

**THE EFFECTIVENESS OF EDUCATION
AND ECONOMIC GROWTH¹****Marek Biernacki**

Abstract. It has been shown in the article that education in Poland is very efficient up to the middle level, though, this prepared human capital does not affect the economic growth in Poland measured by the GDP *per capita*. One of the main unsolved problems is the lack of cohesion of higher education and the national economy, which is expressed, among others, by the lack of the correlation between the graduate structure and the labor market. In the last twenty years the number of students in Poland has increased almost five times, hence the concern for a higher education quality improvement and, as a consequence, for economic growth. The article is an attempt of analysis of the reality of the above mentioned state.

Keywords: effectiveness of education, economic growth.

JEL Classification: D8, D2.

1. Introduction

Poland is facing a serious problem: on the one hand, it should significantly reduce the public debt, on the other, improve efficiency and quality of social services, through which human and social capital that is essential for the growth of the economy can increase significantly.

In plain words, the problem of the education system can be expressed in the question: how do I get the best quality education for every penny spent? These problems are dealt with by the economics of education, which explores the links between public expenditures and the quality of schools. However, at the level of state authorities the question about the education system should be: how to educate, to obtain the greatest economic growth and greatest social well-being? There are several answers to the issue

Marek Biernacki

Department of Mathematics, Wrocław University of Economics, Komandorska Street 118/120,
53-345 Wrocław, Poland.

E-mail: marek.biernacki@ue.wroc.pl

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below: “additional average year of schooling in the population above 24 years increases the rate of economic growth by 0.44% *per annum*” (Barro, 2001).

“The quality of education is more important than the quantity of years of education” (Hanushek, Kimko, 2000). Barro and Lee examining more than 100 national economies during 1960-1995 in five-year intervals said, *inter alia*, that: “the most significant for economic growth are the results from the natural sciences and mathematics” (Barro, Lee, 2000). These statements are consistent with intuition because greater human capital facilitates the absorption of high technology from the countries “leaders”, and human capital is harder to adapt to new technology rather than physical capital. This paper shows that Poland’s education system, including the level of secondary school, is very effective; however, this developed human capital does not translate into the country’s economic growth as measured by GDP *per capita*. Possibly, there is a lack of cohesion between higher education and the national economy. This article is an attempt to analyze the above state of reality.

2. Education in Poland

Among schools covered by the educational system there are: 6-year primary schools; two- and three-year lower secondary schools, where education is compulsory; next, upper secondary schools, i.e. two- and three-year basic vocational schools; three-year general secondary schools; and specialized secondary schools and four-year technical secondary schools. At the next level of education, there are five-year universities, broken down by three-year undergraduate studies (bachelor degree studies) and two-year master degree studies.

Table 1. Students by levels of education (in thousands)

Schools	2005/06	2009/10	2010/11
Primary	2 602.0	2 234.9	2 190.6
Lower secondary	1 596.8	1 322.1	1 260.6
Secondary	1 719.7	1 519.5	1 464.9
Post-secondary	313.5	284.8	298.8
Higher	1 953.8	1 900.0	1 841.3
Students for every 10 thousand	509.4	493.4	476.4

Source: Poland in numbers, Central Statistical Office (GUS).

Table 1 presents a rolling demographic decline which should instigate even more motivation for creating an effective training consistent with the needs of the economy and society.

Table 2. Schools and students divided into public and private in 2009/2010

	Schools		Pupils in thousands	
	public	private	public	Private
Primary	13 033	936	2 171.5	63.4
Lower secondary	6 519	725	1 270.1	52.1
Post-lower secondary	6 802	832	1 453.8	65.8

Source: Central Statistical Office (GUS).

