CHANGES IN RETURN TO HIGHER EDUCATION IN POLAND 1998-2004.

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ABSTRACT

In the article private rate of return to higher education in the 1998-2004 period is considered. The model is based on comparative advantage theory and extended Mincerian wage equation. The extension is made to account for non-random decision to undertake studies at university level. The estimate of private rate of return in Poland is roughly 9.5%, and it is among the highest in Europe. In addition, the unexpected rise in rate of return is observed. This change has been linked to labour market transformation and Skill Bias Technological Change phenomenon. Also the influence of financing tertiary education is considered. The rate of return to higher education has risen and graduation has positively affected the obtained wages.

Keywords: Return to education, private returns, skill biased technical change, sample selection.

Introduction

Recent Polish Central Statistical Office survey "Educational Path of Poles" [Ścieżki Edukacyjne Polaków, D.Kilińska, S.Radcowski 2005] of educational determinants and educational career choices has shown that young persons perceive education as an investment. People that have decided to undertake such investment expect that it will pay off in near future with satisfactory income level, better career perspectives, higher prestige, and last bit not least, that it will lower the risk of unemployment spell.

Investment in human capital creates a great opportunity for people, families, firms and a society as a whole. This is the simplest way to achieve higher level of social welfare. Human capital accumulation accelerates technological and economic growth. Nowadays, in the era of

globalisation, common markets and expansion of knowledge based economy investment in human capital becoming necessity. The total gains form investments in education are higher than economic rate of return, which is estimated in this article. In the survey several factors that hardly measurable and quantifiable, such as self-development, social interactions and/or well-being are left aside. They all are vital part of social return to education, i.e. public benefits that are received by society from increased amount of knowledge by its participants.

The return to investment in education can be viewed as a discount rate. In such case return is defined as a value that equalises the stream of incomes and the stream of expenditures in a given point of time. For university level of education it is a point that equalises the wage stream of an university diploma holder, with a wage stream of secondary school graduate, taking into account the cost of obtaining the university degree and the opportunity cost.

The private rate of return captures additional financial incomes earned, which can be attributed to higher qualifications. To estimate this value one has to take private borne cost and expected increase of future incomes only, without considering taxes and social benefits. Government social policy influences the profitability of an educational investment. The argument is raised that transfers and fee reductions for young students increase the total rate of return, lowering the private rate of return. But on the other hand, the private rate of return is lowered due to social security system and progressive tax system. As it is shown by A. de la Fuente [2003] in Europe investment in education seems to be more attractive than financial investment, because the former is supported by the government. Such investments are supported by covering a large share or total investment cost. The common policy instruments are subsidies or tax reductions. Public support of educational investment makes, even in countries with progressive tax system, a real negative tax on human capital. [C.Harmon et al. 2002]

The article is divided into six main parts. In the first, methods and results for rate of return to education models in European countries are presented. The second part raises methodological issues. The empirical model is described with implications for analytical form. In the third part, education financing is considered. In the fourth, datasets are presented and in fifth the empirical results. The article ends with a summary and results discussion.

The return to education

Many economic surveys found a positive relationship between educational degree and received salary. Labour market surveys for United States indicate that each additional year of education pays with an average wage increase of 7.5% [D.Acemoglu, J.Angrist 1999]. In neighbouring Canada Y.Bar-Or with co-authors estimated the rate of return to 4-year university diploma on 30% [Y.Bar-Or at al 1995]. In a recent survey V.Caponi and M.Plesca [2007] showed that individuals with a university degree earn 30-40% more than secondary school graduates. In similar survey R.Blundell et al [2001] showed, using various econometric techniques that having an university diploma raises the average salary by 25% in United Kingdom. In another survey for that country D.Card [1999] estimated the annual rate of return to education of 6-11% depending on a field of study.

Similar results are obtained in studies concerning European Union members. G.Brunello, S.Coni and C.Lucifora [2001] examined the Italian labour market data, and showed that the average yearly rate of return to university education is about 6.2% for males, and 7.5% for females. This result has been confirmed by C.Mendolichcio [2005]. She showed, that rate of return to education for women are in interval 7-12% and for men's in 6,5%-11%. Comparable results for UE15 were obtained by C.Harmon, H.Oosterbeek and I.Walker [2002]. They estimated the average annual rate of return on 6,5%. A. de la Fuente [2003] in report prepared for European Commission estimated the yearly rate of return to education on 6,2%, while he stressed that in the long horizon there is an additional 3,1% premium form quicker technological development.

