

# Macro- and Microeconomic Risks of Student Loans in an International Context

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## Abstract

This paper deals with an apparent gap in the higher education finance literature. The risk of individual and social investment in higher education is not a well-researched topic compared to, for example, the rate of return to education investment; however, some authors strongly suggest that a student loan market bubble will be behind a new economic crisis. The tuition fees and debt balance is growing at a rapid pace. In many countries tuition fees are low, but there is a possibility to borrow for investment in education. This can lead to irresponsible investment behaviour. The paper will conclude that the student loan market is too small to cause a macroeconomic crisis, but that it is a market with many stakeholders and irresponsible behaviour should not be allowed. With the examination of a Hungarian sample, it can be concluded that in a situation where rational investment behaviour might not be expected in the context of higher education, signs of rational investment behaviour can be found. The risks of post-secondary studies are not yet fully understood and measured, and for this reason suggestions for further research will be made.

Keywords: Economics of Education, Higher Education Finance, Student Loan, Income-Contingent Loan,

JEL: G15; I22

## 1. Introduction

Human capital accumulation is an important factor behind economic growth. For this reason human capital investment has long been a debated topic in the economic literature. Approaching the workers in a company as some kind of capital can be dated back to Adam Smith; however, the works of a theoretical school led by Shultz and Becker laid the foundation for a human capital investment theory. There are several questions at issue, from human capital measurement through labour market information asymmetries to human capital investment constraints. This paper contributes to the discussion on the risk of individual human capital investment. The basic idea is that individuals are willing to spend time and/or money to invest in their own human capital because it will make them more valuable workers, among many other advantages, so they can earn more in the future. The cost of human capital are foregone earnings and monetary costs. The yield can be, for instance, a wage advantage because of enhanced productivity. It is a financial investment decision, particularly because human capital investment through higher education is a long term investment and getting a degree can take 3, 5 or even more years. It is not easy to predict what will be the wage for a given qualification, or whether there will be any demand for it on the labour market. Moreover, individual features can cause cycles in earnings. We can consider education a risky financial investment. In the empirical literature review section the theoretical consequences of such a line of thought will be introduced.

An environment of agents making risky investments can create interesting scenarios. If they underestimate risks, and the investment is relatively cheap<sup>1</sup> this can lead to investment bubbles and eventually to a crisis. Some suspect that this is exactly what is going on in the student loan market. The argument laid out in the press by writers such as Davies-Harrigan (2012), McCluskey (2013) or also in the Hungarian press (PSZO, 2012) is the following: American student loans, like the main lending mechanisms such as Stafford and Perkins loans, are federal loans; the government is creating a bubble by allowing easy access to student loans, which has the effect of growing tuition fees. Higher tuition fees demand higher lending which in turn creates higher tuition fees. Eventually this will lead to a situation in which graduate borrowers will be unable to pay back their debt and the government will be left with a huge uncovered amount outstanding. That is a sure recipe for a debt crisis.

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<sup>1</sup> For instance if one has to choose between a high chance of unemployment with low possible wage offers and a currently low-interest rate student loan and easy education, the second option might be very tempting but will not have a high return.

This is not only an overseas phenomenon. The recent global economic crisis had a severe impact on the Hungarian economy that led to years of stagnation. It was one of the reasons behind the government's need to intervene in the status quo of the Hungarian higher education system. Most students recently starting in such fields as economics or law must pay a full cost contribution. To aid this change in the costs of education a new student lending vehicle was introduced (Balogh et al, 2012), called Diákhitel 2<sup>2</sup>.

People all are spending more<sup>3</sup> on risky investments in human capital. Is this something similar to an expansion of a bubble that will eventually lead to a crisis? If a higher education crisis happens, will it be similar to the recent US housing market correction? Can it be a trigger for a macroeconomic setback?

This paper approaches these questions from two directions. First, it will consider whether the market is big enough where it is the most expected to have a domino effect in the whole economy. Second, we will ask whether the investors can be considered financially reasonable, where they are the least expected to be. By financial rationality we understand a behaviour which chooses higher risk only when it is rewarded by a higher return. The empirical section will introduce results from a Hungarian sample. The education programs chosen by the sample can be fitted to an equation that derives from the financial theory of the efficient frontier.