Recently in Poland there have appeared non-public schools, whose fees are high for Polish conditions. One should note the upward trend in the number of private schools and universities and the fixed number of public schools and universities. However, it seems that the increasing number of private schools and colleges has not increased the quality of education. Higher education has developed rapidly in numbers. In 1990/91 the number of students in Poland amounted to 404 000, in 2000/2001 it reached 1 685 000, and in 2009/2010 it was 1 900 000. At the same time the infrastructure and the number of teachers increased at a much weaker pace. Hence, there naturally appeared the tendency of multi-jobbing of academics, and, unfortunately, the quality of education has ceased to be the main goal of education. R. Galar (2001) notes that: “education today, conducted in the dominant mode of didacticism can only help to acquire knowledge of a well-articulated *know-what* and to some extent, covering rather formalism than understanding the essence of things, *know-why*”. The main problem of tertiary education is the lack of structure of the correlation between graduates and the labor market. When human capital is being planned ignoring the surroundings, the issues of quality of education are becoming secondary.

3. Two dimensions of the education system

1. **Professional dimension** – effectiveness of education, which measures the ability to improve the knowledge and skills of a student or a pupil.

2. **The economic dimension** – performance (service efficiency of a school, university), which is expressed by comparing the production contribution and economic effect (graduates).

The **effectiveness** of education, i.e. the ability of an educational institution to improve the knowledge and skills of a student or a pupil, is very difficult to measure. At the level of lower secondary school or high school, final and initial exam results, which are used for this measurement, are flawed. The selection of tasks that do not necessarily check the whole area of knowledge and errors of evaluation by examiners. At the level of higher education, the matter is even more complicated: the variety of subjects, examiners who care for a good test result and a not always coherent program of study, and, at the same university, a significantly different number of hours devoted to the same subject (and for the same material) are the factors that make it extremely difficult to measure the effectiveness of training. Evaluation of university education is usually spread over time and largely verified by the labor market (employers) and any increase or decrease in economic growth.

Various economic activities and those interested in economic activities variously define **efficacy** (effectiveness). The conditions of such comparisons may be as follows:

a) **Various alternatives** of activities' implementation/*ex post* assessment and the associated relative effectiveness. Results of a given school of education (university or faculty) are dependent on a mixture of cases of pupils (students), defined as the variability of their knowledge, skills, and abilities, as well as socio-demographic data and links to organizations, resources, and other characteristic aspects of the school. Therefore, to make comparing the effectiveness of teaching between education units possible, the relative efficiency must be tailored to the specific (in the context of the student) and specific (in the context of the school) variables using appropriate statistical methods. The simplest example of a class of linear models is a statistical model of “a university production function” expressed by the formula (Goldstein and Spiegelhalter):

$$y_{ij} = \beta x_{ij} + \gamma z_j + u_j + e_{ij},$$

where:

y_{ij} – a quantitative result of i , the student (students), in j , this school, university (faculty);

x_{ij} – corresponding characteristics of the pupil (student);

z_j – resources of j , the university (faculty);

u_j – measures relative effectiveness of that school (university, faculty);
 e_{ij} – is the random error;

β and γ – vectors of constant coefficients connected to x_{ij} and z_j , respectively. By estimating the vectors β and γ , the effectiveness of u_j j of that school can be estimated.

In this approach, the result of the j -educational institution is relative, i.e. that on the basis of the result one can build a ranking of educational institutions and isolated schools that teach more or less effectively. Compare with, for example, Biernacki, Ejsmont (2011).

b) **The objective achievements** (as a realization of stated objectives). In this approach, efficiency is understood as the relation between the current and expected outcome. The result should be described quantitatively, e.g. such as grade (points) from a final exam. In order to compare with the expected result, one should analyze other students' results from the same examination. An example of such analysis is the international PISA study on a group of 17-year-olds (see Table 3).

Table 3. International comparison of average educational attainment of 17-year-olds

Country	2003	2006	2007
USA	483	490	481
Germany	503	499	505
Italy	466	476	469
Poland	490	495	500

Source: OECD PISA.

From Table 3 we can see the progress of an average result of the high level of education among Polish high school students.

In higher education as a result, we can take for example “external evaluation”, i.e. human capital increase of a graduate (translated into an increase of their salary). In an international comparison, this dimension of effectiveness of education in Poland is relatively low (see Figure 1).