As it was pointed by G.Psacharopoulos [1993] return to investment in higher education decreases with growth of the national income per person. As a result it is expected that in Central and Eastern European countries, so also in Poland, the rate of return to education is higher than the average for European Union members. However, conducted empirical researches indicate a picture very different form one expected. A.Newell and B.Reilly [1999] have analysed distribution of wages in several transition countries and found that return to education is on remarkably low level. They estimated the rate of return to education on 2% only. F.Pastore and A.Verashchagina [2006] in Belarus' education survey arrived at similar conclusions. The transformation and decentralisation processes lead to an increase in rates of return to education. The rate reached the level of 4-5% depending on country specifity. In

comparison with G.Psacharopoulos [2003], which for developed countries estimated the rate of return to 7-12% yearly, it is obvious that in Central and Eastern Europe economies higher education was undervalued. It was rewarded in term of prestige, but not in earnings.

It is worth to notice that in late nineties all transition economies faced local crisis. Among the causes was a deficit of workers with suitably high qualification levels. As a result of transformation labour market has changed. The expectation in terms of qualifications and skills has risen. There was a fall in demand for low qualified workers, and an increase for specialists. As a result young people after secondary school have difficulties with finding a job. In order to take a relief from a difficult labour market situation they could continue education. In addition to the transition effect, there exists a demographic effect. In this period persons form large cohorts entered labour market. This two effect combined have created an educational boom. The number of university level students rose dramatically. At the beginning of transition process the figure was 9,8%, after ten years in 1998/99 – 25,4%. Since that date it rose by about 2% annually reaching the 36,8% in academic year 2004/05. At the moment it exceeds 38%.

The higher education system, since early nineties, has been in a transformation process. The main change was an adjustment to the new market conditions and individual's expectations. The most important new element in higher education system is emergence of privately owed universities. In non-governmental schools, in opposite to governmental ones, the student has to pay fee. Development of private schools has exploded at the time of curricula diversification to two-stage education with compulsory bachelor and master degrees. It creates an opportunity for private schools to run bachelor studies. Another important factor is an increase in the number of offered places in non-stationary study scheme. There was also change in a structure of student by type of education. The fraction of full-time students has lowered, while fraction of part-time has risen [D.Kilińska, S.Radcowski 2005]. This change occurred despite the fact that the latter scheme is fee-paying.

At the beginning of transition process there was 7 non-state owed universities. Nowadays, the number is nearly 350. The important date is year 1997, when private universities outnumbered state ones. In result of long and rapid increase for educational services Poland has the most developed non-public university sector in Europe. The private sector students are counted for 40% of student population.

In the first phase of transition non-governmental universities have offered bachelor programs only. At the moment about 25% offers master programs, and a few of them PhD programs [OECD 2003].

The dynamic development of private university schools has been attributed to demand side of the economy. Nevertheless, this finding stands in an opposition to empirical researches that point out rather low level of return to higher education in transition economies. The main factor that is a cause of underestimation of return rate is a dual character of the economy at early stages of transition. The return rate models are constructed with a market wages assumption. The assumption is correct when we consider private sector only. In a public sector non-market mechanism ruled the wages. In addition to that, the state was a main employer. As a result low rate of return to higher education was found.

Methodology

There are several ways to estimate the rate of return to higher education. In this research we employ the Mincer model [1974]. This is most frequently used model in empirical economics. The Mincerian wage equations are commonly used in several labour economy fields, such as return to education, wage inequalities, or pay-gender discrimination gap. In this method empirical data are fitted to logarithm of actual wage by a linear regression model. Characteristics such as education level, age as a measure of work experience and socio-demographic characteristics are used as explanatory variables. This basic model is extended by inclusion of the mechanism that allows for controlling non-random selection in university education.

The model is based on comparative advantage theory. Each individual chooses their preferred education level. In order to do that, she compares streams of future incomes with alternative education levels. At every moment she could withdraw from an education system. Continuation of studies is considered as an investment, because there is a necessity to choose between current costs and future incomes. Studies postpone the entrance to the labour market and lessen working activity time. Analogously to the standard cost benefit analysis of investment project, it is possible to calculate the internal rate of return. This return rate is defined as interest level that equals present value of cost stream with present value of future expected incomes stream.