The paper will conclude that even where the higher education market size is huge, the numbers are not high enough to be considered as a potential risk factor. Moreover, rational financial behaviour patterns will be found where they are least expected. Combining the two conclusions means that human capital investment market growth is not a macroeconomic threat. The results will even suggest that the deterrent effect of the risk might not be the most interesting microeconomic problem.

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<sup>2</sup> However, its popularity failed to live up to the expectations, as was pointed out by the following article: [http://hvg.hu/karrier/20121210\\_diakhitel\\_2](http://hvg.hu/karrier/20121210_diakhitel_2)

<sup>3</sup> Both their current and future capital.

## 2. Literature Review

Becker (1964) gave examples, theoretical background and the tools to calculate the rate of return to education, and since then it has been a very popular topic in the literature (see several literature reviews and empirical works by Psacharopoulos, such as Psacharopoulos (1995) or Psacharopoulos – Patrinos (2004)). The basic idea was that investment in education is no different from financial investments from the point of view of decision-making. The value of the investment is the net present value of the cash-flows generated by it, and the rate of return is where the net present value is zero. Some of the more interesting findings are that the rate of return is exceptionally high (more than 10%), and in some cases this does not diminish with a higher level of education, which basically means the more we invest the higher rate of return we experience; moreover, the social return is usually positive as well (T. Kiss, 2010).

The risks of education investment have also been studied since the early 70's. There are some theoretical papers with important insights (Levhari, D. – Weiss, Y. 1974, Eaton – Rosen 1980, Hamilton, J. H. 1987, Anderberg – Andersson, 2003; da Costa – Maestri 2007; Anderberg 2009; Jacobs et al, 2009) and some very useful empirical literature (Carniero et al, 2003, Cunera et al, 2004; Chen, 2008). There is a debate over whether we should consider education a risky investment in human capital or as an insurance against labour market risks. Chen (2008) finds that the divergence from the expected return for education was unforeseeable for the cohort he examined. This means it cannot be traced back to family background, or individual features. Consequently, we cannot predict if someone will be better or worse off with a degree than the average degree holder. Hillman (2014) published a study dealing with the fact that students with low-incomes and from minority backgrounds have a disproportionately high chance of defaulting on their student loan. This constitutes a risk. However, Anderberg – Anderson (2003) pointed out that degree holders have better labour market statistics, a lower unemployment rate, higher expected earnings, and better health conditions. In this sense the degree is an insurance, although it should be added that it is not an automated insurance like car-insurance. For example, if one is involved in a traffic accident the car insurance company automatically pays for the damage if current conditions are met. That is automated insurance. However, there is no contract or policy that makes it certain if an individual becomes unemployed he will get a job earlier than somebody without a degree. There has been no unarguable answer to this debate; however, some contributions will be made in this paper.

Before we turn to that issue, we should examine the individual investment in higher education in a little more detail. The following is usually calculated as a rate of return to education:

First we have to calculate the net present value of the education investment. Equation (1) is based on the rate of return calculation presented in Blöndal (2002).

$$NPV_j = \sum_{t=a}^l (1 + \delta)^{-(t-a)} C^j(t) + \sum_{t=a+l+1}^n (1 + \delta)^{-(t-a-l)} B^j(t) \quad (1)$$

Where:

$\delta$  – Alternate cost of education (can be the rate of return to a lower level of education)

$t$  – The age of the individual when starting level  $j$  education, which takes  $l$  years to finish

$C^j(t)$  – Net cost of  $j$  level education

$B^j(t)$  – Net income advantage of the degree holder with  $j$  education over  $j-1$  education

$w^j(t)$  – Net annual earning with  $j$  level of education

$\tau(w^j(t))$  – Tax rate with  $j$  level of education

$g$  – Rate of economic growth

$S(t)$  – Money transfer after education

$R(t)$  – The student loan repayment

$\gamma^j(t)$  – Unemployment rate in the given cohort ( $j$  education,  $t$  age)

