from the 1997 to 2012 period (Fig. 1).

Over the 2010-2012 period, the percentage of part-time students paying for education decreased below 50% of all students at public and private universities. The number of part-time students declined in 2012 by 297 thousands, which is 29.6% of the students for the 2005/2006 academic year. At the same time, the total number of students decreased by 14%. As a result, since 2010, the sources of financing education structure has changed - in 2005 as many as 58.9% of students had been paying fees, while in 2012 only 47.1%. In public universities, the percentage of part-time students decreased from 43.8% in 2005 to 27.2% in 2012.

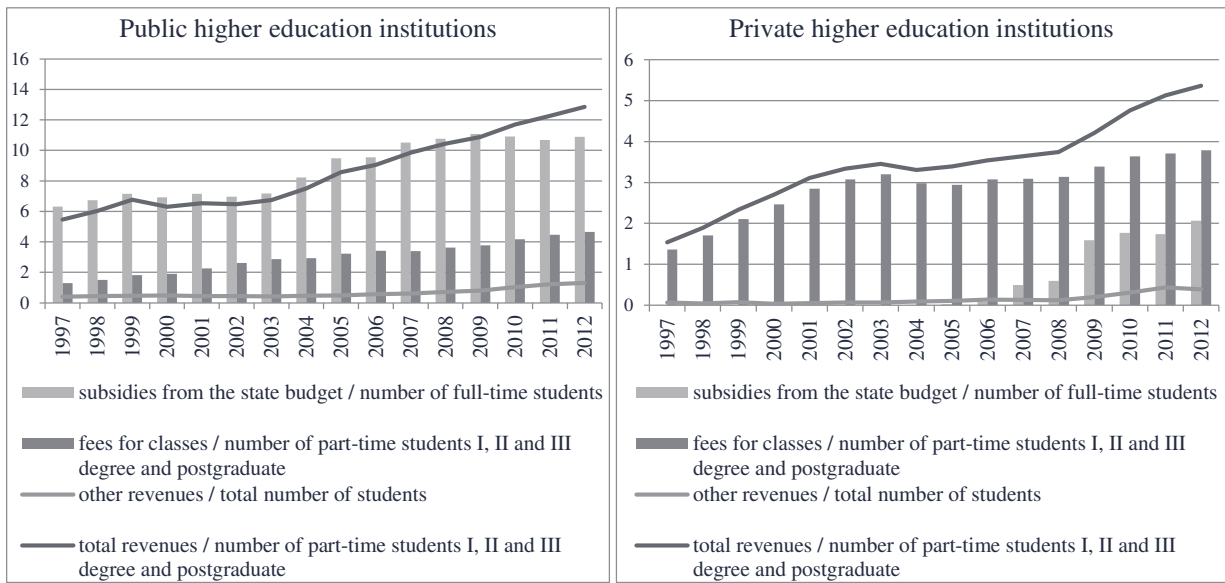
Figure 1. The revenue growth rate of public higher education institutions main activity and the change in the financing structure in the years 1997-2012



Source: own calculations based on CSO data on Higher Education and its finance for years 1997-2012.

A broader look at the financing of the higher education system by those who are studying free of charge (student-doctoral component of the grant algorithm impacts the donation in public universities and grant resulted from teaching full-time doctoral students in private universities) and by those paying fees, indicates that the percentage of paying for higher education services is gradually, but steadily, decreasing. In total, paid education share decreased from 66% in 2000 to 61% in 2008 and 51.5% in 2012. Sudden change in the financing structure of higher education, intensified by demographic processes, has negatively affected the financial situation of universities in both sectors of ownership. In public universities share of students paying for education has been decreasing gradually from 50.7% in 2001 to 32.5% in 2012. Analysis of unit revenues of educational activities of universities in total (per participant of educational services) shows the growing importance of revenues from activities other than education, especially since 2010, and the stabilization of the nominal amount of the basic grant for teaching per full-time student, particularly since 2009 (Fig. 2).

Figure 2. Revenues of higher education per student in the years 1997-2012 (in thousand PLN)



Source: own calculations based on CSO data on Higher Education and its finance for years 1997-2012.