To reduce the complexity of the analysis the rate of return to education is treated as the parameter characteristic to an individual. It is assumed, that undertaking investment at individual level has no impact on general equilibrium of the economy. Henceforth, the marginal return rate is not affected by decision of other society members. The next simplifying assumption is that the study costs are uniformly distributed over a study period. In reality, they are usually higher at the beginning and then decline.

Let Y_{ij} be lifetime labour income of person i with education level j. Let X_i be a vector of observable abilities and socio- demographic characteristics and ε_i a vector of unobservable terms that have an influence on the labour income. The cost of achieving education level j is C_{ij}. It varies among individuals due to specific abilities and predispositions heterogeneity. Let V_{ij} be a value of education level j for person i. The mechanism of choosing desired education level can be presented as:

$$Y_{ij} = f(X_i, \varepsilon_i) \tag{1}$$

$$V_{ij} = \max_j \left(Y_{ij} - C_{ij}\right) \tag{2}$$

One chooses such education level j, that maximises the difference between stream of incomes attached to this level and the cost required to achieve it.

The analytic formula is a modification of Willis and Rosen [1979] model. In our model we restrict the analysis to the choice between the high school degree H and the university degree U. We assume that wages are increasing functions of the time. The rate of growth depends on workers education level and is g_h for person with high school education and g_u for university diploma holder. Studying process is time-consuming. To reach the university diploma, a person has to dedicate 12% of his potential labour activity time. The amount of time necessary to achieve a diploma is marked T years. If one's chooses university education his stream of incomes is given by:

$$y_{Ui}(t) = \begin{cases} 0 & 0 \le t \le T \\ \overline{y_{Uo}} \exp(g_u (t - T)) & T < t < \infty \end{cases} \tag{3}$$

The variable *t* represents working time and *(t-T)* is a measure of working experience. We can denote income equation for a high school person in a similar way:

$$y_{Hi}(t) = \overline{y_{H0}} \exp(g_h t) \quad 0 \le t < \infty \qquad (4)$$

The income stream is determined by two parameters: the starting salary for each education level $y_{.0}$ and the growth rate $g_{.i}$. The person, while making decision about going to the university compares discounted future values of income.

$$PV_{ui} = \int_T^\infty y_{ui}(t) \exp(-r_i t) dt = \frac{\overline{y_{u0}}}{(r_i - g_u)} \exp(-r_i T) \qquad (5)$$

$$PV_{hi} = \int_0^\infty y_{hi}(t) \exp(-r_i t) dt = \frac{\overline{y_{h0}}}{(r_i - g_h)} \qquad (6)$$

The discounted value of education cost is equal PV(C). The person *i* chooses university education if PV(U)-PV(C)>PV(H), so the net benefit from achieving the university degree are greater than the benefits form secondary school education.

The discounted values of education level equation given by (5) and (6) are not earnings equations. They reflect an economic mechanism of choosing between two different levels of education. The salary level is a function of education, experience measured by age and social and demographic characteristics. It is commonly assumed in the labour economy that the distribution of earnings is well approximated by the log normal distribution. The wage equation for each education level could be represented by the classical linear regression model.

This specification requires that two subsamples from the population to be extracted and the model to be estimated on each one separately. The fact of being a member of one group is determined by the previously made choices. The education level is up to some point pre-determined by the social background of the person (Becker 1976). The subsamples would not have random sample properties. The sample selection problem will occur and as a result the least squares estimators would be inconsistent. Moreover, they can be different in both

groups. The difference in the estimators of the model parameters is inconsistent with the assumption that X matrix consists all observable social and demographic characteristics, which influence wages. In such a case, as is pointed out in the contemporary economic literature [Card 1997; Blundell et al. 2001; Harmon et al. 2002] to eliminate the sample selection bias it is necessary to include a selection equation in the model. It describes the mechanism of selecting the observations to the estimation sample. The complete model can be written as

$$\begin{cases} w_0 = Z_i\delta + \xi_i \\ \ln(w) = X_i\beta + W_i\gamma + \varepsilon_i \end{cases} \qquad (7)$$

where w_0 is a selection indicator, Z_i is a selection variable matrix, U_i is a university degree indicator variable. The model can be consistently estimated by two-step procedure or the maximum likelihood method [Heckman 1979].