$\varphi^j(t)$  – Cost of  $j$  education

and:

$$C^j(t) = [1 - \tau(w^{j-1}(t))] [1 - \gamma^{j-1}(t)] w^{j-1}(t) (1 + g)^{t-a} + \varphi^j(t) (1 + g)^{t-a} - S(t)$$

$$B^j(t) = [1 - \tau(w^j(t))] [1 - \gamma^j(t)] w^j(t) (1 + g)^{t-a} -$$

$$- [1 - \tau(w^{j-1}(t))] [1 - \gamma^{j-1}(t)] w^{j-1}(t) (1 + g)^{t-a} - R(t)$$

The internal rate of return of such an equation<sup>4</sup> is called the rate of return to education. As can easily be seen this requires a huge amount of data. A large panel of data is needed for a long period of time and for different levels of education to take into account the foregone earnings.

The foregone earnings is the  $w^{j-1}$  value, the earnings that would have been earned without obtaining a given level of education. The usual benchmark is the average earnings with secondary school education. This kind of calculation is costly but more meaningful when it is calculated for a large proportion of the population. For example, what are the rates of return in the Hungarian education system? It becomes more difficult when we want to calculate what

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<sup>4</sup> The  $\delta$  value that makes equation (1) zero.

kind of return people should expect, if they completed, for instance, their MSc degree in a 6 semester economics program in 2007. Another methodology is based on the Mincer income equation which will be considered in the Results chapter of the paper.

It is also important to take from equation (1) the fact that the rate of return is sensitive to how the costs are dispersed over time. Student loans can help to postpone some costs to the period when the benefits are realized. It is a commonly accepted fact that higher education financing is one of the economic markets where government is right to intervene. One of the reasons is that human capital cannot be a basis for a mortgage. The bearer and the human capital itself cannot be separated, so if a default occurs the bank cannot take it away and sell it. Because of this there would be a lack of financial support for those people who would want to study, and so government should step in as a financier or a guarantor (Stiglitz 2000). Setting up a state-financed or stated-guaranteed student lending mechanism is one possible way, among many, for the government to help people to obtain degrees, and has positive external effects for the whole of society and can be a motor behind economic growth. In fact, aiding human capital investment has a positive social rate of return, because of the progressive taxation<sup>5</sup> system (T. Kiss, 2010), but the social rate of return and public investment in a general sense is not the topic of this paper.

The possibility to take out a loan for human capital investment is very important when we are discussing the topic of risk. It makes it possible to make investments today that might not be justified by a future income advantage. Human capital cannot serve as a mortgage, so in any case of default the lender cannot be compensated. So with student lending a standard annuity loan can be unfortunate, because in low income periods it can trigger a default<sup>6</sup> and the lender will be left with a huge outstanding sum. If this occurs en masse then the student loan company has to default as well. A risk management option can be to set the lending scheme to be income-contingent. These type of loans are not like mortgages where repayment is unconnected to the income of the borrower. With an income contingent loan the borrowers pay a given share of their income (Chapman, 2006; Berlinger 2009). Theoretically, in this case high losses can be deterred, because there are no periods in life when the student loan repayment is a very high proportion of the income, or must be paid when the borrower is unemployed. The Hungarian student loan system is exactly like this, and the amount of payment is calculated from the level of income two years prior to the date the payments are due.

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<sup>5</sup>This is also represented in equation (1)

<sup>6</sup>Bear in mind that the debtor also knows that nothing can be taken away from him or her.

However it must be seen that serious and problematic over-investment will at some point cause financial turbulence under both financial schemes.

This section has summarised what must be considered when searching for risk factors. We must take into account those costs of education that can be immediate and postponed. The postponed costs are the greater risk factors, because they are financed by future income which is not guaranteed. If the student loan system defaults because of the high level of individual defaults it can affect the higher education system itself. The current level of student numbers could not be financed<sup>7</sup> by the students alone, and universities would be in need of a bail out, the burden of which might fall on the government.

A modern financial market practice is securitization. Various articles (Nasser – Norman 2011) and scientific papers (Gillen 2008) have pointed out that even student loans were part of the securitization process. Securitization played a major role in creating the incentives behind the housing and financial bubble in the middle of the last decade. Securitization, in a nutshell, means that a bank issues derivatives based on their outstanding loans through financial intermediaries. The value of the derivatives usually derives from packages of loans. The value and risk of these derivatives decreased rapidly when investors realized that subprime loans were heavily represented in these seemingly low risk, high return portfolios (Király et al 2008).

