IS THE TRANSITION TO THE 12-YEAR SCHOOL EDUCATIO N IN UKRAINE ECONOMICALLY JUSTIFIED ?

by

Olga Varetska

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Abstract

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by Olga Varetska

Chairperson of the Supervisory Committee: Professor [Name]
Department of [Name]

The objective of this thesis is to estimate whether the transition of Ukraine from 11-year to 12-year school education is economically justified. Using an approach based on the theory of human capital and DerzhKomStat (State Committee of Statistics) data, the benefit (net present value of additional personal life-time earnings) and costs (foregone earnings and government budget expenditures) of this transition were calculated. The obtained internal rate of return appeared to be less than the actual real interest rate in Ukraine (and its forecast for the relevant time period). Thus, on purely economic grounds, transition to 12-year general school education does not seem to be justified. It is possible that it may be justified on other reasons (political, social, etc) which are not addressed in this paper. The reasons for the obtained negative result are: low increase in earnings as a result of an additional schooling year and discount rate being high in Ukraine. The result is robust to the possible future changes in real GDP, in the rate of enrolment to high-school, and in taxation rate. The result changes from negative to positive if the real interest rate in Ukraine falls below 2.57%, or if the differences in wages of more and less educated labor force increase considerably. Analysis of the present situation in education in Ukraine suggests that creation of incentives for completing more years of general school and investments in preschool education at kindergartens and/or college preparatory courses could be more beneficial.

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GLOSSARY

Age-Earnings Profile. Earnings of a person at each year of his life.

DerzhKomStat. Ukrainian State Committee of Statistics.

General School in Ukraine. At present includes elementary (grades 1 through 3), secondary (grades 4 through 9), and high-school (grades 10 through 11).

INTRODUCTION

The new law on education in Ukraine (*The Law of Ukraine about General School Education*) was adopted by Verhovna Rada in 1999. Among other changes in the current education system, this law postulates prolongation of general school education from present 11 years to 12 years. This change affects the children that enroll to general school starting academic year 2001 (Verhovna Rada 1999, 32).

The major reason for the new law, as noted by the Minister of Education and Science V. Kremen, is the desire of Ukraine to adopt Western standards in different areas, in this case in the area of education (Koryunenko and Rapina 2001, 4). This reason is important, since similarities between Ukraine and Western countries would lead to better understanding and cooperation. However, the decision on such a major change that would effect a large fraction of the population and the economy as a whole should account for all possible economic implications as well. What has been ignored is whether the transition to a 12-year schooling system is economically justified for Ukraine, that is, whether the internal rate of return on the project is higher than the interest rate in the economy.

It might be argued that education is not an issue of primary concern in Ukraine at present, since much more important problems are currently at stake. But investing in education can provide an increase in economic growth of the nation as well as numerous qualitative benefits, as discussed later.

Nevertheless, in a country such as Ukraine, where a considerable lack of financing is encountered, special attention should be devoted to estimating whether the projects undertaken by the government are beneficial or not. Since at present education is the area in which additional investment by the

government would be made in order to finance the additional year of schooling, it should be estimated whether those expenses really pay off.

In spite of the fact that the new law on education has been already adopted, the answer to this question is still urgent since actually the first 12^{th} grade students will appear in 11 years, and there is still time to take at least partial account of issues that were overlooked when the law was adopted.

Since public schools are non-profit organizations, the usual profit-maximizing approach is not valid. The analysis is based on the consideration of costs and benefits of the proposed change to the society. Using the approaches and techniques developed in the framework of human capital theory makes it possible to obtain reliable and useful results.

At the same time, the goal of this study is essentially different from most other economic studies of education, since they mainly analyzed the given present condition of the educational system in a stable economy, and not the effects of future transitions in educational systems. At best, the effects of changes that took place decades ago were analyzed (Denison 1965 as in Bayeva 1998). Nevertheless, the techniques and accumulated results of those works provide firm grounds for analysis in this case as well.

The goal of this thesis is to estimate whether the transition of Ukraine from 11-year to the 12-year school education is economically justified. To reach this goal the following tasks should be solved:

- Identification and estimation of the benefits of the transition from 11-year general school education to 12-year;
- Identification and estimation of the costs of the transition from 11-years general school education to 12-year;
- Calculation of the internal rate of return of the project and its probability distribution;

- Analysis of the obtained result, its robustness to the assumptions, implications, and dependence upon the economic parameters.

Chapter 1

LITERATURE REVIEW

Since the aim of this work is economic justification of the transition from 11 to 12 years of general school education, in this chapter I attempt a brief overview of the modern economic treatment of education and its results. Here I also provide an outlook on the present situation in the educational sector in Ukraine and existing views on its improvement as a background of the reform. These issues should be accounted for in further economic analysis of the reform.

1.1. Economics of Education

In modern economic theory, general school education, as well as other types of education and training, is treated as acquiring human capital. The concept of human capital was developed by many prominent economists in an attempt to provide some insight into economic growth in time and its differences across countries (Becker 1993). Human capital "…consists of the abilities, skills, and knowledge of particular worker" (Romer 1996, 126). Generally, the concept is enlarged to include health, migration, etc. (Becker 1993, 11). But, according to the goal, in this study only education will be considered.

In order to investigate the evolution of human capital theory, it is relevant to start with basic economic growth models. The original Solow model has the following form:

$$Y(t) = F(K(t), A(t)L(t)), \qquad (1)$$

where Y denotes output, K denotes capital, A denotes "knowledge" or "effectiveness of labor", L denotes labor, t denotes time (Romer 1996, 7).

The empirical analysis based on the model showed that accumulation of capital per worker could explain only a small fraction of output per worker changes over time and countries. The knowledge accumulation approach also faces significant difficulties in explaining cross-country variations since it needs a postulate of unrealistically strong knowledge proliferation barriers (Romer 1996, 121).

The attempts to overcome these difficulties led to development of the models of the following general appearance:

$$Y(t) = F[K(t), H(t), A(t)L(t)], \qquad (2)$$

where H denotes human capital and the other notations are the same as in (1). Inclusion of human capital variable can provide for stronger effect of saving and population growth upon production per worker than the original model does (Romer 1996, 126).

Besides, the concept of human capital provides the possibility of addressing such questions as earnings distribution, the role and place of the education in production, its significance in increasing productivity and motivation, etc (Romer 1996, 134). In spite of having some controversies and unresolved issues, which will be mentioned below, this concept allows for obtaining some tangible results and as such will be the basis of this study. Following is the description of the main assumptions, features and implications of human capital theories.

At present, education is one of the most important, evident, and analyzable directions of investments in human capital (Dobrinin et al. 1993 as in Bayeva 1998). Education contributes to economic growth through productivity in three ways, according to McConnell and Brue: it contributes to the cumulative knowledge of the work force; it facilitates the acquiring of new knowledge,

that is, it increases the amount and quality of human capital; and it contributes to development of new knowledge (McConnell and Brue 1992 as in Bayeva 1998).

However, studying the direct effect of education upon productivity is possible in only a limited number of special cases (as in the comparison of productivity of workers with different levels of education doing the same job with a quantitative output), which could not help in solving the task of this study. The products of mental activity do not always take material form; it is rather difficult, perhaps impossible, to conduct a comparative analysis of the workers that belong to different professional and qualification groups; it is not easy to extract the net effect of education, etc. For these reasons the studies resort to different indirect techniques and estimations. Since the close relationship between the productivity and the wage is generally recognized, in the studies of the effectiveness of human capital, earnings are used instead of productivity (Kapelushnikov 1981, 96).

Three approaches to assessment of economic effectiveness of education were distinguished, according to Bayeva (1998, 33). The first uses the correlation between the level of education or expenditures on education and the rate of economic growth in different countries. For instance, Western studies found strong correlation (r=0.96) between GDP per capita and expenses for education per capita in 17 developed countries (Bayeva 1998, 33). But this approach does not allow for obtaining causal relationship. As Becker (1993, 24) put it, the number of dishwashing machines is likely to correlate with GDP as well.

The second approach, developed by Schultz, assumes that the direct contribution to the economic growth is equal to the share of GDP invested in human capital (education) multiplied by the rate of return on investment in human capital. Using this technique, it was found that 21% of GDP increase

in the USA in years 1929 – 1957 was explained by development of the education system (Schultz 1972 as in Bayeva 1998).

According to Denison (1965), the third approach considers the direct economic significance of education as its effect upon the work force quality improvement. By means of using educational structure of the working force and wages of persons with different years of education, this approach allows for identifying the contribution of education to the increase of GDP. The contribution of education to economic growth is obtained by multiplication of the increase in the number of the people with a given level of education by their incremental wages (Denison 1965 as in Bayeva 1998).

The last two approaches assume that investments in human capital (as any other investments) are spontaneously regulated by the market to maximize the return rate. In most cases of general education, and especially in FSU countries, this is not true.

As could be seen, all these approaches are of limited value for this study. Because they consider the educational system as given, the effects of its changes at best are assessed post factum. They provide reasonable estimation of the education contribution to GDP under the conditions of stable market economy and a given educational system. Moreover, their main concern is the behavior (choice) of an individual, not society as a whole.

In spite of this, studies of the education effectiveness are of great practical value since they identify the sources and rates of economic growth, facilitate optimal distribution of the resources between education and other investments, partially explain distribution of earnings (Bayeva 1998).