Higher education financing

The public finance subsidy for tertiary education system is on quite high level. The budget expenditures share is accounted for 2-4%. This sum amounts for 0.8-1% of GDP and is comparable to other European Union Member states. In public records local governments and private expenditures are omitted. This is not a big problem because they both together do not exceed 1% of university incomes. The budget subsidy is spend mainly on maintenance infrastructure and teaching (78%), financial support for students (18%) and investments (6%). Beside subsidies state universities receive incomes from conducting research projects and other activities.

The characteristic issue in finance system is a research grant system. The universities have to compete for research grants. This system allow for efficient use of limited resources. Over 80% of grants are founded by the state budget. The other research founders are industry firms (10%) and international grants.

Finances of the private sector universities are completely different. Up to year 2004, only two catholic ones were subsidised by government. The other schools could apply for research grants only. The main difference between public and private tertiary schools is a share of

incomes from teaching. It the former the amount do not exceeds 25%, I the later is about 97,5%.

Sample characteristics

The main data source is Households Budget Survey (HBS). It is yearly, representative study that collects information about households with a special attention paid to incomes sources and expenditures structure. The household are drawn with rotation method, that, means that after a year the half of the sample is replaced by new households. Every four years the complete new sample is drawn. The reason for periodical replacement of household in the sample is to keep representative.

Each year over 30.000 households are surveyed. Each of them during one month fills a records about its demographic structure and personal characteristics. On special sheet household write down, all inflows that they have received in month, and all outflows that pertain to functioning of the family during that particular month. There are over 2500 households surveyed monthly. This way of collecting the information causes some difficulties with usage of the data. There are certain incomes that can be present at particular time, i.e. income form selling agricultural products. In methodological appendix the statistical office warns data users that simple extrapolation of farming income is an inappropriate method. To overcome the problem we also omit the data from households for which farming was the only or main income source. This way of handling the problem is justified in economic theory. The farming income is highly correlated with land productivity, and very weakly related to human capital productivity [T.Czekaj 2006]. As a consequence, farmer's income is only partly determined by its education and abilities.

The return rate estimation covers the 1998-2004. The time span is determined by data coherency and availability. The first sample was drawn in 1997, however this part of the dataset could not be used. The reason is a change in statistical regions after the administrative reform. The data concerning 2005 was not available at the time of the research.

The empirical sample is restricted to the individuals at working activity age (16-65 years), who receive incomes form work or self-employment. In order to correct for a selection process information about non-working persons is also included. In addition, information

about non-fulltime employees is discarded (about 120 observations each year). This step is necessary because data does not provide information about exact number of hors worked, so it is not possible to calculate hypothetical full time earnings. Another excluded group are individuals who combine incomes from employment and social assistance. For this group of employees this wage level is limited by a law. Analogously to the part time workers this specific group has a labour supply that differs greatly from standard one. In addition, the persons who declare that work is not their main source of income, also were discarded. The latter group decide to work on non-economical basis, so their wage may not reflect the value of their working abilities.

Table 1. Sample characteristics.

Variable	Characteristics		
	mean	min	max
gender	0.4362	0.4264	0.4473
age	39.2503	39.1224	39.5212
age^2	1636.9641	1622.3160	1669.4420
age*university	10.7013	10.0711	12.0790
(age^2)*university	452.5175	431.8404	501.6163
management position	0.2721	0.2422	0.2914
administrative position	0.3387	0.2903	0.3826
family	0.7814	0.7518	0.7978
log wage	7.1067	6.9066	7.2317

Source: Own computations based on HBS data.

After all data correction operations about 35.000 observations are left in the sample. The data consists of information about persons that completed education and received high school or university diploma. Women's have a larger share in the sample (57,03%). This is attributed to fact that it is more usual for men's than women's to choose secondary vocational school and start begin to work. As it is shown in recent surveys [D.Kilińska, W.Radkowski 2005] in most cases educational decisions are driven by economic needs or are the results of voluntary choices. The average age in analysed sample is higher than in labour active population. Due to high wage replacement rate in low income-education groups, these people decide to leave the labour market before reaching the retirement age. For the more educated persons early retirement is not so profitable, they work longer on average. The variable *university* is an

indicator of university education level and has an auxiliary role. The labour active individuals with university education are on average 10 years older than high school graduates.