Based on data from the Central Statistical Office in 2012 average fees for the classes at public universities (4 663 PLN) were about 23% higher than in private universities (3 786 PLN), and over the analysed 16 year span average fees at public universities were 3% higher than fees at private sector. It can be assumed that the difference in amount of individual fee for educational services between public and private universities was partly influenced by the legislation that imposes self-financing of part-time studies by public universities. Fees charged can not exceed the costs incurred to the extent necessary to open and conduct at the university part-time studies including the costs of preparing and implementing the development strategy of the university, in particular the development of academic staff and infrastructure (for education and research purpose), including depreciation and repairs [art. 99 PSW]. They could also be due to the higher cost of doing paid studies in public universities.

4. METHODOLOGY

The research will be conducted on the basis of data, purchased from CSO, on higher education for 2013. The data contains forms like the F-01/S on revenues, costs and financial results of universities, the S-10 on higher education as at November 30th and the S-12 on scientific scholarships, postgraduate and doctoral studies and employment in universities, for universities grouped into 29 groups for statistical secrecy. Universities were grouped according to form of ownership (public and private), type (the extracted by the CSO and POL-on: public higher education institutions, including

universities, higher schools: technical, agricultural, economic, teacher education, artistic, medical universities, academies of physical education and other private higher education institutions, including academies of economics and others), as well as the size of the university (according to the number of students) with a focus on the education of part-time or full-time studies. In order to study the main determinants of funding of the higher education costs level by state grants and fees charged for educational services in relation to the revenues of teaching, a least squares method (OLS) regression is conducted. Definitions and descriptive statistics of dependent and explanatory variables used in the regression are described in Table 1.

Table 1. Definitions and descriptive statistics of variables used

Name and definition of variable	Mean	Std. Dev.	Min	Max
Education costs covered by grants = grants from the state budget / costs of teaching at higher education institutions	0,580	0,306	0,005	0,894
Fees share in educational revenues - the fees for educational services / total revenues from teaching activity	0,301	0,328	0,021	0,955
Unit cost of education without financial assistance (coefficients for number of students as in the CSO methodology)	15,770	10,797	4,429	40,811
Average fee for part-time studies	6,242	5,573	0	24,891
Civil contracts = salaries of civil contracts / total costs by nature	0,089	0,052	0,031	0,201
Grant-funded wages = the basic grant for higher education / wages with charges from the employment relationship	0,811	0,440	0	1,418
Educational revenues to wages ratio = total revenues from teaching activity / total wages with charges	1,271	0,128	1,034	1,606
Class size = the number of students per academic staff (full time employment)	22,415	16,498	4,308	59,660
The number of visiting professors	6,7591	9,034	0	38
Postgraduate to part-time students ratio = the number of postgraduate students / the number of part-time students	0,205	0,096	0	0,467
Internationalisation = the number of foreigners full-time and part-time doctoral studies / the number of teachers - foreigners	0,487	0,735	0	3,591
Foreign languages = the number of foreign languages / the number of full-time and part-time students	0,449	0,078	0,307	0,608
E-learning = the share of blended learning students (educated on distance)	0,010	0,029	0	0,126
Administrative burden = the number of students per "administrative staff" (full- and part-time employment)	24,331	17,219	4,921	64,145
Students per assistant professor = the number of students / the number of assistant professors (full- and part-time employment)	75,939	144,624	0	731,228
Students per senior lecturer = the number of students / the number of senior lecturers (full- and part-time employment)	294,71	571,034	18,878	2330,295
Cost-intensity of studies according to formula (1)	2,070	0,483	1,449	2,855

Source: own calculations based on CSO data on Higher Education and its finance for 2013.

In the study I will take into account the average cost-intensity of education weighted by number of students for each programme of varying coefficients of the cost-intensity (*WCI*):

$$WCI = \frac{\sum_{i=1}^N k_i s_i}{\sum_{i=1}^N s_i} \quad (1)$$

where:

N - number of different fields of study carried out at the university;

k_i - cost-intensity of i field of study according to the Regulations and Communications of the Ministry of Science and Higher Education on the cost-intensive ratios (range 1.0-3.0) for individual fields of full-time study;

s_i - the total number of students from all years of study of the i -th field of study (based on data purchased from the CSO, retrieved from s Section 4 of the S-10 Statements of higher education as at November 30th).

