

# Estimation of Internal Rate of Return (IRR) to Investments in Education in Latvia

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**Abstract**—The objective of the paper is to estimate Internal rate of return (IRR) to education in Latvia based on methodology used by OECD. IRR shows the efficiency of investments in higher education as private return at level of individual. IRR method includes estimation of several factors related to employment probability, pensions and wage premiums, labour taxes.

The data of research are based on Labour Force Survey data issued by Central Statistical Bureau of Latvia for year 2010. Objectives of the paper are directly pointed to seeking for methods of recovery of the national economy and further development. The issue of the paper is very urgent as it applies to welfare of the society and growth of human capital.

**Index Terms**—Employment, IRR, wages

## I. INTRODUCTION

During economic crisis social policy was subjected to pressure and in many countries budget for social policy and education was cut. However education and training have proven their efficiency and can become important tool in overcoming crisis and promoting development. The Council of the European Union states that: “Efficient investment in human capital through education and training systems is an essential component of Europe's strategy to deliver the high levels of sustainable, knowledge-based growth and jobs that lie at the heart of the Lisbon strategy, at the same time as promoting personal fulfillment, social cohesion and active citizenship” [1]. Therefore it is important to encourage investments in education proving the efficiency of these investments. Rate of return to investments in education has estimated by many economists and two main approaches are used (one is known as investment approach – Net present value and Internal rate of return, the other is based on econometric approach known as Mincer earning function). The author will look more detailed on Internal rate of return approach used also by The Organisation for Economic Co-operation and Development (OECD).

There is opinion that rate of return below 10% in higher education is evidence of inefficient investment in higher education [2]. However the author would like to argue this opinion pointing out that available data about OECD countries (at different reference period but not older than 2005) show that average private rate of return for men is 12,4% and for women 11,4% but social rate of return for men is 10,8% and for women is 8,8% [3]. Besides in such countries like

Denmark, France, Germany, Italy, Netherland, Norway, Sweden, United Kingdom private rate of return for men and women are below 10% and it is not directly related to efficiency of investments in education in mentioned countries. The returns are typically higher for men probably because of larger overall income inequality. Typically public or social rate of return is lower as private rate of return puts forward the advantage of education at individual level. The returns are comparatively lower in Scandinavian countries mainly because of compressed wage structure and higher education system which is almost free of charge. Taxation and social policies in each of the countries are also very important to evaluate the public rate of return. In comparison with previous years rates of return at private and public level have tendency to increase. Rates of return estimated by OECD indicate larger rate of return from higher education than secondary education levels (ISCED 3-4).

The author would like to point out that higher rate of return is estimated in developing countries – for example the private rate of return for men significantly exceed 10% in such countries like Czech Republic (17,6%), Hungary (20%), Poland (21,4%), Portugal (18,5%), Slovenia (19,1%), Turkey (19,3%) [4]. In most cases the rate of return is higher for men. Author estimated rate of return using another approach – econometric approach developed by Jacob Mincer (1974) using data of Labour Force Survey 2010 and rate of return for women is higher as rate of return for men [4]. Author assumes that it can be explained by lower base work salary for women which make return higher from mathematical perspective. It means that for the same amount of increase men will have lower rate of return. Usually gross earnings are taken into account especially for countries where progressive income tax system is developed. In Latvia equal income tax is applied to all employees and author used net wage. Besides in July 2012 24,8% from all employees received minimum wage or less which might lead to the thought of high undeclared incomes [5]. In addition people are more aware about their net incomes but not gross work salaries and paid taxes.

Rates of return will be different in countries with high work salary inequality and shortage of highly educated people in some countries as well as it could lead to higher demands for individuals.

OECD estimates the return to education by net present value approach (NPV) which is close to internal rate of return method – both are based on investment approach using discount rate. NPV represents measure of the economic benefit obtained during individual working life related to the costs of higher level of education. Discount rate approach makes it possible to compare costs or payments over the time [6]. However latest researches used combination of two

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approaches estimating IRR based also on Mincerian equation results.

TABLE I: FACTORS OF NET EMPLOYMENT PREMIUM, 2010

Factors	Meaning	Value
$\Delta$	differential between the "take-home-pay" rate $(1 - \tau)$ and the net benefit replacement rate	1-0,2494 = 0,751
$\tau$	average tax factor for the reference group, defined as a weighted average of the average tax rate on labour earnings and the average tax rate on unemployment benefits (3,81%), with weights given by the employment and unemployment probabilities	$0,783 \times 30,78 + 0,221 \times 3,81 = 24,94$
$\tau_0$	Average tax rate on labour earnings	30,78% <sup>a</sup>
$p'$	employability premium, i.e. marginal increase in the employment probability from completing the next higher attainment level per year of tertiary education	$81,1 / 66,1 = 22,7\%$
	Average employment rate by secondary education level (ISCED 3-4), age 25-64	66,1%
	Average employment rate by higher education level (ISCED 5-6), age 25-64	81,1%
$S'(X_0)$	Survival rate (the ratio of the number of students who are awarded an initial degree to the number of new entrants to the level n years before, n being the number of years of full-time study required to complete the degree [4, Glossary]) Author assumed that average number of full-time study n = 4 years.	58,95%
	Number of students who are awarded in 2010	26541
	Number of new entrants in 2006/2007	45025