Extensive calculation of education effectiveness at micro level was realized by Becker (1993). According to Becker, there is a strong link between investing in human capital and economic growth. He indicates that "…since human capital is embodied knowledge and skills, and economic development

depends on advances in technological and scientific knowledge, development presumably depends on the accumulation of human capital" (Becker 1993, 324). The empirical evidence on which Becker bases his argument is that in the US during 1910 – 1950, 25% of the growth in per capita GDP was explained by growth in the level of schooling. Moreover, an analysis that took into consideration about one hundred countries indicates that investing into human capital is an important variable in determining the per capita growth of the economy (Becker 1993, 324).

Most of the above approaches suggest high and positive returns to education both for an individual and the society. The reason for that, as was already mentioned, is likely to be the assessment of advantages of education under conditions of status quo in the education system and stable economy. On the other hand, it is difficult to conceive that prolongation of years of education for the economy beyond some limits would bring large and positive rate of return, because of fast growing foregone earnings and increasing direct costs as the amount of human capital increases. This is supported by the finding of Becker (1993) that the rate of return declines with additional years of education, for instance, for college education it is lower than for high school (Becker 1993).

Using cross-national time series data, Lant Pritchett (1997) suggested that the increase in human capital does not lead to growth of output per worker and aggregate output of the nation. The model estimated by Pritchett is the following:

$$\hat{y} = \hat{a} + a_k * \hat{k} + a_h * \hat{h} + \varepsilon, \qquad (3)$$

where is per worker per annum growth rate of output, $\hat{k}$ is per worker per annum growth rate of physical capital, and $\hat{h}$ is per worker per annum growth rate of human capital.

This equation was estimated using two sets of cross national time series data that consisted of a panel of 5 yearly observations during the period 1960-85 for many countries (Pritchett 1997, 3). The resulting coefficient of educational capital was small, negative and statistically significant. The author checked the results for robustness, for measurement error, tried adding the initial level of GDP per worker to the regression. In any case, the result persists.

Pritchett also developed three hypotheses, which are likely to explain why there is no positive aggregate effect of schooling on economic growth, while there is an evident positive effect of individual education on individual earnings. The first possibility is that education does not really translate into human capital. It is just a signal to employers, which results in higher wages, but since no increase in human capital occurs, neither is there an increase in economic growth. This possibility is not very realistic since numerous studies, such as those conducted by Ashenfelter and Krueger in 1994, as indicated by Pritchett (1997, 38), have suggested that education does, in fact, result in an increase in skills, and is not a pure signal.

The second possibility is that the demand for education in general is falling and the return to education is falling as a result. This argument cannot in itself account for the negative coefficients of education either, because there has been no evidence of a dramatic decrease in returns to education (Pritchett 1997, 43).

The third possible explanation is that the increased human capital is applied to unproductive areas such as rent seeking. In this case whether education will or will not cause growth of the economy depends on the policy climate of the particular country. This third possibility is definitely true for the countries in which the government faces high employment pressure and employs the surplus labor force into the public sector, where it is bound to be unproductive (Pritchett 1997, 48).

In conclusion, Pritchett indicates that the results of his analysis should in no case be interpreted as a directive for governments not to invest additional funds in education. In many cases, reforming the political environment of the country would increase the probability of human capital accumulation resulting in economic growth. Such evidence is available for some Eastern European countries, for example, for Slovenia, where the transition to a market economy increased the returns to education, according to Orazem and Vodopivec, as reviewed by Pritchett (1997, 54). Moreover, there are numerous non-economic justifications for investing into education, such as a decrease in crime and child mortality rates (Pritchett 1997).

Accounting for the reviewed literature which provides contradictory evidence as to the benefits of investing in human capital, it is important to provide the viewpoint of Dresh (1975). According to Dresh, an optimal structure of work force education, at which the productivity reaches its maximum, corresponds to each given condition of technology and production organization. If the actual structure of education differs from the optimal one, then by matching them through investment in human capital it is possible to achieve increases in productivity. When the optimal structure of the work force is achieved, the further increase in education level will not translate into productivity increase. Thus, investments in education could be viewed as contributory to the nation's GDP if they bring the overall level of education closer to its optimum level. They could be as well viewed as inefficient if the optimal level of education for the nation has already been achieved (Dresh 1975 as in Kapelushnikov 1981).

Moreover, Dresh suggests that excessive subsidizing of education by the government leads to the situation when different sectors of economy obtain the possibility of using highly educated work force at comparatively low costs. Excessive supply of educated workers leads to their employment to the positions previously occupied by the workers with much lower level of qualification. In this case, education does not provide for economic growth

because of non-productive usage of resources (Dresh 1975 as in Kapelushnikov 1981).

My analysis will use the following features of the theory of human capital:

- Emphasis on the lifetime-earnings profile of an individual rather than on his current earnings (Becker 1993, 37);
- Acknowledgement of individual time as a key economic resource (the need for accounting for foregone earnings) (Becker 1993, 38);
- Treatment of an individual as an embodiment of knowledge and skills, which he or she acquired through education and professional training and which are a certain amount of productive capital (Becker 1993, 16);
- The market price of a particular individual's human capital, as a price of any other commodity, is determined by its correspondence to the particular needs of a given economy and the relation between demand and supply (Dresh 1975 as in Kapelushnikov 1981).

The above listed features of the human capital theory by no means are complete, but they provide a good basis for approaching the goal of this study.

1.2. Present Situation in General School Education

To provide an overall situation of population education in Ukraine, it should be said that in general the number of people with completed high school education is low. As could be seen (Fig.1), although the initial fall in the enrolment rate to high school from 1989 to 1993 was followed by steep increase, it still remains low. This suggests that the measures directed at reducing the drop-out rate at schools in Ukraine could be potentially more efficient at increasing the population education level than introducing the 12th year of education.

At the same time, the educational standards in Ukrainian schools are high. The students do very well at international competitions (Balandiuk 2000, 11).

Thus, the relevance of 12th grade introduction in order to bring Ukraine's level of education to the international level is questionable.

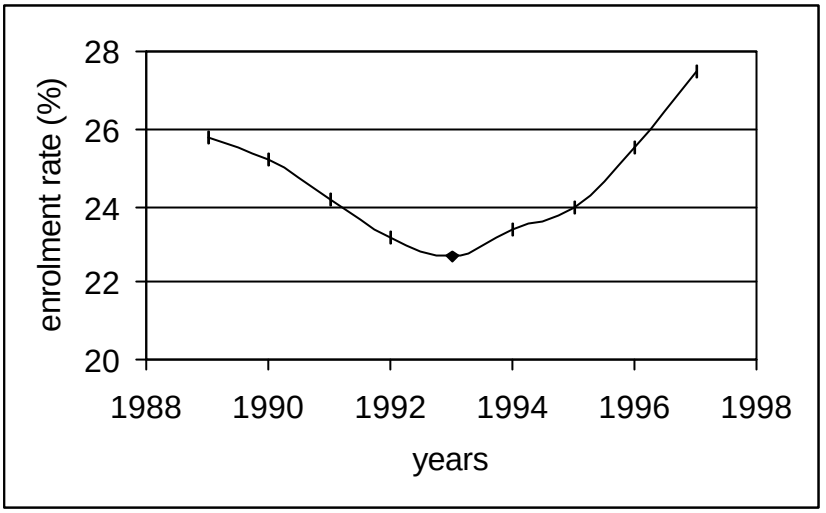

Fig. 1. High school enrolment rate in 16 – 18 years age group in Ukraine (UNICEF 1998).

Apart from considering the necessity of investing into education as opposed to other areas, the issue of selecting the educational area that needs investing the most is also relevant. According to Balandiuk (2000), there are numerous areas that need additional funds in order for the system of education to function properly. First of all, up till recently, the average teacher's salary was Hrn 120-125 per month (Balandiuk 2000, 11), which was not always paid on time. Such a small amount of money did not provide sufficient motivation for teachers to provide a high level of schooling, in some rural areas certain subjects were not studied due to unavailability of teachers willing to teach them (Balandiuk 2000, 11). Numerous supplies and textbooks are lacking. Only one third of the students of 10th and 11th grades is supplied with all the needed textbooks. In the future the proportion of the students supplied by books will rise only to 70%. On average across Ukraine, one computer is shared between 70 students. According to the Minister of Education, diminishing this number to 25 students would provide good computer education. Moreover, although the concept of education is changing at

present, the majority of teachers do not correspond to the new requirements: they are not familiar with the computer, they cannot teach children to use the Internet in order to get the needed information (Balandiuk 2000, 11). So, investment in teachers' training according to the current needs could also be efficient.

Although at present the situation in the educational sector in Ukraine is difficult, as indicated by V. Bulavko (2001), there are some improvements as compared to the last year. The most severe problems brought up for consideration to the Ministry of Education last year included low wages for teachers (average wages received by the population working in the educational sector is lower by Hrn 246 than those set by the law (Bulavko 2001, 19)); wage arrears in the majority of rural regions; absence of age benefits.

According to Bulavko (2001), on January 31, 2001, the Cabinet of Ministers adopted the decree 378 "About the Realization of the Relevant Articles of the Law 'About Education'". According to this decree, starting April 1, the wages of workers of the educational sector were to be increased by 25%, and starting September 1, by additional 15%. Nevertheless, the teachers' salary will remain low compared to salaries in other sectors (Bulavko 2001, 19).