5. ANALYSIS AND RESULTS

The starting point for the study of factors influencing sources of financing higher education costs, taking into account the cost-intensity of studies, was to resolve the unit cost of education for universities groups analysed using two alternative methodologies: Polish Central Statistical Office's (CSO) and Ministry's of Science and Higher Education. The results are presented in Table 2. Higher education costing, using the CSO methodology applied in the study, which is based on costs of teaching activity, fixed at the level of individual groups of universities, in relation to the number of students conversion rate determined as a weighted sum of the number of part-time students by a factor of 0.6, and the number of full-time students, post-graduate and doctoral students with a weight of 1.0. However, under the Ministry of Science and Higher Education methodology costs of teaching are related to the number of students conversion rate equal to the weighted sum of the number of part-time students with a weight of 0.5 and full-time students and postgraduate students with a weight of 1 and doctoral students with a weight of 2.5. The average cost of education by distinguished groups of public higher education institutions according to Central Statistical Office methodology is higher than the cost of education determined according to the methodology of the Ministry of Science and Higher Education, due to the different denominators, by about 5%. But for private higher education institutions that cost is about 0.3%-3.9% lower in the case of private academies of economics, and higher by 0.15%-0.38% for the other private higher education institutions. These differences result from differences in the number of students converted at different rates: the part-time (coefficient of 0.5 or 0.6), postgraduate (weight of 1.5 versus 1.0) and doctoral studies (2.5 vs. 1.0 in accordance with the CSO methodology). There are similar differences in the fixed direct costs of education, i.e. remuneration with social security contributions and deductions to the Social Fund for workers employed under a contract of employment in universities engaged mainly in teaching (education is more than 90% of their activity). On average salary overheads of contracts of employment in public schools represent 72% of the education cost, while in private schools only 49%. In public higher education institutions the education costs fluctuate from 8510 PLN (in schools focused on the part-time education) and 4429 PLN in other large public higher education institutions up to 40811 PLN in the higher schools of art (theatre and film). High costs of education are associated with the implementation of specialized courses in small groups and with the use of expensive specialized equipment and materials for laboratory classes.

Table 2. The unit cost of education by type and size of higher education institutions in 2013