Student loans were and are part of this ongoing process. The process itself is beneficial for every participant. Securitization can allow more lending to students and less risk for the lender, for example American tax-payer citizens, as this process allocates the risk to those who are willing to take the risk of a portfolio which includes student loans. This statement holds as long as student loans do not become garbage loans that default in most occasions without any mortgage asset to be taken. And this can indeed be the case; Macchiarola – Abraham (2010), for example, showed that even degrees that traditionally offered safe returns – like degrees in law – have lost this feature in the new economy.<sup>8</sup> If these student loans turn out to be garbage loans and most of them default then this can seriously decrease the trust in these derivatives. These derivatives can multiply the size of a market, because a basic asset can be the underlying asset of several derivatives or be the beginning of a chain of derivative

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<sup>7</sup>It is only a problem when the higher education financing system is highly reliant on private investment through tuition fees.

<sup>8</sup>While mentioning this trend we should not forget the expansion of education. More colleges and universities appeared, offering the same qualifications but not necessarily the same quality (See for example Guri-Rosenblit et al 2007 on massification of education).

deals (Gillen 2008). The student loan market exhibits most of the symptoms of a bubble (Macchiarola – Abraham 2010).

This argument is only valid if it is impossible to bail out student lenders or even the debtors. In the case of the housing market it was impossible to bail out every failed loan, and it was also impossible to bail out every bank to keep the derivatives valuable.<sup>9</sup> But if student lenders remain creditworthy in spite of student loan defaults the derivatives will keep their value.

A more worrying case can occur if the government is not flexible in bailing out. A turning point in the 2008 financial crisis occurred when Lehman Brothers was allowed to go bankrupt (Fernando et al 2012). If government action is limited then the borrowers' financial rationality plays a crucial role. Hungary is a good example of this. In Hungary fee-paying higher education is relatively new, and the system of education programs went through a dramatic change (Haug-Tausch 2001, Sursock-Smidt 2010). Financial responsibility might be ignored in such a confusing time.

Based on the literature the following hypothesises will be examined:

Hypothesis 1: There is an economically developed country where private investment in higher education is large enough compared to factors which cause regular macro cycles, such as financial market value or government spending.

Hypothesis 2: There is a country where the student loan debt market (postponed costs of investment) is comparable to housing debt, which we know can cause a crisis.

Hypothesis 3: There is a reason to think that the behaviour of average individuals when borrowing for education is not financially reasonable.

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<sup>9</sup>Serious moral hazard issues can be discussed here, as well.



## Data and Methodology

The first two hypothesis will be examined through the analysis of openly available databases. Eurostat and OECD databases, along with Worldbank and Eurostat, offer publicly available aggregate data. OECD's Education at a Glance is the largest dataset that allows international comparison. The necessary comparison(s) will be made.

The third question in the last section is more complicated. As was mentioned, calculating NPV for large investor groups is more feasible. A very detailed example is available in Avery-Turner (2012). They point out that in spite of the growing costs and indebtedness, choosing higher education is still a rational and rewarding investment for most; however, they point out it is not universal and there are people who lose out.

However it might not be surprising that US investors are more or less financially consequent about their investment in education. As we will see in the empirical section, the US education system is one of those that demand the most private investment. Their tuition fees are high compared to the European education systems.

However, there are countries where the education system is in turbulent change, data availability is limited and the initial financial investment is low. Hungary is a prime example of this. During the 2000-2010 period the traditional 4 year college and 5 year university system was partially replaced by a 3 stage BSc-MSc-PhD system, which was supplemented by 2-year vocational training. This was called the Bologna process (Haug-Tausch 2001, Sursock-Smidt 2010). The Hungarian Higher education system offers full time training and part time training as well. The education programs are available in state-funded form; however, if one studies for a second degree at a given level or cannot reach the minimum entry criteria<sup>10</sup> then one can participate in the same education programs making a cost contribution or paying a tuition fee<sup>11</sup>. Even when a full cost contribution is necessary it is mostly around 500-1000 EUR per semester (Stéger-Szövényi (ed.) 2013). Most recently, 77% percent of students taken on by the system have been in state-funded programs.<sup>12</sup> Those who apply for higher education can choose a wide variety of education programs, from 2 year programs to even 6 year programs. Many of these programs are fairly new and were introduced by the Bologna-process. Most of the applicants have access to state-financed

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<sup>10</sup>This is based on the applicants' secondary school performance, final exam grades, and in some cases entry exams taken for the higher education institute.