According to the Minister of Education and Science, V. Kremen, all arrears were liquidated before April 1, 2001, and now for the first time during independence there are already no wage arrears in the area of education (Bulavko 2001, 19). A 3-year computerization plan that is going to include all schools with special emphasis on rural ones is going to start soon, according to Gergel (2001, 2).

Numerous inefficiencies in the education system provide possibilities for redistribution of budget expenditures in order to solve many financial problems that schools face without actually increasing the budget (Berryman 2000, 58). For example, per student space norms are much higher in post-

Soviet countries than in OECD countries. Energy consumption by schools is two to three times as high as in the West. The working load of teachers is much lighter compared to their Western colleagues (Berryman 2000, 59). Numerous changes in schooling would free additional sources, which could be channeled to teacher salaries, books, etc.

Thus, literature indicates that although there are numerous areas in education in which funds are needed, problems in some of the most vital areas are gradually being solved at present, and some of the other areas could be helped by simply eliminating the inefficiencies in the educational sector. The economic efficiency of the planned budget expenditures on 12th grade as compared to other possible investments is not a priori clear.

Chapter 2

THEORY AND METHODOLOGY

The goal of my thesis is to conclude whether the proposed transition from 11-year to 12-year general schooling is economically justified or not. In order to accomplish this goal, I use cost and benefit analysis, in which I quantify and compare the major costs and benefits of the proposed transition. In order to identify the major sources of costs and benefits, I turn to Becker's *Human Capital* (1993).

2.1. Basics

Gary S. Becker discusses the effects on earnings of investment in human capital. Although different types of institutions providing knowledge to students are discussed by Becker, formal schools are relevant to this analysis. He defines school as "…an institution specializing in the production of training" (Becker 1993, 51). In order to approach the issue of costs and benefits, Becker divides the costs of schooling into direct costs and indirect costs. The indirect cost of schooling is the amount of forgone earnings (during the time of studying). The direct costs are the costs associated with studying itself: costs of buying supplies, paying the tuition, etc. Depending on the circumstances, these costs can be covered by the individual (as in Becker's analysis) or by the government. The major incentive for investing into education is the future benefit, namely, the lifetime increase in earnings of a more educated individual (Becker 1993, 52).

Becker predicts that an investment in human capital steepens the age-earnings profiles, that is, during the investment period the earnings are lower than they would have been otherwise, and during the later period they are higher. Further, Becker argues that an increase in earnings also increases the

motivation of the employees to work, which, in its turn, also contributes to productivity, and, consequently, to earnings (Becker 1993, 57). Taking Becker's analysis as the basics for my analysis, I incorporate all the relevant costs and benefits in the following section.

2.2. Outline of the Research

Following Becker's approach, the main quantifiable costs of changing from 11 to 12 years of general school education will be:

1. Expenditures from the government budget for the additional year of studying, which consist of: personnel costs (the salaries of the teachers, consultants, etc), costs of materials and equipment;

2. Opportunity costs of students, measured in terms of the forgone earnings during the additional year of schooling.

One other possible source of costs of this analysis is the opportunity cost of teachers. I consider the opportunity costs of the additional staff that will be hired for the 12-th grade as being reflected by their wages. Thus, no opportunity costs are accounted for in this category.

The main quantifiable benefit of my analysis is the benefit of higher productivity of better educated workers, described by the increase in their before tax earnings during all the years of work experience.

Another source of benefits is the benefit of "externalities", or gains from more educated population to the society; the latter consist of reduction of crime rate, child mortality, and other cultural and social effects. Although some attempts were made to quantify those (Belli et al 1998), I address these benefits in my analysis as being purely qualitative.

The effectiveness of the expenditures for the additional 12th year of general school education could be addressed through the internal rate of return. The

latter is the discount rate that equates the present values of the benefits and costs of the project (Becker 1993, 61). In the case of my analysis:

$$\sum_{n=1}^{N} \frac{\Delta I}{(1+IRR)^n} = G + FE, \quad (4)$$

where ΔI stands for the increment of before tax earnings, G – government expenditures, FE – foregone earnings, N is the number of years of work experience, and IRR is the internal rate of return.

Comparing the internal rate of return with the real interest rate in the given country, it is possible to conclude whether it is worthwhile to undertake the project. The internal rate of return higher than the interest rate indicates that the return on the project would be larger than the opportunity cost of the money. The internal rate of return lower than the interest rate indicates that the return will be smaller than the opportunity cost of the money. Moreover, analyzing the parameters, which affect the internal rate of return, it is possible to identify the conditions that would shift the probability of its value in the desirable direction.

2.3. Outline of the Procedure of Estimating the Main Costs and Benefits

2.3.1. Government Expenditures

In the case of the proposed general school reforms in Ukraine, the cost will include government (budget) expenses and opportunity cost of the students. These additional budget expenditures will begin in 11 years when the first 12^{th} year of schooling appears. No estimates of the additional budget expenditures are available at present, and they are not accounted for in the projected budget.

Additional budget expenses in the case of 12-year instead of 11-year schooling could be estimated as $1/11^{th}$ part of the variable expenses on general school education in year 2013. Thus, I assume constant returns to scale: as an

additional $1/11^{th}$ is added to scale of the "production", so is a $1/11^{th}$ added to the cost of production. Such an approach could underestimate the real expenses for the following reasons:

1) It does not account for the extension of the educational facilities, new computers, etc. But, at present, these improvements are needed anyway, and they will take place whether there will be 11 or 12 years of schooling.

2) The cost of new buildings is not accounted for. Although new premises could have been built in other circumstances, such a possibility is not considered in the case of Ukraine. It is not necessary, since the majority of schools are underutilized because the buildings were planned during the Soviet era when budget expenditures and resulting activities were not cost-effective (Berryman 2000, 58). Moreover, even in the case of not underutilized schools, where expansion of premises would have been reasonable, such is not proposed. Instead, students of higher grades would study in the evening hours in order to be able to seat all the students. Moreover, space per student in the post-Soviet countries is one-third to two times larger than in the Western countries (Berryman 2000, 59). Thus, there are numerous possibilities for increasing the scope of schooling without incurring additional costs.

3) The labor of the new teacher might provide diminishing returns to scale. However, the employment of new staff need not be necessary, since most teachers in Ukrainian schools have a very light teaching load compared to the West, and the number of teachers per a fixed amount of students is two to three times higher in Ukraine (Berryman 2000, 59). Moreover, the increase in the wages of teachers (by 25% in April, 2001 and by 15% in September, 2001) (Bulavko 2001, 19) would provide for no real decrease in returns from teachers' education resulting from the 12^{th} grade compared to the present situation.

4) The approach of using $1/11^{th}$ as the estimate assumes that the cost of one year of general schooling does not depend upon the grade. And this is not true, since high school education needs the teachers of higher qualification (higher salaries) and more sophisticated equipment than elementary education.

According to the last reason, the assumed $1/11^{th}$ estimate could underestimate the real expenses. Thus, my estimation of the government expenses provides their lower value. The implications of the expenditures underestimation will be discussed later.

2.3.2. Increase in Earnings Net of Opportunity Costs

As to benefit calculation, generally, there are three possibilities of estimation of population earnings increase due to an additional year of general school education. One of these possibilities is to conduct an experiment, i.e. to choose several representative schools, organize 12-year education there, and then register their graduates' earnings during their lifetime. Usage of this approach was duly criticized by Bracey (1999) in the case of assessment of the effectiveness of voucher school system in the US, on the grounds that "even if vouchers work in the small-scale experiments conducted todate…, these results cannot be generalized to larger-scale programs, because so many additional forces would come into play" (Bracey 1999, 8). In my case this approach is still less practical because of being expensive and time consuming. Moreover, its results will be overestimated, since they will concern a small group of more competitive individuals.

Next, benefits of the transition to 12-year education could be estimated using the experience of other countries. This approach was realized in assessing the effectiveness of the voucher school system introduction in the US by Carnoy and McEwan (Carnoy and McEwan 1999 as in Bracey 1999, 9). But in the case of my study, this approach is not likely to be relevant, since education's

effect upon population's earnings is likely to depend critically upon the particular economy.

Accounting for this, I use the third approach that involves estimation of the benefits using the available data for earnings dependence upon education in Ukraine at present. Namely, I attempt to extrapolate the available present earnings of people of different ages (accounting for the available forecasts of earnings increase with time) to one more year of general school. This can be done using analytical expressions for earnings dependence upon years of schooling and work experience, which can be obtained with regression analysis.

To simplify the task, I assume that appearance of large amount of better educated people in Ukrainian labor market will not drive down the labor cost. This assumption seems reasonable, since, as the world experience shows, better educated labor force is capable of generating larger GDP (Becker 1993, 324).

To sum up the above, the goal of this research includes the following tasks :

- building the regression equation of earnings as a function of general school education years and work experience;
- taking the differences of the earnings during the years of work experience of 12-year school graduates (obtained as extrapolation of the regression equation) and that of present 11-year school graduates. The first of these differences, which corresponds to the first year of work experience of the present 11-year school graduates, would represent the opportunity cost of the students, since it represents the lost year of work;
- incorporating the government expenditures and calculating the internal rate of return of the project and its probability distribution;
- analyzing the obtained result, its robustness to the assumptions, implications, and dependence upon the economic parameters.