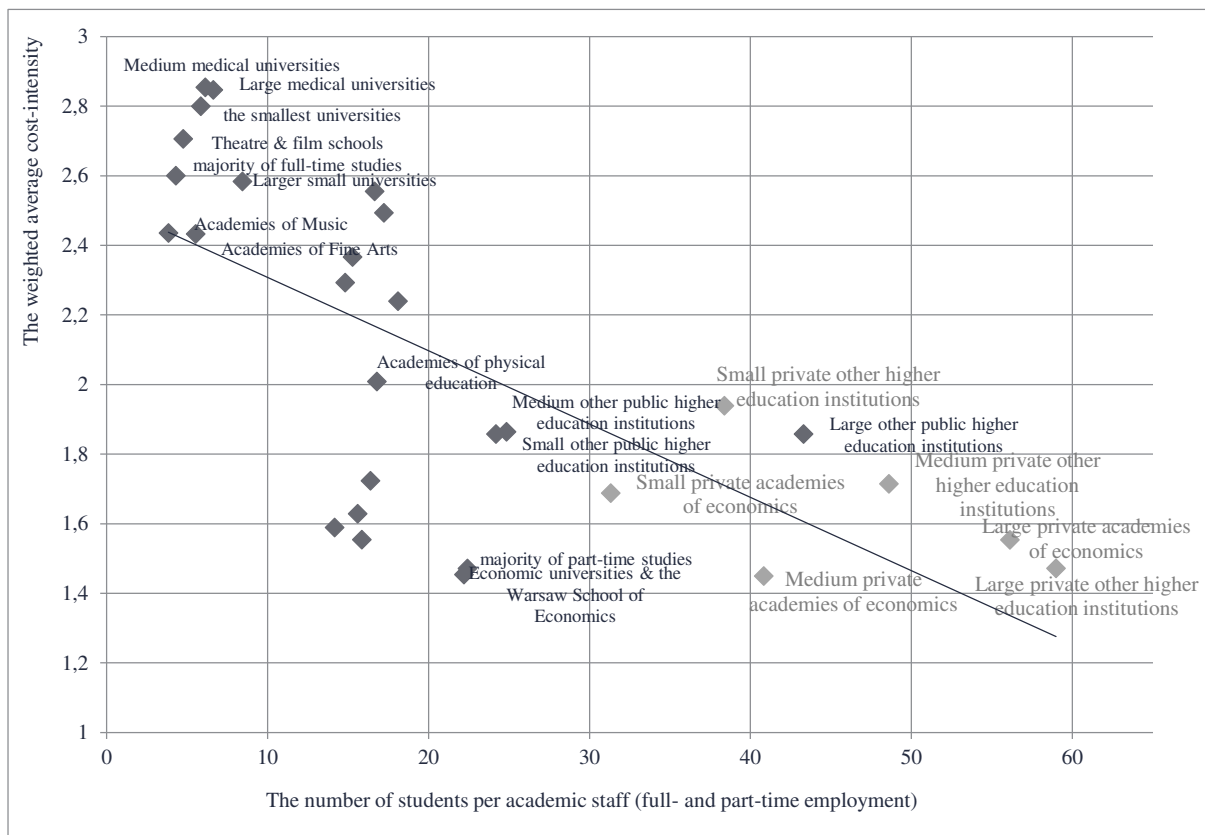
Type of higher education institutions	Statistical measure/ a group of higher education institutions	Unit cost of education (in thousands PLN) - some statistical measures			
		Central Statistical Office (CSO) methodology without financial assistance	Ministry of Science & Higher Education (SHE) methodology without financial assistance	Wages with charges to the employment contract / denominator by CSO methodology	Wages with charges to the employment contract / denominator by SHE methodology
Public higher education institutions	Mean	18,076	17,208	13,043	12,422
	Median	12,607	12,276	9,429	9,011
	Std. Dev.	10,757	10,094	7,574	7,115
	Coeff. of Variation	0,595	0,587	0,581	0,573
Private higher education institutions	Mean	7,197	7,384	3,554	3,650
	Median	6,737	6,755	3,320	3,283
	Std. Dev.	1,479	1,820	0,865	1,039
	Coeff. of Variation	0,206	0,247	0,244	0,285
Group of higher education institutions		Unit cost of education – the average values (in thousands PLN)			
Universities	Large	14,245	13,118	9,786	9,011
	Larger medium	11,622	10,926	8,402	7,899
	Smaller medium	10,604	10,003	7,963	7,512
	Larger small	21,006	20,060	15,303	14,614
	The smallest	31,152	29,190	21,387	20,040
Higher Technical School	Large	12,307	11,737	10,287	9,810
	Medium	12,607	12,276	8,839	8,607
	Small	10,974	10,859	7,852	7,770
	Technological universities &	12,937	12,672	9,429	9,236
Higher agricultural schools		12,751	12,324	10,160	9,819
Teacher education schools		9,663	9,237	7,470	7,141
Universities with the majority of part-time studies		8,510	8,088	6,468	6,147
Universities with the majority of full-time studies		36,624	35,156	28,097	26,970
Private academies of economics	Large	6,341	6,361	2,717	2,725
	Medium	6,737	6,755	3,327	3,336
	Small	9,940	10,331	5,192	5,397
Other private higher education institutions	Large	5,951	5,943	2,879	2,875
	Medium	5,531	5,326	2,933	2,824
	Small	7,095	7,016	3,320	3,283
Economic universities & the Warsaw School of Economics		9,236	8,429	6,691	6,107
Medical universities	Large	26,202	24,469	19,116	17,851
	Medium	30,714	28,613	20,567	19,160
Higher schools of art	Academies of Music	37,906	35,925	27,824	26,370
	Academies of Fine Arts	29,428	28,002	17,983	17,111
	Theatre & film	40,811	38,513	29,244	27,597
Academies of physical education		11,275	10,823	8,543	8,200
Other public higher education institutions	Large	4,429	4,452	3,387	3,405
	Medium	9,839	9,869	7,172	7,194
	Small	10,899	11,049	8,016	8,127

Source: own calculations based on CSO data on Higher Education and its finance for 2013.

Private universities do not provide education at such relatively expensive fields of study which either require specialized equipment and teaching resources or have to be carried out under special conditions and in small groups. Hence, their costs of education are at a much lower level than in public sector, ranging from particular 5531 PLN in medium-sized private institutions of higher education to 9940 PLN in small private academies of economics. This is confirmed by the relationship between the weighted average cost-intensity of studies (proposed in the author's methodology) and number of students per academic staff (full- and part-time employed) (Fig. 3).