Other “external measures” of effectiveness of higher education are the likelihood of a graduate to find a job and a job in accordance with the completed direction of study and the time needed to find a job after graduation (i.e. the value of graduates on the labor market). Unfortunately, in Poland we have one of the largest, surveyed by OECD countries, an unemployment

rate of graduates: 6.2%. In the Wrocław agglomeration only about 60% of graduates work in the field in which they graduated. Thus, assessing with this measure, the efficiency of our higher education is low.

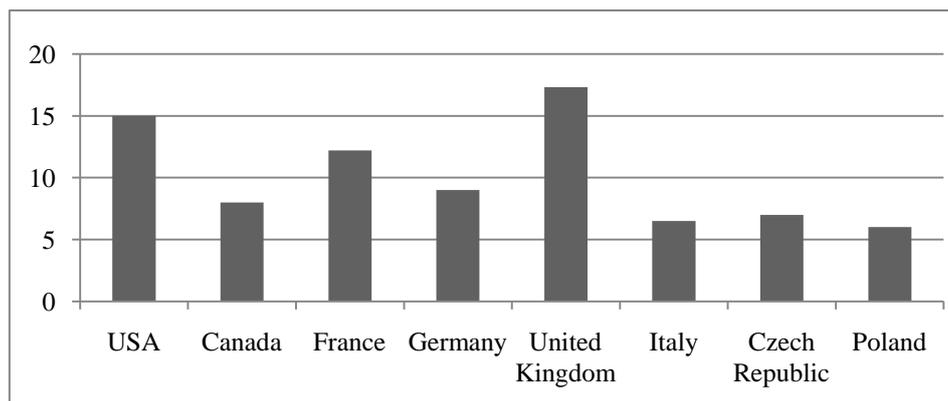


Fig. 1. Percentage increase in the salaries of university graduates compared to other countries
Source: OECD.

c) **Compliance with the standard** (quantitative characteristics of the service)/*ex ante* assessment. Effectiveness of education can be understood as a standard, i.e. an adequate product and process quality, hence, if the result and the process are within the standards, the school teaches effectively.

Organizations and certification of improvement of the quality of education to the secondary level include:

- Teacher Training Centre (CODN) is an institution established by the National Ministry of Education (MEN) in order to support the policy for a national system of teacher training.

- The foundation Center of Civic Education (CEO) is a non-governmental educational institution whose purpose is to promote civic knowledge. The CEO implements the following programs for pro-quality education: Educational Policy of Local Government and “Learning School”.

Signs of quality in education:

I. “School with Class”, the CEO together with *Gazeta Wyborcza* award this quality distinction, whose school selection criteria are as follows:

- teaches each student well;
- teaches how to think and explore the world;
- it helps to believe in yourself, it creates a good climate;
- assesses fairly;

- develops the students socially and teaches sensitivity;
- prepares for the future.

II. “The learning school” awarded by the CEO.

III. “Now Polish good school”, accreditation of the Environment of Schools of Social and Educational Society.

IV. “Interkl@sa” promoting schools that train students to function in an IT environment.

V. “Green Certificate” promoting environmentally friendly schools, awarded by the Foundation for Environmental Education.

The evaluation of educational process activities takes place at three levels:

- school: the head teacher together with other teachers examine the process of education, proposing development plans;
- the superintendent of education: provides school with information on its relative results, which should help it in improving quality;
- The Ministry of Education, which oversees and facilitates the work of superintendents of education.

The study of the process of education at the appropriate level of quality in Poland is supervised by the National Accreditation Commission.

As part of the Bologna structure of qualifications the basic outcomes of learning (which must be measurable and confirmed) are:

1. knowing and understanding,
2. knowing how to act,
3. knowing how to be.

d) **Efficiency.** The “production system” which is a school, financial outlays in the form of teachers’ salaries, cost of technical equipment, operating costs and operating fees (in schools and private institutions, and public evening and extramural classes), are transformed into a certain number of graduates, bachelors and masters.