<sup>a</sup> - Tax rate. <http://appsso.eurostat.ec.europa.eu> Single parent without children 100% of average worker (sector C-K)

One of the main investment costs is foregone earnings which depends from wage levels in particular countries and length of study. Other indicators of private return to investments in education are probability to find a job (unemployment rate), taxes and private costs of education. Therefore education expenses should be covered by higher incomes in future to recover direct and indirect expenses of education and foregone earnings as well. Besides length of education, work salary amount, unemployment rate and access to labour market are taken into account. Access to education depends as well in each country by supporting system (supported mainly by state or partly by individuals and state). OECD calculates foregone earnings at level of the legal minimum wage or earnings which include part-time work [7].

Public benefits from investments in higher education are lower social expenses (in case of unemployment) and others social benefits supported by state budget, higher incomes from taxes (in case of progressive income tax), higher incomes from consumption taxes, higher social insurance contributions in current social budget (if social insurance taxes linked to current expenditures from social budget for pensions not for savings). However indirect costs such as foregone taxes should be taken into account. Public costs include foregone tax incomes (income and social insurance taxes) and public expenditures of education (direct and indirect such as state grants to students).

$$NPV = - \sum_{t=0}^{d-1} C_t / (1+i)^t + \sum_{t=d}^{64-a-d} B_t / (1+i)^t \quad (1)$$

$C_t$  – costs at period t

$B_t$  – benefits at period t

$d$  – duration of studies

$a$  – age at the beginning of activity in the labour market

Costs are composed of following costs:

Foregone earnings + direct private expenditures – grants allocated + increased future taxes + lost transfers

Benefits are composed of following benefits:

Increases in earnings + higher probability of being employed (unemployment effect, 1 minus unemployment rate applied to average annual salary).

## II. ESTIMATION OF INTERNAL RATE OF RETURN

Author estimates IRR – internal rate of return which is composed of several influencing factors. We will use formula provided by Angel de la Fuente and Juan F. Jimeno and used as well by Romina Boarini and Hubert Strauss [8], [9].

$P'_{net}$  is the net employability premium estimated as  $\Delta p'$   
 $S'(X_0) = 0,751 \times 0,227 \times 0,5895 = 0,1005$

All tax rates incorporate personal income taxes and employee social insurance taxes (except employers' taxes).

$\theta_{net}$  (net wage premium) =  $p(1-T') [\theta S'(X_0) - v] = 0,661 \times 0,7175 [0,1038 \times 0,5895 - 0,0088] = 0,0248$

TABLE II: FACTORS OF NET WAGE PREMIUM, 2010

Factors	Meaning	Value
$p$	employment probability for people with upper-secondary education	66,1%
$T'$	marginal tax factor for a person of the reference group, defined as a 'weighted' average of the marginal tax rate on labour earnings and the marginal tax rate on unemployment benefits (3,81%), with weights given by the employment and unemployment probabilities	$0,783 \times 35,0 + 0,221 \times 3,81 = 28,25$
	marginal tax rate on labour earnings	35%
$\theta$	wage premium per year of tertiary education (see explanation: Mincerian wage equation)	10,38%
$S'(X_0)$	Survival rate	58,95%
$v$	labour market experience premium Author used the data (experience premium) obtained from Mincerian wage equation (0,0091 in case of man and 0,0085 in case of women, weighted average is equal to 0,0088)	0,0088

Mincerian wage equation:

According to this method such factors as average years of schooling, the age of employee, average net income of employee and work experience are taken into account [10]. The results indicate the average rate of return from one additional year of schooling by gender and average for all working population with gender employment weights. The data of research are based on Labour Force Survey data issued by Central Statistical Bureau of Latvia for year 2010. Author made several restrictions on general random. As a result research covers data of about 6140 employees which is statistically significant.

$$\ln Y_{s,x} = \ln Y_0 + rs + \beta_1 x + \beta_2 x^2, \quad (2)$$

where  $x$ : years of experience

$Y_{s,x}$ : annual earnings of an individual with  $s$  year of schooling and work experience  $x$

$Y_0$ : earning capacity after completion of schooling

$S$ : years of schooling

$r$ : rate of return

In case of men rate of return  $r = 0,0925$  which is equal to 9,25%. In case of women education has higher rate of return and exceeds 11, 44% from each additional year of schooling however it can be explained by comparatively lower base work salary.

To estimate the average Mincerian rate of return the author uses weights of women and men employment. Taking into account employment of women and men in age group 20 – 64 we get average Mincerian rate of return which is equal to 0, 484238× 9,25 + 0,515762×11,44 = 10, 38% [11].