Education in higher education institutions of the weighted average cost-intensity of studies above 2 is carried out at public universities, in relatively small groups (at 4,3-18 students for one academic teacher), and education in private universities is provided at the cheapest specializations, i.e. those with of the lowest weighted average cost-intensity of studies, with 31-59 students per a teacher. It can be assumed that, despite the involvement of part of the staff (beyond the minimum staffing) in private universities under civil law agreement, classes in private schools are conducted in relatively larger groups. The most expensive education is conducted at medium and large medical universities, with a high weighted average of the cost-intensity of studies 2,855 and 2,847 respectively, and in relatively small groups (6.12 and 6.63 student). The results of the study indicate that higher aggregate indicators of the cost-intensity of analysed higher education institutions groups there are in the case of educational services for smaller groups of students.

Figure 3. The weighted average cost-intensity of education compared to the number of students per academic staff in higher education institutions in 2013



Source: own calculations.

Conducting estimation of linear regression model using OLS was preceded by an analysis of the correlation. The results of model estimates of the determinants of the education costs level financed by grants from the state budget and fees charged for educational services of higher education institutions in relation to total revenues of education are presented in Table 3. The findings confirmed a strong positive correlation between the higher education costs level financed by subsidies from the state budget and salaries level with charges funded by the basic subsidy, and therefore also with administrative and research and education (academics) staff employed and paid from public funds. However, the greater stability of personnel employment measured by a higher level of financing their basic salaries by the grant reduces the incentive for offering of paid educational services, and thus reducing the share of payments for educational services in total revenues from teaching.

Table 3. Results of estimation of models of determinants of education costs level financed by grants from the state budget and fees charged for educational services of higher education institutions

Explanatory variable	Education costs covered by grants		Fees share in educational revenues	
	Coeff. Std. Err.	t-stat p-value	Coeff. Std. Err.	t-stat p-value
Unit cost of education	0.0021742* (0.0012573)	1.73 (0.102)	0.002407*** (0.0007633)	3.15 (0.007)
Average fee	-0.003428** (0.0015972)	-2.15 (0.047)	0.0059015*** (0.0010868)	5.43 (0.000)
Civil contracts	-1.026798*** (0.2203115)	-4.66 (0.000)	1.141826*** (0.1418572)	8.05 (0.000)
Grant-funded wages	0.5619628*** (0.0332107)	16.92 (0.000)	-0.5669249*** (0.0222006)	-25.54 (0.000)
Educational revenues to wages ratio	-0.1687006* (0.0833341)	-2.02 (0.059)	0.238127*** (0.0641296)	3.71 (0.002)
Class size			0.0026621*** (0.0006947)	3.83 (0.002)
Visiting professors			-0.001669*** (0.0004636)	-3.60 (0.003)
Postgraduate to part-time students ratio	-0.1655461* (0.0886672)	-1.87 (0.079)		
Internationalisation	0.0307689** (0.0126031)	2.44 (0.026)	-0.0184706*** (0.0061331)	-3.01 (0.009)
Foreign languages	-0.1602935 (0.1129655)	-1.42 (0.174)	0.2079333** (0.0745842)	2.79 (0.014)
E-learning			-0.136673 (0.1904787)	-0.72 (0.484)
Administrative burden	0.0020086** (0.0008734)	2.30 (0.034)		
Students per assistant professor	0.0000937 (0.0000594)	1.58 (0.133)	-0.0000972** (0.0000393)	-2.48 (0.026)
Students per senior lecturer			-0.0000724*** (0.0000131)	-5.52 (0.000)
Cost-intensity	0.0412129 (0.0260859)	1.58 (0.133)	-0.0807711*** (0.016565)	4.40 (0.001)
Constant	0.3669223*** (0.1225309)	2.99 (0.008)	0.3456349*** (0.0786093)	4.40 (0.001)
Number of groups / R ²	29 / 99.41%		29 / 99.83%	
Statistical tests for a total insignificance of the variables	F(11,17) = 261.79 Prob > F = 0.0000		F(13,15) = 678.49 Prob > F = 0.0000	
Ramsey RESET test:	F(3,14)=1.63, Prob>F = 0.2273		F(3,12)=3.31, Prob > F = 0.0573	

Symbols: ***, **, *, #, ## – significant at the level of 1%, 5%, 10%, 15%, 20%.

Source: own calculations based on CSO data and the Minister of Science and Higher Education's Regulations and communications.

The observed relationship indicates that the higher the level of payroll costs with overheads of contracted employment is funded by basic grants, the higher adjustment made by education institution in the structure of employment and other costs of teaching to the statutory possibility to fund them by grants within the existing grant algorithm. And the smaller the range of payroll costs with overheads of contracted employment are funded by basic grants, the more the university increases the offer of paid education. And in consequence the share of fees charged for educational services in total revenues from teaching is increasing.