To follow the outlined approach, I need to choose the function to approximate the total earnings (I) of the ith agent dependence upon the accomplished years of general school (YGS) and the after school years of experience (X). The values should be referenced to the time of the first graduation after 12-year schooling, t (year 2013), i.e. $I_{it} = f(YGS_t, X_t)$. One of such functions was proposed by Mincer (1974). For the ith individual it has the following form:

$$\ln I_i = \beta_0 + \beta_1 * YGS_i + \beta_2 * X_i + \beta_3 * X_i^2 + \varepsilon_i, \quad (5)$$

where I_i - earnings, βs - regression coefficients, YGS - accomplished years of general school, X - person's work experience in years, ε – error term (Mincer 1974 as in Dougherty and Jimenez 1987).

This function has been widely used in most works on earnings dependence upon years of schooling and experience. Later, C. Dougherty and E. Jimenez (1987) provided thorough analysis of its specification, assumptions, statistical properties, and formal proof. Following this work, the Mincerian function is based upon three assumptions:

- "The appropriate definition of the dependent variable is the logarithm of earnings, as opposed to earnings as such or any other functional form.
- There is no interaction between the contributions of the schooling and work experience variables to earnings.
- A single function can be used to model lifetime earnings, making no distinction between early and mature labor market experience" (Dougherty and Jimenez 1987, 2).

These authors used data for education level (years of education) and respective earnings of persons in Brasilia. Regressing these data using semi-logarithmic equation (5), the linear one, and applying the Box-Cox transformation, they obtained convincing evidences in support of the Mincerian functional form. The Mincerian functional form also turned out to

be better regarding relative homoscedasticity in respect of schooling and work experience variables. They also found the residuals to follow relatively normal distribution (Dougherty and Jimenez 1987, 12-16).

The modification of Mincerian specification by the addition of the terms that account for interaction between years of schooling and years of experience suggested these interactions to be positive and significant (Dougherty and Jimenez 1987, 18). It should be said that in my case the interaction appeared to be insignificant[1].

[1] This conclusion was made by regressing my data on the function that included interaction terms:

$$\ln I_i = \beta_0 + \beta_1 * YSS_i + \beta_2 * X_i + \beta_3 * X_i^2 + \\ + \beta_4 * YSS_i * X_i + \beta_5 * YSS_i * X_i^2 + \varepsilon_i$$

Chapter 3

EMPIRICAL MODEL AND THE RESULTS

In this chapter I provide the empirical basis for the economic analysis of the transition from 11 to 12 years of general school education. Here, according to the approach developed in the previous chapters, I provide benefit and cost calculations and come up with the internal rate of return for the additional 12^{th} year of general school education. The chapter begins with description of the statistical data that I will use in further calculations.

3.1. Data Description

The data set used was constructed by DerzhKomStat based on the "Survey of the Standard of Living of Households of Ukraine" that was conducted by DerzhKomStat in 1999 (DerzhKomStat 1999). The sample selection of the households that was analyzed is representative of the entire population of Ukraine. The categories of the population not represented by the sample selection are: persons drafted to the military service, persons located in the places of imprisonment, persons who constantly live in parental homes, retirement communities, dormitories, and persons that represent the marginal classes of the population. The sample was selected on the basis of the stratification according to the regions and classes of the urban and rural population proportionally to the number of population in each group. 9435 households took part in the survey.

The process of statistical weighting was used to distribute the data of the sample observation to the general selection. According to the results of the analysis of the participation of the respondents in the survey, one surveyed household had on average a statistical weight of (was representative of) 1884

households of Ukraine. The relative standard error of earnings in the sample selection is 1.42% (DerzhKomStat 2000).

Each observation consists of six variables: age, sex, family status, level of education, total after tax earnings, and weight of each observation. The weight is the number of identical observations in the population. Level of education has 11 categories:

1 – complete higher (college or university) education (5-6 years depending on the college)

2 – unfinished higher education

3 – basic higher education (4-5 years depending on the college)

4 – technical-school education

5 – vocational education

6 – complete general school education (11 years)

7 – basic general school education (9 years)

8 – elementary school education (3 years)

9 – does not have elementary school education (0 years)

10 – did not want to answer

99 – does not know

The original data has 25,772 weighted observations. Not all of these observations could have been used for the purposes of this study. The observations with ages below 18, with missing age, with missing education levels, with missing earnings were rejected. After dropping all these observations, I remained with 17,715 weighted observations, or information about 33,938,870 persons (sum of all observations multiplied by their weights).

3.2. Benefit Calculation

3.2.1. Dependence of Earnings on Years of General School and Age

After choosing the regression function in the previous chapter, the next step is inspection of the data to verify if they actually follow the supposed pattern of earnings increasing with more years of schooling and years of experience. For this purpose I choose to build the graphs of age-earnings profiles for averaged earnings of individuals with 0, 3, 9, and 11 years of schooling. The 11-year category also includes college education, since a person has to have 11 years of general school to enter a college. On the basis of the same reasoning, the 9-year category also includes vocational and technical schools. 3-year and 0-year categories include only those who have 3 and 0 years of schooling, respectively. The obtained results are presented in the Fig. 2 through Fig. 6.

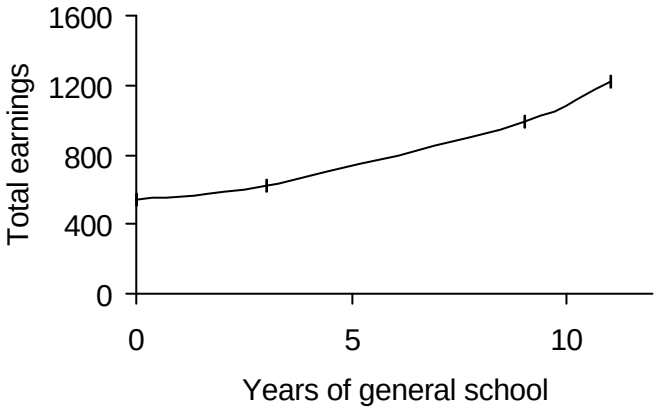

Fig. 2. Total earnings dependence upon accomplished years of general school education

The inspection of these figures suggests that total earnings of a person actually tend to increase with the years of education. Besides, as in other studies on the return to education (Becker 1993), the earnings first increase with age and then decrease. Such a pattern of earnings dependence on years of general school and age is satisfactorily described by the Mincerian earnings function (Dougherty and Jimenez 1987). It could be noticed that the value of