In education, the economic effect is the sufficiently high state of knowledge and skills of the graduate (student, pupil). In the measurement of school performance it is often assumed that the economic effect is the number of graduates, and the contributions are the expenses of the state budget and the budgets of local governments on education plus tuition (DEA method). A multivariate statistical approach is based on the construction of structure of the total costs’ function with some parameters that depend on the internal utility of the individual objects analyzed. Then, to calculate the performance of schools, the learning outcomes (graduates) are divided by total costs. An example of such a function of the total cost of the school may be a translog function (Jondrow et al., 1982):

$$\ln C = \alpha_0 + \beta_N(X) \ln N + \sum_{i=1}^n \alpha_i \ln P_i + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln P_i \ln P_j +$$

$$+ \frac{1}{2} \beta_{NN}(X) \ln(\ln N)^2 + \sum_{i=1}^n \lambda_{iN}(X) \ln P_i \ln N + \delta A + u + v,$$

where:

- C – the total cost of the school;
- N – the number of graduates;
- P_i – price of the production factor i ;
- A – a synthetic factor that measures different “environmental” conditions;
- u – inefficiency factor;
- v – random factor (random error with average of 0);
- X – characteristics of teaching staff (teachers).

Unknown parameters, established on the basis of the data taken from the set of objects (schools).

Table 4. International comparison of annual expenditure per pupil school at different levels (PPP in \$, 2007)

	Primary	Secondary	Higher	Average
USA	10 229	11 301	27 010	14 269
Germany	5 548	7 841	13 823	8 270
Italy	7 383	8 004	8 673	7 948
Poland	4 063	3 590	5 576	4 134
OECD Average	6 741	8 267	12 907	8 216

Source: OECD.

Table 5. Unit costs of higher education in Poland in 2006

	Univ	WST	WSE	AR	WSP	AM	AWF	WSA	WSZ	Other
Unit cost (€)	9 952	12 619	7 636	13 819	5 689	20 602	11 234	30 642	5 637	16 993
Number of students in the conversion (in thousands)	530	302	84	86.4	74	83.8	27.3	13.3	88	26

Meaning of the acronyms: Univ – Universities; WST – Higher Schools of Technology; WSE – Higher Schools of Economy; AR – Universities of Agriculture; WSP – Higher Schools of Pedagogy; AM – Medical Universities; AWF – Universities of Physical Education; WSA – Higher Schools of Arts; WSZ – Higher Vocational Schools.

Source: Universities and their finances in 2006 (Central Statistical Office (GUS)).

Table 6. Comparison of the effectiveness of international education

	A	B	C	D	D/B in %
USA	24 074	40 088	39	490	1.22
Canada	19 992	19 994	31	526	2.63
France	10 704	33 548	53	506	1.50
Germany	11 594	48 167	64	499	1.03
Italy	8 764	31 291	53	476	1.52
Czech Republic	6 774	37 925	59	509	1.34
Poland	4 589	10 263	15	495	4.82

A – annual expenditure per student in PPP \$; B – Annual salary of a school teacher with 15-year experience in PPP \$; C – wage per hour of teaching, the same teacher; D – average rate of knowledge and skills of 15-year-old; D/B – reflects the function of the quality of education and hence we can say that our educational system is at the forefront when it comes to the effectiveness of training of the average high school student.

Source: OECD in Figures 2007 Edition.

For comparison, in non-public schools the unit cost of education amounted to 5541 PLN with of 455.2 thousand students. The higher the unit cost of education, the lower the economic education efficiency of the university. In Table 6 an international comparison is made for a full picture of the effectiveness of education in Poland.

4. Impact of education on economic growth

The empirical studies (Dougherty, Jorgenson, 1966) show that the share of human capital in the growth of GDP, depending on the countries and periods ranges from 5% to 20%. Empirical verification of models of growth (Griliches, 1997; Mankiw et al., 1992; Florczak, 2008), in particular GDP *per capita*, shows interesting, for the economies, conclusions regarding human capital.