It is important to remark that employment structure has changed dramatically during seven years as an effect of transition. As it is shown by Newell and Socha [2007] during 1998-2002 private sector employment rose by 50% and exceeded public sector employment. The traditional production sectors (farming, mining, industry) lost their importance. On the other hand there was a great expansion of service sector. It is also worth to note that self-employment share rose to 11%. This group of workers is very much diversified. It contains small business owners, managers, craftsmen's and workers. The presence of this group may have an important impact on the result, but on the other hand, plays also an important role in the economy.

Results

Before the return rate to university is calculated, basic sample characteristics will be analysed. The analysis departs form average net wage level. The next step is to use empirical data to construct wage profiles for employed persons and also for those who decided to study. In the final step we compare economics cost and benefits from studying with special attention paid to alternative cost.

Table 2. Average monthly wage.

year	nominal net wage	real wages in 2004 prices
1998	975.94 zł	1318.26 zł
1999	1001.04 zł	1237.18 zł
2000	1129.09 zł	1279.56 zł
2001	1207.96 zł	1286.23 zł
2002	1249.12 zł	1288.27 zł
2003	1289.47 zł	1314.57 zł
2004	1342.85 zł	1342.85 zł

Source: Own computations based on HBS data.

The average net wage from employment has risen during analysed period. The rate of wage growth in real terms was, of course, much slower. It is worth to notice that in 1999 the real

wages have declined. This decline could be easily linked to an effect of four major reforms and economic perturbations. These unsettlements may have an influence on estimated return rate.

We compare the actual wage levels with hypothetical wage profiles calculated from wage equation parameters. Assumed theoretical framework determines the model with sample selection. The wage equation functional form is a standard Mincer type equation that includes additional information about place of living (town size, region), type of job (worker, clerk or managerial position) and legal status of job contract (regular or self employment). The role for additional variables is to separate factors that independently from the education level influence wages, from those, which jointly determine education and wages.

The wage equation is estimated for each year separately. As a result we receive seven sets of estimates. In table 3 we present characteristics of coefficients.

Table 3. The wage equations coefficients.

Variable	Coefficient		
	mean	min	max
gender	0.2015	0.1625	0.2293
age	0.0587	0.0489	0.0688
age^2	-0.0007	-0.0008	-0.0005
age*university	0.0254	0.0229	0.0281
(age^2)*university	-0.0002	-0.0003	-0.0002
management position	0.2811	0.1981	0.3781
administrative position	0.1938	0.1485	0.2409
family	0.1010	0.0750	0.1354

Source: Own computations based on HBS data.

The variables included in the wage equation are in accord with labour market theory. Positive sign for *gender* variable show that employers tend to pay higher wages to the men than women, even if both have similar qualifications and working experience. This might be an indication of gender related wage discrimination. Coefficient for age and age squared may be interpreted as diminishing marginal returns from working experience. The university education premium is positive. Not surprisingly, among high wage earners are people with

managerial positions and at the bottom are blue-collar workers. The latter group is a reference category in the wage equation.

The wage growth rate for managerial positions was much faster than for workers. This finding indicates that having better skills is adequately rewarded on a labour market. The other coefficients beside control variables such as town size and regional dummies, reflect a regional diversification of average wage. The wage level rises along with city size, and with closer distance to western border.

The parameter values for control variables do not vary in time. It is worth to notice that coefficients for working position related to wage premium grows with time. Such behaviour is in accord with Skill Biased Technological Change theory [D.Card. J.DiNardo 2002]. When the wage diversification rises as an effect of SBTC, then what we observe is a faster wage growth rate for qualified personnel in technologically advanced branches of industry. On the other hand, unskilled workers wages fall.

Using results from wage equations for each year, the wage distribution in terms of education and age level was calculated. To reflect high correlation between education level and working position, it is assumed that university graduates occupy managerial positions and high school graduates administrative ones. It is also assumed that all remaining characteristics for both groups are on the same mean level. The wages in both sub-populations are behaving similarly. At the beginning of working career wages rise as result of increased working experience. The university graduates enter the labour market 5 years later, however, they start from higher salary. In addition, the growth rate for the latter group is faster. The highest earnings are received by persons with 44-48 years. After passing 50 years the wages decline slightly. The effect can be explained by older workers' lower productivity. This effect is compensated by experience; the compensation is higher for university graduates.

Economic cost of education can be easily decomposed into two main factors. The first factor is financial cost. It includes studying fee and living costs. The second element is alternative cost. Student resigns from participation in a labour market, so the amount of unearned income may be treated as an opportunity cost of studying. The sum of opportunity costs includes the probability of finding a job by young persons.