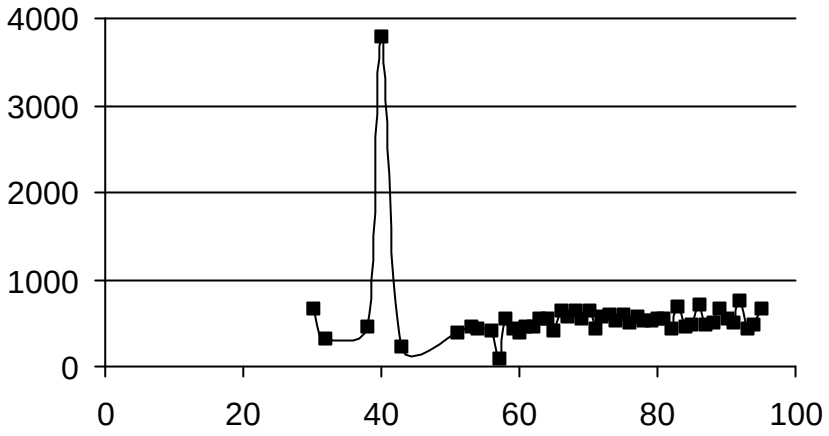

Fig. 3. Age-earnings profile for a person with 0 years of schooling

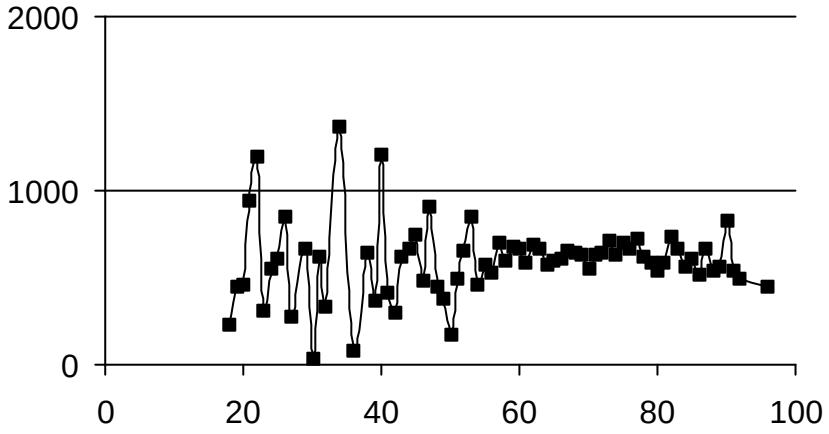

Fig. 4. Age-earnings profile for a person with 3 years of schooling

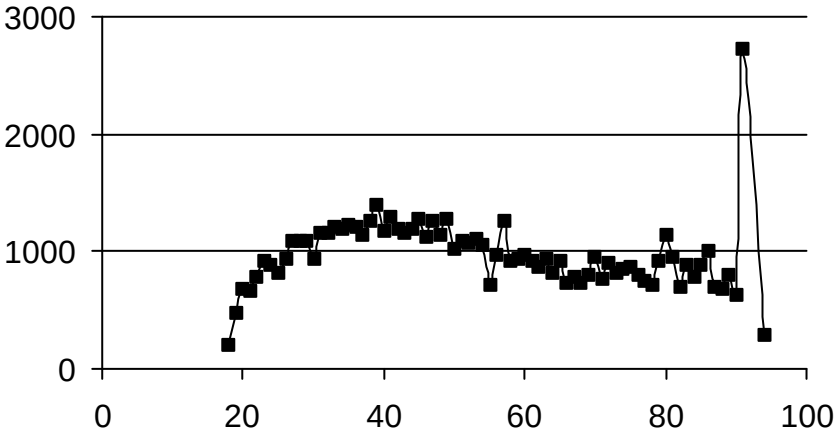

Fig. 5. Age-earnings profile for a person with 9 years of schooling

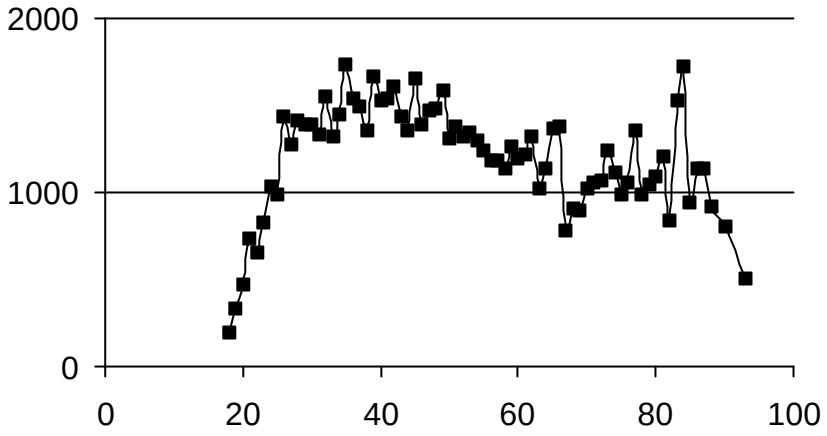

Fig. 6. Age-earnings profile for a person with 11 years of schooling

total earnings for the age of 40 in the category of people without schooling (Fig. 1) and for the age of 91 for those with 9 years of education sharply differ (about 3 fold) from the other values in these categories. Each of these data came out of one single observation. In spite of having weights of 2016 and 2393, respectively, these data seem to be very unrealistic and they were discarded in the following analysis. Thus, the following analysis was carried out using 17,713 observations or 33,934,461 individuals.

3.2.2. Regression Analysis and Results

In function (5),

$$\ln I_i = \beta_0 + \beta_1 * YGS_i + \beta_2 * X_i + \beta_3 * X_i^2 + \varepsilon_i, \quad (5)$$

I use the following representations of the variables.

Explanatory variable X represents the years of experience. Since, according to the law, the people in Ukraine are eligible to work starting 16 years of age and enter general school at 6, explanatory variable X is calculated as follows:

$$X = \min\{\text{Years of age} - 16, \text{Years of age} - 11 - 6\} \quad (6)$$

The upper limit for "Years of age" is 57, since it is the average pension age in Ukraine (UN Program of Development 2000).

Explanatory variable YGS, which denotes years of general schooling, has four relevant values: 0, 3, 9, and 11 years of general schooling, according to the gradations adopted by the official statistics in Ukraine. To simplify the calculations, the 11-years of school category includes those persons that according to the database I am using have complete higher (college or university) education, unfinished higher education, basic higher education, and complete school education (entering a college is only possible after accomplishing high school). The category of people, who accomplished 9 years of general school, will include persons with vocational/technical school education, since 9 years of school are needed to obtain it, and those with just 9 years of general school. Assuming that after zero or 3 years of general school a person is not likely to continue his education, these categories will include only the persons with elementary school education and those, who do not have elementary school education, respectively.

The data on earnings in the data set does no account for taxes paid on wages by an individual. Since I am interested in social benefit of education, the before tax earnings should be used. These I obtained on the basis of present taxes on earnings:

Earnings (Hrn/mo)	Taxes (Hrn/mo)*
up to 17	0
18-85	(I-17)*.1
86-170	(I-85)*.15+6.8
171-1020	(I-170)*.2+19.55
1021-1700	(I-1020)*.3+189.55
1701 and more	(I-1700)*.4+393.55

Source: Decree of Cabinet of Ministers "About Earnings Taxes of Citizens" December 26, 1992.

* I stands for before tax earnings

Besides this, enterprises make payments to pension and insurance funds that amount to 37% of the before-tax earnings of their employees (Verhovna Rada 1997, 2000b, 2000c). Since presumable increase in personal earnings with better education involves increase in these payments, I added 37% to personal before tax earnings.

Since the expenditures for the additional 12th year of general school education will be made in 2013, I chose this year as the basis for all the following calculations. The original DerzhKomStat data on earnings were obtained in 1999. Accordingly, it is necessary to adjust the values for the year 2013. I did it according to the available prognosis for the indexes of real wages (Research Institute of Labor and Employment of the Population 1999) and increased the earnings in 1999 by 1.45 times. A higher than forecasted increase in wages is not likely to change the results significantly, as will be explained later.

The results of the regression (5) running[1] with the explanatory variables and on the data as described above are presented in the Table 1.

All the regression coefficients appeared to be highly statistically significant. Substituting these regression coefficients into (5) I obtain the following equation:

$$\ln I_i = 5.92 + 0.061 * YGS_i + 0.054 * X_i - 0.00067 * X_i^2, \qquad (7)$$

where I_i - earnings of an individual i, YGS - completed years of schooling, X - years of person's work experience.

3.2.3. Age-Earnings Profile

I used equation (7) to obtain age-earnings profiles for those, who accomplished 11 years of schooling and those, who would accomplish 12 years of schooling. Since average pension age in Ukraine is 57, the range of

[1] I used software STATISTICA for Windows Release 4.3 StatSoft, Inc. 1993.

Table 1. Summary output of total earnings (year 2013) regressing on the accomplished years of general school and experience

Regression Summary for Dependent Variable: LNINC (minc.sta)						
R= .27675769 R^2= .07659482 Adjusted R^2= .07659473						
F(3,3393E4)=9383E2 p<0.0000 Std.Error of estimate: 1.0673						
		St. Err.		St. Err.		
N=3393E4	BETA	of BETA	B	of B	z	p-level
Intercpt			5.917756	0.000948	6242.323	0.00
YGS	0.152097	0.000197	0.060975	7.9E-05	771.6385	0.00
X	0.838215	0.000633	0.054321	4.1E-05	1323.816	0.00
X2	-0.69514	0.000658	-0.00067	6.3E-07	-1056.98	0.00

Source: DerzhKomStat data.

experience for the persons with 11 years of general school is 1 to 40 years. By substituting in this equation YGS = 11 or 12 and X from 1 to 40 or 1 to 39, respectively, and by multiplying the obtained earnings by the forecasted number of high-school graduates in the year 2013 which amounts to 504,997[1] (Research Institute of Labor and Employment of the Population 2001) and by the corresponding real wage indexes (Research Institute of Labor and Employment of the Population 1999)[2], I obtained the earnings profiles presented in the Table 2.

Table 2. Calculations of the difference between earnings of 11 and 12-year school graduates

X (years of experience)*	Earnings after 11 years of schooling (mln. Hrn)**	Earnings after 12 years of schooling (mln. Hrn)**	Earnings increase (mln. Hrn)
1	402.06	0	-402.1
2	449.58	453.49	3.91
3	499.79	504.80	5.02

[1] This number is not likely to change much in the following years, since although the number of relevant population is decreasing, the enrolment rate is increasing slightly (Berryman 2000). Thus, I assume year 2013 to be representative in the respect of the number of graduates of the following years.

[2] This source provides forecasts of real wage indexes up to the year of 2030. I extrapolated the coefficients relative to 2013 up till the year of 2053 using quadratic in years regression.

4	552.66	558.95	6.29
5	608.17	615.91	7.74
6	666.24	675.62	9.38
7	726.82	738.04	11.22
8	789.81	803.06	13.26
9	855.09	870.61	15.51
10	922.55	940.54	17.99
11	992.04	1012.73	20.69
12	1063.39	1087.01	23.63
13	1136.42	1163.22	26.80
14	1210.93	1241.14	30.21
15	1286.70	1320.56	33.86
16	1363.52	1401.26	37.74
17	1441.11	1482.98	41.87
18	1519.23	1565.45	46.22
19	1597.61	1648.41	50.80
20	1675.95	1731.55	55.60
21	1753.96	1814.56	60.60
22	1831.35	1897.15	65.80
23	1907.80	1978.98	71.18
24	1983.00	2059.73	76.73
25	2056.63	2139.06	82.43
26	2128.39	2216.64	88.25
27	2197.96	2292.15	94.19
28	2265.03	2365.24	100.21
29	2329.30	2435.60	106.30
30	2390.48	2502.90	112.43
31	2448.28	2566.84	118.56
32	2502.45	2627.13	124.68
33	2552.71	2683.47	130.76
34	2598.85	2735.61	136.77
35	2640.63	2783.30	142.67
36	2677.86	2826.31	148.44
37	2710.37	2864.43	154.06
38	2737.99	2897.48	159.49
39	2760.61	2925.31	164.70
40	2778.11	2947.78	169.67

Source: author's calculations.