As a starting point, we take the production function by Cobb-Douglas describing the model of growth in the whole country's scale:

$$Y = F(K, L) = aK^\alpha (L \cdot h)^\beta,$$

where:

Y – GDP;

a – a certain constant;

F – fixed assets;

L – number of employees;

h – the quality of worker, which includes their knowledge, skills, health and sense of security;

α and β – the relationship between growth of expenditure and growth of production.

Thus, with the assumption the production function will be a power function: $Y = f(h) = a \cdot h^\beta$.

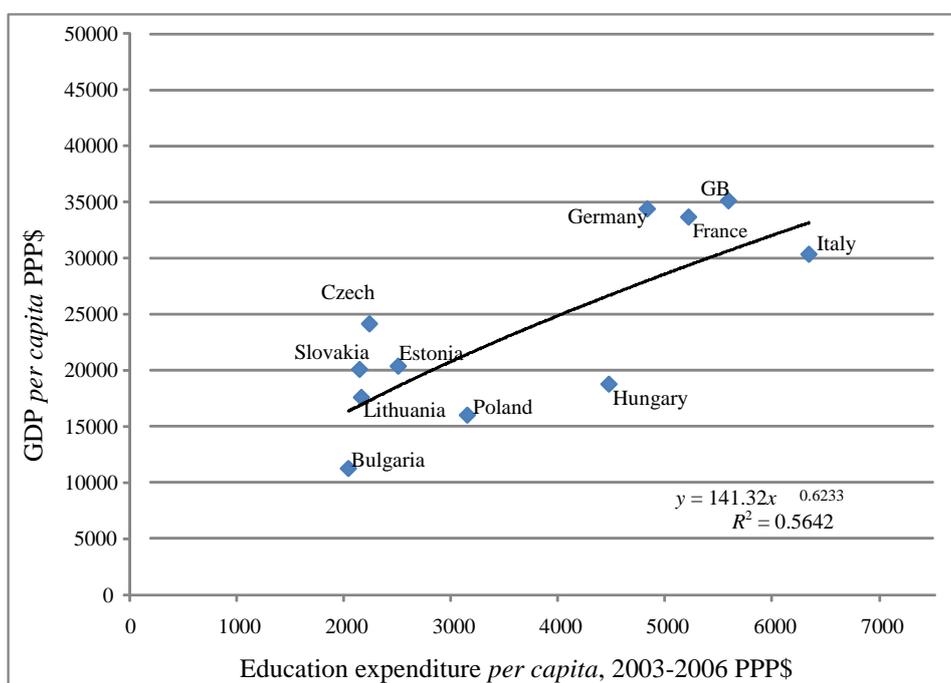


Fig. 2. Dependence of the size of *per capita* GDP from the expenditure on education

Source: *Human Development Report 2009*.

Figure 2 shows that in Poland, expenditure on education does not transform into economic growth. The next Figures (3 and 4) document the thesis already proposed that the problem of education in Poland is in higher education and, more specifically, in the absence of a coherence between the system of higher education and the economy.