The studying fee in analysed time period was not constant. Up to 2002/2003 academic year average studying fee was rising along with inflation. During following years the situation has changed. Growing number of private universities, and increased recruitment for fee-paying studies in state owed one's change market from supplier to customer-oriented. In reaction to falling relative interest for fee-paying university studies, the end of demographic peak and lower inflation rate many schools decided to offer incentives for study candidates. This process prevents studying fees from increasing. Vast majority of schools used the inflation slowdown to keep fees at a constant level. This meant, that the study cost decreased in real terms. The average annually studying fee in academic year 2000/2001 was 6.300 zloty. [GUS]

The second part of financial cost is living expenses. During studying, the student has to pay for house and cover other necessary expenditures. As it was shown by Strawiński [2006], one can assume that total living expenses in 2000 was 9.600 zloty. We assume that the living expenses grow at inflation speed.

Table 4. Yearly cost of university education.

Year	Studying fee	Living expenses	Total cost
1998	5300 zł	7400 zł	12 700 zł
1999	5700 zł	8100 zł	13 800 zł
2000	6300 zł	8800 zł	15 100 zł
2001	6700 zł	9600 zł	16 300 zł
2002	6900 zł	10200 zł	17 100 zł
2003	7000 zł	10500 zł	17 500 zł
2004	7000 zł	10700 zł	17 700 zł

Source: Own computations based on HBS data.

During seven years financial cost of studying increased by 40% in nominal value, which means that in real terms the cost decreased by about 9%. This real cost decrease is due to lower share of studying-fee in total study financial cost.

University education opportunity cost estimation is based on hypothetical wage profiles for average individuals. It equalizes the amount of hypothetical unearned incomes during a study period. Unearned income real value is 1200-1300 zloty before tax. This amount seems to be reliable, because this is a market wage level for secondary school graduates in that period.

Table 5. Opportunity cost estimation.

year	Opportunity cost	Opportunity cost in 2004 prices
1998	54 000 zł	72 941.00 zł
1999	60 100 zł	74 277.35 zł
2000	68 700 zł	77 855.03 zł
2001	73 600 zł	78 369.20 zł
2002	73 500 zł	75 803.61 zł
2003	75 200 zł	76 663.32 zł
2004	81 600 zł	81 600.00 zł

Source: Own computations based on HBS data.

Education is among characteristics that describe human capital. Therefore, analogously to the physical capital, it is possible to estimate level of inputs required to increase level of education. The starting point for the economic analysis is an assumption, that individuals are rational, and make their choices according to maximum expected utility theory. In the model, university studies are treated as investment. To finance the investment young person has to take a bank loan.

Using the wage equations coefficients, hypothetical wage profiles are computed for persons with different education level. The next step is transforming the wage profiles into lifetime earnings. For university graduates, from earnings the financial cost, bank loan cost and the opportunity cost were all subtracted. This gave net value of educational investment. The return rate was calculated as a proportion of additional net income to high school graduates lifetime earnings.

Return rate to university education estimation of 6-9% level agrees with expectations. Similar result was achieved by Strawiński in earlier work [Strawiński 2006]. To prove result robustness several models were estimated. In all models the return rate estimates ranged form 5 to 10% depending on used wage equation.

The special attention was attached to observed phenomenon of sharp increase in return rate between year 2001 and 2002. This effect is observed in all but one empirical model. The odd model is one that does not use working position dummies. In this model the estimate of return rate is 6-7% for all years. To investigate this change we looked at wage dynamics and wage

diversification. The nominal wages rose by 50% on average for low skilled workers, while for high skilled workers the figure is 100%. The similar observation was made for administrative workers.

Table 6. Return rate from university education

year	Yearly return to university education	Return rate to university education	Yearly return to university education	Return rate to university education
	with opportunity cost		without opportunity cost	
1998	6.83%	34.16%	8.43%	42.13%
1999	6.09%	30.46%	7.68%	38.42%
2000	6.60%	33.00%	8.21%	41.03%
2001	5.44%	27.20%	7.04%	35.19%
2002	8.72%	43.60%	10.26%	51.29%
2003	9.27%	46.35%	10.62%	53.08%
2004	8.79%	43.97%	10.21%	51.04%

Source: Own computations based on HBS data.