PENS(R) pension premium =  $\gamma (R) (1 - T_p^*) k [\theta S^*(X_0) - v]$  = 0,063× 0, 74× 0, 56 [0, 1038× 0, 5895 – 0, 0088] = 0,026 × 0,0524 = 0,0014

$$\gamma (R) = \frac{R}{R+g+v-\omega} \frac{1-e^{-(R+g+v-\omega)(Z-U)}}{e^{RH}-1} \quad (3)$$

TABLE III: FACTORS OF PENSION PREMIUM, 2010

Factors	Meaning	Value
$\gamma (R)$	Discount factor on pension benefits $R = r - g - v$ $g$ = labour productivity growth over the past decade $v$ = labour market experience premium (author used Mincerian equation results) $\omega$ = real growth rate of pensions $Z$ = life expectancy at birth $U$ = average retirement age	$R = 10,38 - 3,87 - 0,0088 = 6,50$ $\gamma (R) = 0,06294$ $g = 3,87\%$ per year (2001 – 2010) $v = 0,0088$ $\omega = 12,04\%$ per year (2001 – 2010) <sup>a</sup> $Z = 73,8^b$ (2010) $U = 60,93$ year <sup>c</sup>
$T_p^*$	Marginal income tax rate for pensioners	26%
$k$	Pension benefit replacement rate The author estimated replacement ratio as average net incomes while working to net average pension, 2010	175,88/316 = 0,56

$a$  – SDG03. Average size of pensions paid (lats). www.csb.gov.lv

$b$  – IMG07. Average life expectancy at birth (years).

www.csb.gov.lv

$c$  – Data of the State Social Insurance Agency.

The author estimated average retirement age using D. Latulippe methodology based on assumptions about minimum retirement age at 45, distribution of population, retirement and activity rates referring in five years groups [12]. In this case the average retirement age is 59, 61 years. Further author will use the official retirement age estimated by State Social Insurance Agency which is equal to 60, 93.

$R$  combines  $r$  the private return to schooling (at which the future stream of income is discounted) with  $g$  and  $v$ .

OPPC (opportunity cost of schooling) =  $p (1 - \tau) = 0,661 \times 0,751 = 0,496$

DIRC (direct cost of schooling) =  $\mu e^{vH_0/2} = 0, 1299 \times e^{0,1569} = 0,1569$ , where

$\mu$  – is direct private cost of tertiary education, expressed as a fraction of the wage of an upper-secondary degree holder.

In Latvia private expenditure on higher education was 54, 9 million LVL equal to 78,12 million euro (Latvian Bank official rate 0,702804 LVL = 1 euro)

The author estimated average number of students in 2010 taking into account drop out, number of graduates and new students.

$$V = S_{-1} (1-1/3k) (1-1/2k) + 1/3U - 1/2 B = 95 370, \text{ where}$$

$k$  – drop-out rate in 2010 = 0,157

$S_{-1}$  – the number of total students on previous year 1st October = 112 555

$U$  – the number of students enrolled in 2010 = 30 944

$B$  – the number of students who obtained degree or qualification in 2010 = 26 541

The private expenditure does not include indirect costs of higher education (for example living costs or accommodation rent) but mainly covers direct costs like tuition fees, books. The average private spending on higher education was 575 LVL or 819 euro which is 12, 99% from average wage of an upper-secondary degree holder. The estimated rate shows the fraction of wage which should be allocated or invested from private resources obtaining higher education.

The average wage of an upper-secondary degree holder was 6305 euro in 2010 (ISCED 3-4 levels, NACE sectors B-S (Industry, construction and services (except activities of households as employers and extra-territorial organisations and bodies).

$H$  = length of the working life. The author used Mincer approach  $U - \text{Max} (6 + S_0)$  where 6 is schooling starting age and  $S_0$  average length of education.

The author used the methodology of Robert J.Barro and Jong-Wha Lee to estimate average length of education [13]. The indicator is estimated taking into account the share of people who obtained particular level of education, share of population referring in five years groups and average number of schooling in each level of education.

The average years of education in 2010 (age 25 – 64) was 12,45 years. From this we get  $H = 60,93 - 6 - 12,45 = 42,48$  years.

$H_0$  is retirement age of an upper-secondary degree holder and it is equal  $H_0 = 60,93 - 6 - 12 = 42,93$  years.

$$IRR = \frac{\theta_{net} + P'_{net} + \text{PENS} (R)}{OPPC + \text{DIRC}} = 19,40\% \quad (4)$$

The results indicate relatively high private internal rate of return which is typically for new EU member states and developing countries.

Author stressed that all used indicators indicate average “temperature” in the country and include differences between employees with high and low incomes where Gini coefficient in Latvia is very high (in Latvia it was 36,1% in 2010 in comparison with 30,5% in EU27) [13]. However it shows the tendencies and it is rather good indication where return from private investments in education is high and valuable. It is estimated that increase in net wage premium and net employability premium have direct and positive effect on private internal rate of return. Increase by 3 percentage points on wage premium it is expected the increase of internal private rate of return by 1, 25 percentage points which shows that wage increase from one additional year of schooling increase faster than expected increase from labour market and social benefits. For example, increasing employment probability for employees who have higher education by 3 percentage points the private internal rate of return will also increase by 3 percentage points. In addition the increase in private costs for higher education as tuition costs the expected private internal rate of return will decrease which leads to negative feedback from private investments in education.

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