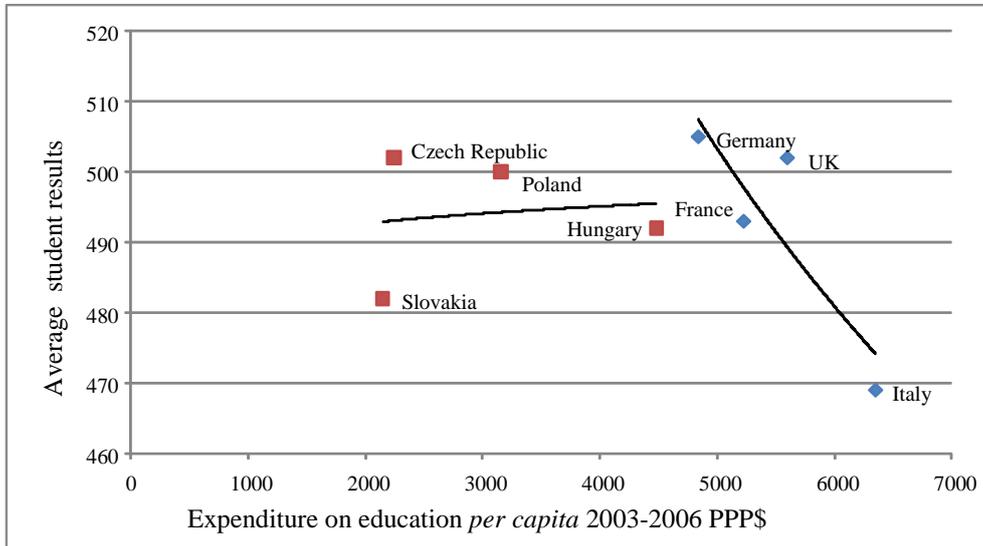


Fig. 3. Dependence of average student achievement as a result of spending on education per head of the division into developed and developing

Source: *Human Development Report 2009*.

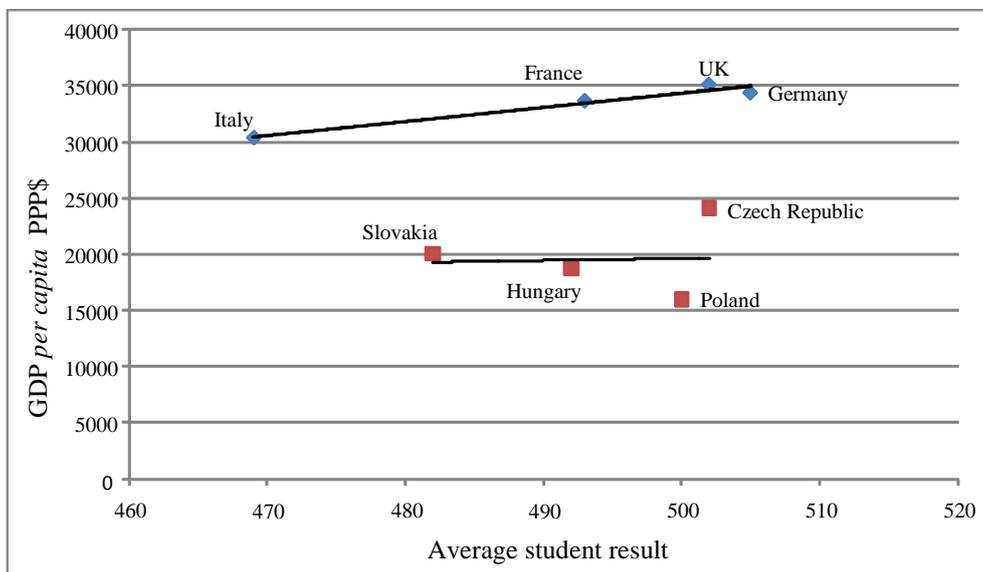


Fig. 4. The dependence of GDP per capita from the average result of the achievements of students

Source: *Human Development Report 2009*.

Jeżowski (2010), by analyzing the average education score of lower secondary pupils of Lower Silesia depending on funding per pupil at local level (three-year average cost of education), showed no correlation – the Pearson correlation coefficient for both parts of the exam was 0.0233 and 0.0549, respectively.

Table 7. The correlation ratio between the average educational outcome (calculated on the basis of final exams), voivodships and average GDP *per capita* in 2010

	City of 20 thousand	City of 20-100 thousand	City of 100 thousand	Average
Polish language	– 0.006	– 0.110	– 0.036	– 0.075
Mathematics	– 0.044	– 0.465	0.076	– 0.120

Source: own elaboration based on Central Statistical Office (GUS) and Ejsmont (2011).