*These are actual years of experience for individuals with 11 years of general school; for those with 12 years the actual numbers are 1 less.

** Earnings are multiplied by the number of students and corrected for the projected real wages.

Since a person who graduates from the 12-year school starts obtaining some earnings 1 year later than a person, who graduates after 11-year school, his years of experience are one less than those for 11-year graduates in column 1. Thus, the value in the first cell of the column "Earnings after 12 years of schooling" equals zero. Respectively, the value in the first cell in the column of "Earnings increment" is negative, representing the forgone earnings because of the lost year. The total forgone earnings amount to Hrn 402 mln.

Since the regression was run on the data of earnings both for employed and unemployed, there is no need in additional accounting for possible unemployment either during the job search after graduation, or during the rest of the life.

In order to calculate the internal rate of return of the 12^{th} grade introduction, the discounted stream of positive incremental earnings from table 2 will be equated to the sum of government expenditures and opportunity costs of students.

3.3. Government Expenditures Calculation

Since the first students are to enter the 12^{th} grade only in year 2012, no exact annual budget expenditure associated with an additional year is present now. Thus, I am going to estimate the figure on my own. The average annual expenditures for public education amount to 7.2% of GDP. The expenditures for general education amount to 65.2% out of total budget for education (UN Program of Development 1999). According to the International Center of Prospective Research, real GDP in year 2013 is forecasted to amount to Hrn 230.194 bln (International Center of Prospective Research 2000). 65.2% of 7.2% of GDP will amount to Hrn 10.806 bln. (the total amount devoted to general school education). Out of this amount, about 60% are devoted to teachers' salaries. 20% are used for repairs, additional furniture in the case of breakage, etc. 15% are used for books. 5% of the amount are used for paying for utilities: electricity, water, heating, etc. (UN Program of Development

1999). In order to find the expenditures of the budget for an additional school year, I assume that the total amount of expenditures is distributed equally among the grades, thus, as I explained before, $1/11^{th}$ of the cost will be added as the result of the additional year[1]. Thus, additional teachers' salaries and additional use of utilities and books, as well as increased breakages are accounted for. Hence, budget expenditures per additional school year will amount to Hrn 10.806 bln / 11 = Hrn 982,384,285.

Adding total foregone earnings to the government expenditures, one obtains total costs: Hrn 402 mln + Hrn 982 mln = Hrn 1384. mln.

3.4. Internal Rate of Return Calculation

In order to calculate the internal rate of return of the transition to 12-year schooling, I use the formula (4) as:

$$\sum_{1}^{40} \frac{\Delta I}{(1+IRR)^n} = G + FE\,, \qquad (4)$$

where ΔI stands for increment of before tax earnings, G – government expenditures, FE – foregone earnings, n is the number of years of work experience, and IRR is the internal rate of return.

Substituting the obtained government expenditures as well as earnings increments and opportunity cost from table 2, I obtain (in mln Hrn):

$$\frac{3.91}{(1+IRR)^1} + \ldots + \frac{169.7}{(1+IRR)^{40}} = 982 + 402\,. \qquad (8)$$

[1] This assumption might well underestimate the real expenses for the 12^{th} grade since budget expenditures for one year of high-school are likely to be larger than for one year of elementary school. Moreover, the whole number of "unofficial" parents' or sponsor's expenses (both in money form and spending their time) such as textbooks, uniforms, donations for repairs, etc. are not included. It would be rather difficult to account for this additional expenses because of their "unofficial" nature and great variance from school to school depending on where it is located and abilities of the parents. Accounting for them would make the upcoming conclusion of this work stronger.

The obtained IRR is 2.57%. This figure is lower than the real interest rate in Ukraine as for now and the nearest future (7 - 10%) and than the possible forecast for the later years (3%)[1].

Thus, the obtained conclusion is that the proposed transition to 12 years of studying is loss-making, and according to purely economic considerations, it should not be undertaken.

3.5. Probability Distribution of the Internal Rate of Return Values

The obtained result is not the "exact" one in the deterministic sense. Since it was obtained on the basis of statistical data that were averaged, the obtained result is just a mean value of the whole continuum of possible values, which is determined by the variance of the regression coefficients. To make the obtained result meaningful for economic analysis and useful for the decision making purposes it should be provided with the probabilities of the particular values, i.e. their distribution.

The estimation of the effect of regression coefficients variance upon the internal rate of return is not straightforward since the dependence of the earnings on these coefficients is not a linear one and the coefficients have different signs. Moreover, the internal rate of return has no analytical expression and is calculated through iterations.

The distribution of the internal rate of return values could be obtained through their multiple calculations with different sets of the regression coefficients that are chosen randomly accounting for their probabilities. The number of these calculations (runs) could be determined empirically by the convergence of the obtained mean values of the internal rate of return.

---

[1] No official short–run or long-run forecasts of real interest rates in Ukraine were found by me in the available sources. 3.2% is the average real interest rate of UK, Germany, and Japan during years 1997-1999 (*Encyclopaedia Britannica* 2001, Deluxe Edition CD-ROM, s.v. "interest rate"). The same number (3%) is suggested by Ukrainian economists as the real interest rate 7 to 15 years from now. Up till that period, they suggest 7 –10% interest rates (Kolbun 2001).

Realizing this approach, I found that the mean value of the internal return rate converged to the number of 2.57% after 1000 runs. The standard error of the mean is 0.01%. This number of runs resulted in the distribution presented in Fig. 7.

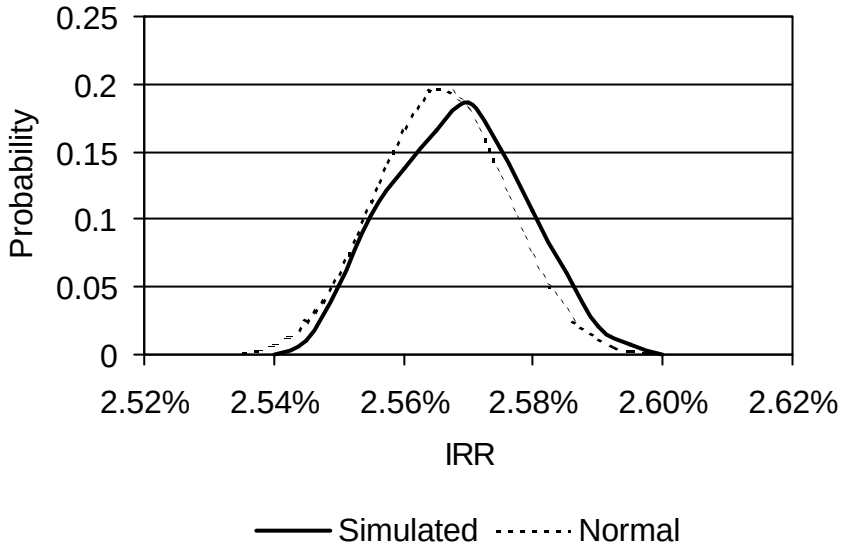

Fig. 7. Probability distribution of the internal rate of return of the investments in the additional 12th year of general school education

The normal distribution curve with the mean value of 2.57% and the standard error of the mean of 0.01% is also presented in the Fig. 6. As could be seen, the obtained distribution of the internal rate of return values is close to the normal one. This is supported by Kolmogorov-Smirnov test ($d = 0.027$, $p > 0.20$) and Lilliefors test ($p < 0.1$). Fig. 8 presents corresponding cumulative distribution of the internal rate of return.

Hence, I obtained that the distribution of the internal rate of return values is close to the normal one with mean of 2.57% and standard error of 0.01%. Accounting for the obtained distribution of the internal rate of return of the investments in the additional 12th year of general school education, even under the projected interest rate in Ukraine of 3% the return is negligible.

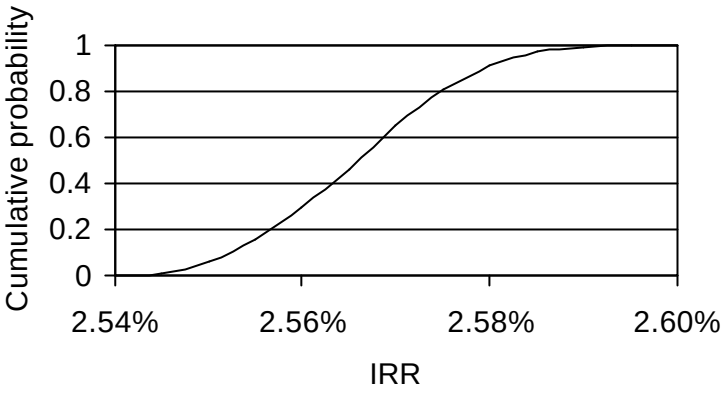

Fig. 8. Cumulative probability distribution of the internal rate of return of the investments in the additional 12th year of general school education

Chapter 4

DISCUSSION

To answer the question if the proposed by the new law transition from 11 to 12-year general school education in Ukraine is economically justified, I performed cost-benefit analysis and obtained the value of the internal rate of return and its distribution. The benefits were estimated through extrapolation of present earnings of people with 0, 3, 9, and 11 years of general school education for one more year using regression function with Mincerian specification. The costs included foregone earnings of students because of one more year at school and additional government expenditures. During these calculations, I accounted for the available forecasts for real earnings indexes and GDP growth.