Similarly positive correlation between the share of paid education in the educational activity of higher education institutions and the level of coverage of the salaries by revenues from teaching, altogether with a negative relationship with the level of coverage of the employment costs by grants, points that the offer of part-time and postgraduate studies by universities with unused human resources (not fully financed by grants) is increasing. Higher share of fees charged for educational services in the revenues of teaching is accompanied by greater flexibility in employment (measured by the share of wages of civil-law contracts in costs by nature), while more stable financing of staff from the state budget (expressed by higher financing of teaching costs by grants from the state budget) is accompanied by lower use of civil-law agreements.

The higher average fee for part-time studies, the higher education institutions are more likely to provide paid educational services (a higher proportion of fees for educational services in total revenues of teaching). Higher average fee for part-time negatively influences the level of coverage of education costs by grants from the state budget, which confirms that the lower funding of educational activities from public funds encourages universities to seek alternative sources of financing and charging higher fees for part-time studies.

Higher Education Law requires that public universities self-finance part-time studies, and in accordance to the regulations of law of higher education, fees charged can not exceed the cost of these paid educational services. It can be assumed that higher average tuition fees charged are more appropriate for the full costing, not just the marginal costing.

These assumptions are strongly confirmed by the significant positive correlation between the unit cost of education and the share of fees charged for educational services in the revenues of teaching. Awareness of the education costs and the need for their coverage enforces the universities to increase the share of paid educational services in teaching activities. Additionally, the conclusions are supported by weaker relationship (significant at the 10% significance level) between the level of the unit cost of education and the possibility of a statutory grant to cover the cost of teaching activities.

Increasing the number of listeners of postgraduate programmes in comparison to the number of part-time students lowers the share of subsidies from the state budget in financing the cost of education. This is due to the relatively higher cost-intensity of the services provided within the framework of post-graduate than part-time studies, often as a result of the involvement of practitioners and experts at much higher rates of remuneration than professors, offering catering for listeners or the need for renting halls at market prices in attractive locations.

Conducting postgraduate studies (instead of part-time studies) reduces the financing costs of education with public funds despite the possibility of complementing hours to normal working hours

by academics that have not executed teaching full-time, on-time imposed by law. In such a situation, an academic teacher is not entitled to additional remuneration for the teaching of postgraduate programmes beyond salary funded by a basic grant at public universities. The results indicate that the fees for postgraduate studies to a greater extent cover the costs of education than fee for part-time studies.

The results for the determinants of share of paid forms of education in universities teaching activities indicate differences in the structure of employment between the public and non-public universities. In particular, the increasing number of visiting professors, a higher ratio of students per lecturer employed (full- and part-time) or in relation to the number of senior lecturers is characteristic of public universities to a lesser extent pursuing paid forms of education. The positive relationship between the number of students per administrative full- and part-time employee and the level of coverage of the education costs by grants from the state budget, points universities that restrict administrative employment in conditions of demographic decline to have an advantage over the other.

Higher rate of the number of students per academic teacher employed for full-time significantly affects increase of the share of paid studies in education implemented by the university, which indicates that paid education is done in large groups of students. The findings result from the strategy of private universities limiting employment based on contract to the minimum staff level imposed by the higher education law.

The extension of education in foreign languages in full-time and part-time studies shows the positive impact on the share of paid educational services in revenues from educational activities, which results from increasing the number of hours of language courses and, consequently, salary expenses and costs of education. The education costs level financed by subsidies from the state budget is significantly positively affected by a ratio of the number of foreigners in doctoral full- and part-time studies in relation to the number of foreigners employed as an academic. This indicates that universities achieve relatively higher benefits from the adoption of a foreigner for full- or part-time doctoral studies than the associated costs, probably due to the inclusion of them in the component of exchange in the statutory grant algorithm, by a factor of 3. In contrast, such a measure of the internationalization of universities impairs implementation of paid education, probably due to the sufficient support within the financing system of education with public funds.

Performed OLS estimation indicates a significant negative correlation between the share of fees charged for educational services in revenues of education and the weighted average cost-intensity of studies carried out in higher education institutions, with the weights being the number of full-time students by fields of education, and the cost-intensity coefficients were retrieved from regulations and communications of the Ministry of Science and Higher Education. This indicates that education at more cost-intensive fields of study is carried out at universities providing paid educational services in lesser extent, so it is mostly funded by grants from the state budget.