Analyzing the average education scores in secondary schools in all voivodships of Poland, broken down by size of the city according to the average GDP *per capita* in the region, it appears that also here there is no correlation (see Table 7). It can be seen that the quality of education does not directly depend on average input of resources or average “wealth” of parents, which is contrary to common sense and the theory of education economics (Card, Krueger, 1996). Hence, it can be concluded that in order to obtain a good result, it is not sufficient to increase spending on education, or even improve the welfare of the population, but it takes an individual approach to students, who should understand that it just “pays” to learn. One has to teach pupils/students so that they can see a holistic application of their knowledge, and finally a teacher for them should be an authority and friend.

5. Conclusion

Analyzing the impact of the financial contribution on human capital – specifically on education – on the quality of education, then the impact of human capital on economic growth, it was found that the system of education in Poland including the secondary level in comparison with other countries, is very effective. However, in Poland the human capital developed in such a way that it does not translate into economic growth measured by GDP *per capita*. Possibly the problem is the lack of consistency between

higher education and the economy. In the past twenty years the number of students in Poland has increased almost fivefold and this great human capital is not well geared – the current structure of graduates is not correlated with the labor market. Disregard for social and economic reality caused the fact that issues of quality in higher education have become secondary. If academics' salaries are often lower than graduates', how can we build a good faculty? It seems that to ensure the quality of education external interference is needed, but not one that examines only the quantitative indicators of universities, but one that can help verify the consistency between the “supply” of universities and the needs of the market. Hence follows the necessity of cooperation between universities and other economic entities.

Literature

- Barro R.J., Lee J.W. (2000). *International Data on Educational Attainment. Updates and Implication*. NBER Working Paper. No. 7911.
- Barro R.J. (2001). *Human capital and growth*. American Economic Review. Vol. 91(2). Pp. 12-17.
- Biernacki M. (2009). *Effectiveness of mathematical education*. Didactics of Mathematics. Vol 5(9). Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu. Wrocław. Pp. 19-32.
- Biernacki M. (2010). *Jakość usług użyteczności publicznej a dobrobyt społeczny*. Zarządzanie publiczne. Nr 3. Pp. 19-32.
- Biernacki M., Ejsmont W. (2011). *Efektywność kształcenia we wrocławskich liceach*. In: *Ekonometria przestrzenna i regionalne analizy ekonomiczne*. Łódź.
- Biernacki M., Łyko J. (2010). *Economic growth, social wealth and investing in human capital*. Social Research. No. 4. Pp. 5-11.
- Card D., Krueger A. (1996). *School resources and student outcomes: An overview of the literature and new evidence from North and South Carolina*. Journal of Economic Perspectives. Vol. 10. Pp. 31-50.
- Dougherty C., Jorgenson D. (1996). *International comparisons of the sources of growth*. American Economic Review. Vol. 86. Pp. 25-29.
- Ejsmont W. (2011). *Wybrane modele pomiaru efektywności nauczania na przykładzie ponadgimnazjalnych szkół w Polsce*. Doctoral dissertation. Uniwersytet Ekonomiczny we Wrocławiu.
- Florczak W. (2008). *Kapitał ludzki w empirycznych modelach wzrostu*. Ekonomista. Nr 2. Pp. 169-200.
- Galar R. (2001). *Gospodarka oparta na wiedzy i innowacje przełomowe*. In: *Gospodarka oparta na wiedzy*. KBN. Warszawa.
- Griliches Z. (1997). *Education, human capital and growth*. Journal of Labor Economics. Vol. 15. Pp. 330-344.

Hanushek E., Kimko D. (2000). *Schooling, labor-force quality, and the growth of nations*. The American Economic Review. Vol. 90. Pp. 1184-1208.

Human Development Report 2009. http://hdr.undp.org/en/media/HDR_2009_EN_Table_H.pdf.

Jeżowski A. (2010). *Nakłady publiczne na realizację wybranych zadań oświatowych na Dolnym Śląsku a efektywność edukacyjna w latach 2004-2009*. Zarządzanie publiczne. Nr 3. Pp. 109-122.

Mankiw N., Romer D., Weil D. (1992). *A contribution to the empirics of economic growth*. Quarterly Journal of Economics. Vol. 107. Pp. 407-438.