The investment to university education is characterised by relatively high return rate. The actual rate is about 6.5% in late 1990s and about 9.5% in recent years. These values are comparable with numbers for other European countries, placing Poland among countries with highest return to education rates. This finding is in harmony with expectations (see Psacharopulos [2002]), because country with relative low GDP level in comparison to the other European countries and faster rate of economic growth is characterised by high demand for skilled workers. Young persons making study decision take into account current wage levels and expect that they will benefit from university graduation. Obviously, this reasoning has a weak point. The labour market is stable over time. The fact that while study decision is made the return to education rate is relatively high or relatively low, does not mean that true return rate will be high or low. Unfortunately, estimation of unknown return rate is not possible for obvious reasons.

The question about profitability of university studies is still actual. The estimated return rate to university education is positive and is among highest in Europe. This observation help to explain why we observe a great expansion of tertiary schooling in Poland. Graduation from an university program has a positive influence on probability of finding job and wage received.

Unfortunately, there is no general answer to the main question. Relying on our result, we can conclude, that person who decided to study at beginnings of 1990s made vary profitable investment decision. How profitable will be similar decision for current cohorts we will know in next years. The results indicate that profitability is increasing.

REFERENCES

Acemoglu D., Angrist J. *How Large Are the Social Returns to Education? Evidence From Compulsory Schooling Laws*. „*NBER Working Paper" 1999*. Nr 7444.

Ashenfelter O. *Estimating the Effect of Training Programs on Earning*. „*The Review of Economics and Statistics" 1978*. vol. 60/1.

Bar-Or Y., Burbidge J., Magee L., Robb A.. The Wage Premium to a University Education in Canada 1971-1991. „Journal of Labour Economics" 1995. vol. 13/4.

Becker G. *Ekonomiczna teoria zachowań ludzkich*. PWN. Warszawa 1990.

Brunello G., Coni S., Lucifora C. *The Returns to Education in Italy: A New Look at the Evidence* „*IZA Working Paper"* 2000 nr 130.

Blundell R., Dearden L., Sianesi B. *Estimating the Return to Education: Models. Methods and Results*. „*IFS Working Paper"* 2001 nr 19.

Caponi V., Plesca M. *Can Ability Bias Explain the Earnings Gap Between College and University Graduates?*. 2007. IZA Discussion Paper nr. 2784.

Card D. *The Casual Effect of Education on Earnings* w O.Ashenfelter, D.Card *Handbook of Labour Economics*. North Holland. Amsterdam 1999.

Card D. *Estimating the Return to Schooling: Progress on Some Present Econometric Problems.* „NBER Working Paper" 2000 nr 7769.

Card D. Di Nardo J. *Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzels*. „Journal of Labour Economics" 2002. vol. 20/4.

Czekaj T. *Dochodowość materialnych czynników produkcji w gospodarstwach indywidualnych w 2004 roku*. IERiGŻ nr 32/2006.

De la Fuente A. *Human Capital in a Global and Knowledge-based Economy. Part 2: Assesment at the EU Country Level*. European Commission Raport 2003.

Harmon C., Oosterbeek H.. Walker I. *The Returns to Education:A Review of Evidence*. Center for Economics of Education. Londyn 2002.

Heckman J.J. *Sample Selection Bias as a Specification Error.* „Econometrica" 1979 vol. 47/1.

Kołaczek B. *Ścieżki edukacyjne Polaków*. "Polityka Społeczna". 2006. vol. 3.

Kilińska D., Radcowski S. . *Ścieżki edukacyjne Polaków.* GUS. 2005.

Mincer. J. *Schooling. Experience and Earnings*. Columbia University Press. New York 1974.

Newell A., Reilly B. *Rates of return to educational qualifications in the transitional economies*, Education Economics, 1999. vol. 7.

Newell A., Socha M. *The Polish Wage Inequality Explosion*. 2007. IZA Discussion Paper nr 2644.

Pastore F., Verashchagina A. *Private Returns to human capital over transition: A case study of Belarus*. „Economics of Education Review" 2006. vol 25.

Psacharopoulos G. Returns to Investment in Education: A Global Update. World Development. 1994. vol 22. no. 9.

Strawiński P. *Zwrot z inwestowania w wyższe wykształcenie*. „Ekonomista" 2006. vol. 6.

GUS *Szkoły wyższe i ich finanse.* GUS. Various issues from 1998-2005.

Willis R.J., Rosen S. *Education and Self Selection*. „Journal of Political Economy" 1979. vol. 98/5.