Using these data, I estimated the internal rate of return, the values of which appeared to be distributed approximately normally with the mean of 2.57% and the standard error of the mean of 0.01%. This return rate appeared to be well below the real interest rate in Ukraine as for now and the nearest future (7 - 10%) and even below the projected interest rate for later years (3%).

The obtained result is based on a number of assumptions and on the present economic conditions in Ukraine. In the following section, I analyze the robustness of the result to the assumption violation, identify the assumptions and economic parameters that could significantly affect the result and the conditions under which the conclusion could be reversed. Besides, I attempt to suggest alternative investments in education in Ukraine that could be more efficient.

4.1. Assumption Analysis

To make the obtained result meaningful for economic analysis and useful for the decision making purposes, it should be accompanied by the estimation of assumption significance and the consequences of their violation. In obtaining the value of the internal rate of return for the investment in the additional 12^{th} year of general school education, I made the following assumptions:

1. Earnings with the addition of wage-based taxes are valid proxies of productivity of people with different levels of education.

2. The earnings after introduction of the 12^{th} year of schooling could be estimated through extrapolation of the present earnings for one more year of schooling.

3. Mincerian dependence of earnings upon years of general school education.

4. Additional government expenditures equal to $1/11^{th}$ of those for 11 years of general school.

5. Correctness of the projected over time values for earnings and GDP.

6. Correctness of the projected number of high school students.

7. Present enterprise and personal taxation rates will remain the same for the future years.

4.1.1. Proxies of Productivity of People with Different Levels of Education

As it was stressed in the literature overview, empirical analyses based on human capital theory use wages as proxies of productivity. This is justified by the wages being closely related to productivity. While generally it is true, in Ukraine, as in other post communist countries, this relationship is not exact. Because of low wages and widely spread arrears in their payments, many people seek for different sources of earnings that are not reflected by their direct wages at the main place of their employment. These could be different part time jobs, occasional jobs, agricultural production for personal consumption and sale. As a result, the productivity of the individual at his

main job decreases, and, thus, his marginal productivity approaches his compensation at each individual place of work. Intuitively, the possibilities of a person to find these additional sources of earnings and their amounts also increase with better education. Thus, at present, in Ukraine, the total earnings that are used in my study are a relatively good proxy of person's productivity, they are likely to be closer to the marginal product of labor than the direct wages obtained at the main work place.

In assessments of society's benefits from education, as opposed to the individual ones, before tax wages are used. So, I increased the after tax earnings by the tax rate. I also added the enterprise taxes that are based on the wage amounts. These additions are well justified in the case of direct wages but could overestimate the benefits for the society, since taxes are not always paid on additional earnings. Thus, the obtained value of the internal rate of return on the investments into prolongation of general school education could be overestimated, but this makes my conclusion even stronger.

4.1.2. Extrapolation of the Earnings for One More Year of Schooling

Two implications of this assumption could be questioned: whether the additional year would increase earnings at all and, if it does, whether the extrapolation gives the correct result.

The inspection of the available data (DerzhKomStat 1999), as presented in 3.2.1., showed that at present the average earnings do tend to increase with the years of schooling. Statistical significance of the corresponding regression coefficient is high (Table 1). The situation in other countries both developed and developing as analyzed by different economists (Chapter 1), shows very much the same tendency. On these grounds, it can be safely concluded that increase of earnings with the years of general school under the present 11 years schooling system is real, and it will persist under any plausible scenario of future developments in Ukraine.

The additional 12th year of general school education cannot possibly decrease the earnings as compared to the present 11 years. Moreover, I can argue that it will increase the earnings. The future 12th year of the general school is not a marginal year in the education system as a whole. Besides general school, this system includes vocational/technical schools and colleges. As the analysis of the data that I use shows, each of these levels of education, even if accomplished only partially, translates into substantial growth of earnings.

The extrapolation of the actual earnings after 0, 3, 9, and 11 years of present schooling to the future 12th year is also justified. As was already discussed (Chapter 2), the Mincerian equation that I used for this purpose was successfully used under different systems of general schooling in different countries and provided good results.

The alternative approach to the extrapolation of the present general school data could be interpolation of the data for different levels of education. But, in spite of attractiveness of interpolation as compared to extrapolation, this approach would not be valid since it equates qualitatively different levels of education with different tasks and means. Extrapolation in our case is used for just 1/11th interval within qualitatively the same system of education.

Hence, estimation of the increments in earnings through extrapolation of the present data for 11-year school is the best choice. Moreover, I adjusted the obtained results for the available forecasts of economic growth in Ukraine.

4.1.3. Mincerian Functional Form

The actual value of the obtained internal rate of return depends upon the choice of the functional form of the regression equation. I chose Mincerian functional form that has been widely used in the overwhelming number of works on economics of education in developed and developing countries, in legal cases involving earnings, and for decision making on education policy (Chiswick, 1997, 1). It has been shown to be superior to the linear functional form in many respects, including statistical (Chapter 2).

4.1.4. Additional Government Expenditures

As was already discussed (2.3.1.), the estimation of the budget expenditures that was used in my calculations did not account for the higher cost of one year tuition at high school as compared to the average one for general school and for numerous unofficial payments. These costs are relatively not large, but their inclusion would make the obtained value of the internal return rate smaller and the conclusion stronger.

4.1.5. Earnings and GDP Uncertainty Over Time

The obtained result depends upon the projected values of GDP that enter implicitly in the internal rate of return calculation through government expenditures and increments in earnings. The result is robust as to the GDP values because both the earnings and school budget constitute certain percentage of GDP. Hence, increase of the GDP by some amount would mean increase in salaries and in government expenditures, and, as could be seen from the expression (4), the value of the internal rate of return would remain the same. Moreover, if the share of earnings and schools' budget will change during this time, it is not likely to affect the internal rate of return significantly, since the major part of the school budget is salaries of the teachers, which are in line with other earnings. Only in the case of the change in the differences in earnings of more and less educated labor force the result would be affected.

4.1.6. Uncertainty in the Number of High School Students

Errors in the predicted number of students that will graduate after 12 years of schooling are not likely to affect the obtained value of the internal rate of return either. If the number of students changes, there would be a change in total incremental earnings. On the other hand, there should be corresponding changes in the government expenditures, and the value of the internal rate of return would not change drastically. If the number of students changes and the government expenditures would not change, then formally (expression 4), the value of the internal rate of return would be affected. But on the other

hand, this situation would mean changes in the quality of education, which would change the amount of human capital and the internal rate of return in the opposite direction. For example, if the number of students increases (positive effect on the IRR), the quality of education is likely to decrease, and the increase in human capital from education will be less (negative effect on IRR). So, the obtained value of the internal rate of return seems to be robust against possible errors in predictions of the number of students that would obtain 12 years education at general school.

4.1.7. Taxation Rates

The two tax rates used are subjects to change. According to the discussions in the Verhovna Rada, it is likely that the taxation rate will be lowered in the nearest future. But this is not likely to affect the result obtained in this study. Since I consider here the implication of the proposed reform for the whole society, a decrease in taxation would be simply a monetary transfer from the government to the individuals.

The analysis of the assumptions used to obtain the internal return rate of the transition to the 12-year general school shows that:

- the result does not depend upon possible uncertainties in the number of high school students, proportional changes in GDP and personal earnings;
- the result does not depend on the possible changes in taxation rates;
- the obtained value of the internal rate of return could be slightly overestimated because of underestimation of the government expenses.

4.2. Causes that Might Affect the Result

The obtained result could be affected in the future for two reasons. The first one is the possible changes in the difference in earnings of more and less educated population. The second one is the change of the interest rate in Ukraine as compared to the forecasted one.

4.2.1. Changes in Differences in Earnings of More and Less Educated Labor

As it is evident form the expression for the internal rate of return (4), the obtained result depends upon the difference in earnings of more and less educated persons. In Table 3, I provide the difference in earnings of people with different years of general school for internal rates of return of 2.57% (present), those sufficient for the internal rate of return to increase to 7.12% (slightly higher than the present interest rate), and to 3.11% (slightly higher then the projected interest rate).

Table 3. Increase in earnings of people with additional levels of general school education as compared to the previous educational level for different internal rates of return

	Internal rate of return (%)		
YGS	2.57	7.12	3.11
0			
3	20%	34%	22%
9	44%	79%	48%
11	13%	21%	14%

Source: Author's calculations

Changes in the amounts of wages added by each level of general schooling in Ukraine needed to increase the internal rate of return and reverse the result are possible under the condition of substantial economic growth. The later would demand modernization of the dated technologies that at present prevail in most sectors of the economy. Implementation of the new technologies would sharply increase the demand for educated workers and their earnings. But, accounting for the present state of Ukrainian economy, this technological modernization would be possible only through attraction of the Western investments that could provide for both acquiring of the Western technologies and implementation of the new progressive technological developments available in Ukraine. Without this, increase in wages and their differentiation would not pay off.