Statistical analysis of detailed data on the level of separate groups of higher education institutions suggests that underfunding costs of education in medium medical universities equals to 14.5% of the cost of teaching with the basic grant covering only 58.9% of the costs. Underfunding costs of

education at economic universities and Warsaw School of Economics represents 1.1% of the cost of education at the basic grant covering only 57.7%.

For comparison, in the other public higher education institutions that grant financed 75-85% of the cost of education. The fees charged for educational services represented, on average (and for median observation), 92% of revenues of teaching activity of private higher education institutions, of which 75% came from fees for part-time studies. In public universities charge for educational services showed high variability (CV over 49% compared to 2% in the private sector), and the volatility of revenues of part-time studies was even higher (54% compared to 8.5% in private schools).

On average, fees for education accounted for nearly 14% of revenues of educational activities, mostly in the economic universities and the Warsaw School of Economics (28.6%) and the least in the schools of only full-time studies (2.1%) and in the public higher schools of theatre and film (4.2%). The highest revenues of fees charged for part-time studies reached a small private academies of economics (75.6%) and the medium other private higher education institutions (74.4%) and the lowest - large other private higher education institutions (59.5%).

6. CONCLUSIONS

In order to investigate underfunding of costs of education in terms of type of ownership, (educational) profile and size of a university, in this article I applied in practice my own methodology for analysis of the sources of financing higher education costs. Implementation of an original concept of evaluating the adequacy of the cost-intensity of studies, used by Ministry of Science and Higher Education, based on the CSO data on higher education in 2013, showed that education in public universities is provided with the weighted average of the cost-intensity of studies above 2, in relatively small groups (4,3-18 students). While education in private universities is done on the cheapest specializations, with 31-59 students per teacher. The most expensive education is conducted in medium and large medical universities, with a high weighted average of the cost-intensity of studies at 2,855 and 2,847 respectively, and in relatively small groups (6.12 and 6.63 student). The results confirm the adequacy of the MSHE's indicators of cost-intensity of studies to the size of study groups, at least at the aggregate level of group of universities distinguished by forms of ownership, (educational) profiles and size measured by the number of students. It would be recommended to extend this research in case of increased availability of data for individual universities, as indicators of the cost-intensity reflect the relative costs of education. This means that the increase in the cost-intensity of one field of education reduces the cost-intensity of other fields of the more, the more this course has a mass character [Sztanderska 2014, p. 115].

The results of OLS model estimation of the determinants of the education costs level financed by grants from the state budget and fees charged for educational services in relation to total revenues of education have allowed to answer the research questions. In particular, the findings indicated that the education costs level financed by grants from the state budget depends on unit education cost, administrative and academic staff employed who are paid from the basic grant, internationalization of universities (measured by the ratio of foreigners in doctoral programs to the

number of foreign academic teachers) and a larger number of students per administrative staff. In contrast, the reduction of the education cost level covered by grants from the state budget is influenced by higher average fee for part-time studies, a higher share of wages of civil contracts in the structure of expenses by nature, a higher coverage of wages with charges from revenues of teaching and relatively more postgraduate students in relation to part-time students. The share of fees for educational services in total revenues of teaching is determined by unit costs of education, higher average fee for part-time studies, a higher share of wages of civil contracts in the structure of expenses by nature, higher coverage of wages with charges by revenues of teaching, a class group size and the number of foreign language courses. The education cost level covered by grants influences the decision of public universities whether to run paid studies. At the same time, due to the demographic decline, many universities faced insufficient covering of the education costs of the part-time studies by fees. Underfunding of the costs of education in medium medical universities equals to 14.5% of the overall education costs and in economic universities and Warsaw School of Economics it is 1.1% of overall education costs.

To carry out in-depth analyzes of the costs of higher education, it would be necessary to collect data on the costs of teaching in a classification by nature. It seems advisable to change the profit and loss account in the form of separate statement of revenue and operating costs for a relevant system for a margin account, defying income from teaching activities corresponding with their costs. This would enable conducting an analysis of coverage of educational costs in the various segments of teaching. It would also facilitate the monitoring of universities' undesirable behaviours related to the financing of full-time studies by fees charged for part-time studies, as well as to the financing of the costs of part-time studies by sources other than fees.

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