Attraction of the Western investments depends on the creation of the favorable climate that includes free market, democratic reforms in the country, and decrease of corruption. Regretfully, the present Ukrainian leadership has been only slowly moving in this direction. Moreover, the recent events (dismissal of pro-Western foreign minister, mildly market oriented deputy prime minister, and prime minister himself) suggest that it even reverses some of the moderate achievements on this way. The reverse of democratic reforms and political moves of Ukrainian leadership hardly suggest fast economic growth in the nearest future that in its turn could considerably increase differences in earnings depending on education.

4.2.2. Interest Rate

Another reason for the obtained result being negative is the high interest rate in Ukraine at present. It is high compared to the developed countries due to economic and political instability, inflation expectations. Besides, Ukrainian government desperately needs both internal and external investments. Even the forecasted fall in the interest rate after 7-15 years to 3% would not reverse the result. As was already said above, the latest political and economic developments in Ukraine make the possibility of the interest rate falling further highly unlikely.

4.3. Economic Reasons for the Obtained Result

On economic grounds the obtained result appears quite reasonable. Most of the studies that showed high and increasing returns on investments in prolonging years of education (e.g. Becker 1993) were concerned with *personal distribution* of earnings, i.e. benefits for a separate individual from undertaking additional schooling under the existing options in the country. They consider the increase in an individual competitiveness because of investing in his personal human capital rather than increase of human capital for the whole population of a country. In the latter case, individual competitiveness will not change, thus there will be no adequate increase in individual earnings over the

lifetime to compensate for the forgone earnings and the direct costs of education (consistent with my results).

An overall change in the years of education would pay off in the case of change in the demand for more educated workers, which in its turn is determined by economic and technological level of the country. Thus, according to Dresh, (1975), there is an economic optimum of education level that depends on technological level of the economy under consideration (Dresh 1975 as in Kapelushnikov 1981). Say, having many experts in quantum mechanics in a stone age country hardly will increase the level of productivity and the GDP, while large proliferation of this expertise in a modern country, which economy heavily relies upon microchip design and production, would be highly beneficial.

Under the conditions of a market economy, the optimum level of education is achieved, as in the case of other commodities, through the mechanism of demand for and supply of specific level of education. The former is expressed through the differences in earnings of people with different levels of education and shapes individual's incentives for education. A rapid increase in supply of educated labor leads to a decrease in the differences between earnings of more and less educated employees even when *personal* education increases are considered (Dresh 1975 as in Kapelushnikov 1981). The effect would be still larger if *general* education is increased, as in the case of my analysis.

Moreover, the negative effect of adding the 12^{th} year of schooling in Ukraine could be, at least partially, explained by the present state of economy and supply of human capital, which determine rather low increment in earnings with increase in human capital as it is. For example, a comparison of per hour wages of butchers (as an occupation that requires low level of education) and general physicians (as an occupation that requires high level of education) in Ukraine, UK, and in the US, indicates that in Ukraine the spread between the

wages is very low (Hrn1.1 per hour for the butcher and Hrn1.87 for the physician), while in the UK (L5.75 and L24.15) and in the US ($9.07 and $99.99) the spreads are much larger (*Statistics on Occupational Wages and Hours of Work and on Food Prices* 2000).

Thus, due to the low relative demand for educated labor in Ukraine at present, adding supply would decrease the difference in wages of more and less educated people still more. The explanations of the low demand are: overproduction of highly educated labor force in the former USSR inherited by Ukraine, economic crises in Ukraine at present, and sharp decrease in R&D and military spending. Since, at present, increments in earnings with additional education are low, many people with high level of education are occupied at the jobs with low demand for education, many travel abroad.

On the other hand, the present level of education, including general school education, is rather high. For example, Ukrainian school students do well at international competitions, especially in science and math (Balandiuk 2000). Thus, introduction of the 12th grade in order to raise the level of education in Ukraine to the international standard is not relevant.

4.4. Alternative Directions of Investment in Education in Ukraine

Since the obtained result is negative, I suggest alternative possibilities of investing in education.

As was already mentioned, one of the main reasons of introducing the 12th year of schooling in Ukraine is "to be like developed countries" (Koryunenko and Rapina 2001, 4). But the schooling systems in different countries are shaped by their historical traditions, among other things. For example, in the USA children start their schooling at 5 and in Ukraine they are planned to start 12-year schooling at 6. On the other hand, Ukraine has a more developed and popular network of kindergartens (attended by children of 3 to 6 years old) some of which provide good preliminary education. The rate of

kindergarten attendance in Ukraine is about 62% (UNICEF 1998, 24). Accounting for this, the main task of the first year of reformed elementary school in the framework of adding the 12th grade is to bring the knowledge of children to a uniform level (Koryunenko and Rapina 2001, 4), since kindergartens are of different quality. It seems much more reasonable to invest in the last year of kindergarten education than in additional 12th year of general school, at this time the foregone earnings are actually zero. As Becker convincingly showed, there is a decline in return on investments in education over time, because of the decline in benefits as fewer years of life remain and rise in opportunity costs due to higher foregone earnings (Becker 1993). To prove this point for the case of Ukraine, one can compare the age-earnings profile for people, who actually attended kindergartens that provided preliminary education with the would be graduates from 12 years general school (for instance, the one obtained in this study). This proposed analysis should also account for the necessary expenses for the 12th grade and 1 year preliminary education.

One, of course, could argue that children could start the proposed 12 years of general school at the age of 5. But it seems not to be a good option, since 5 years old need somewhat different approach in learning, which would be more effective if combined with games. People who take care of children in kindergartens are better prepared for such an approach than general school teachers. Moreover, most of the kindergartens already have the necessary facilities, as contrary to schools.

Another alternative possibility of investing in education is suggested by figure 1 on page 14. Although the rate of enrolment to high-school has been increasing lately, according to my estimation, the number of high-school graduates among the total population of age 18 and above amounts to 38%. Providing monetary incentives for students to continue studying at high-school could be much more efficient than introduction of the 12th grade, since the majority of the students do not stay in school for so long.

The majority of those who go to high-school are those who continue their education at college (about 65%) (Verhovna Rada 2000a, 32). Thus, this is the category for which the 12th grade is mostly relevant. On the other hand, those who are going to enter colleges and for some reason do not have adequate knowledge could gain it much more efficiently at college preparatory courses, which are staffed with college lecturers who can provide much more adequate college instruction. At present, these preparatory courses exist at a majority of colleges and they have already proved their efficiency. Subsidizing them by the government (at present most of the expenses are covered by students) could make them much more affordable and raise the standards of college education. Moreover, this will partially improve distribution of expenses for education in Ukraine as compared to the developed countries. At present, Ukraine spends only about 10.7% on college education out of the total education budget, the tenth lowest value among 100 countries (UN Program of Development 1999).

As the above discussion shows, the investments in the additional 12th year of general school education at present are not economically justified. The present development in Ukraine does not provide grounds for this conclusion to be changed in the nearest future. Investments in the last year of kindergarten, in college preparatory courses, or in incentives for enrolment to high school could be more efficient.

4.5. Directions for the Future Studies

The area of economics of education is largely undeveloped in Ukraine. This is one of the first studies of the kind. The results of my study suggest three directions of investment in education in Ukraine that could be efficient under the present conditions. Those are:

- Encouraging enrolment to high school;
- Raising the level of education during the last year in kindergartens;

- Subsidies of the college preparatory courses.

There are suggestions of better allocation of the present general school budget expenditures that were reviewed in Chapter 1. Economic studies of these options could provide the grounds for the best solution.

Chapter 5

CONCLUSION

To answer the question if the proposed transition from 11 to 12-year general school education in Ukraine is economically justified, I performed cost-benefit analysis and obtained the internal rate of return.

The benefits were estimated as the present value of additional before tax earnings of the future 12-year school graduates as compared to those of present general school graduates. The costs included the additional government budget expenditures and foregone earnings of the students because of one additional year of schooling.

The additional and foregone earnings due to one more year of schooling were estimated by extrapolation of the available DerzhKomStat data for the people with 0, 3, 9, and 11 years of general school education using the regression equation with the Mincerian specification, which turned out to be superior to alternative specifications.

The obtained internal rate of return of 2.57% appeared to be below the current and the forecasted real interest rates in Ukraine, i.e. government expenditures and foregone earnings are greater than benefits when the last are discounted.

The analysis showed the obtained result to be robust to the assumptions violations. The value of the internal rate of return is only slightly underestimated because of underestimation of the government expenditures (assumption 4). The obtained result could be reversed in the future by two causes:

1. Increase in the difference in earnings of more and less educated population;

2. Decrease of the interest rate in Ukraine below 2.57%.

These changes could take place under the condition of substantial economic growth, which would be possible under the conditions of large foreign investments and technological modernization. At present, the investments in Ukrainian economy are hampered by slow transition to market economy and democracy, high level of corruption.

The overall conclusion of this research is: based on purely economic reasons, at the present state in Ukraine, the investments in the 12^{th} grade do not seem to be justified. Further research would indicate whether suggested investments in the last year of kindergartens, in college preparatory courses, or in providing incentives to increase the high-school enrolment rate would be more efficient.

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