<sup>11</sup>Even these education programs have minimum entry criteria, but these are lower than state-financed programs.

<sup>12</sup>[http://www.felvi.hu/felveteli/ponthatarok\\_rangsorok/friss\\_statistikak/!FrissStatistikak/friss\\_statistikak.php?stat=1](http://www.felvi.hu/felveteli/ponthatarok_rangsorok/friss_statistikak/!FrissStatistikak/friss_statistikak.php?stat=1)

programs. It is very difficult to make decisions in this environment because of the lack of information about the market value of these new types of degrees. Financial rationality is the least expected in such an environment.

For our purposes, Christiansen et al (2006) can be a very useful methodological guide. They used financial economic techniques to better understand the risk-return trade off. They used a standard mean-variance analysis, very similar to the analysis of the fundamental problems of finance.

The original analysis was for risky security investments like shares, bonds or derivatives. They assumed that the available investment possibilities are different kinds of education degrees. The Markowitz theory assumes rational investors invest in efficient portfolios. A portfolio of investments is efficient if it offers the least risk for a given level of return or the most return on a given level of risk. A set of portfolios fulfils these two requirements at the same time. This set is called the efficient frontier. The efficient frontier is part of a parabola in a mean-variance space, but it is more common to graph it in the mean-standard deviation space, where the frontier is a hyperbola (Merton 1972). It is illustrated on Graph 1.

Nowadays this is included in almost every financial textbook. Merton (1972) derived Equation (2) for the efficient frontier<sup>13</sup>.

$$\sigma^2 = \beta_0 + \beta_1 E^2 - \beta_2 E \quad (2)$$

Where:

$\sigma^2$  – Variance of the portfolio return

$E$  – Expected return of the portfolio.

Graph 1 shows the image of the efficient frontier in the mean-variance space. The bold part of the line represents the efficient portfolios. Portfolios outside the line cannot be realized and portfolios within the line are not mean-variance optimal. The non-optimal part of the frontier offers minimum variance for a given level of return, but not the maximum return for the given level of risk.

Christiansen et al (2006) suggest considering an education program as a portfolio of human capital investments. Different education programs offer different enhancements of skills and knowledge. The assumption is that a human capital investor would prefer one education

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<sup>13</sup> You can also find this in the Hungarian literature in Gáll József – Pap Gyula (2010).

program over another if it offers the highest return on a given risk level or the lowest risk on a given return level<sup>14</sup>.

Christiansen et al (2006) finds that some types of higher education degree fit this model, but there are some that do not fit. Some programs, for instance humanities, arts or nursing, do not offer a higher return for more variance, but there are still people who hold these degrees and choose these professions. These programs are not on the efficient frontier but within it. Even the authors point out that some assumptions of the original model probably do not hold for the higher education market. The basic assumption of the theory is that students choose their profession based on risk-return reasoning. This is more likely to be true for securities, but for professions it is not that likely.

We will make a similar examination of a data sample from the Student Loan Centre of Hungary. This is not a public database, but no data was provided to me or any of my colleagues that has any reference to the borrowers' identities. Neither do my results have any relation to the business policy or profitability of the Student Loan Centre.

The data sample is for yearly annual gross real income from 2008 to 2012.<sup>15</sup> The Hungarian student loan scheme is income contingent. They receive income data in order to calculate the necessary payment<sup>16</sup>. The payment can be 6% or 8% of the income two years prior to the due date of the payment. The first two years payment is based on the minimum-wage.

Individuals entered the sample if they had recorded income for any of the years in the indicated time period. The focus of the examination is education programs. Those programs were selected where at least 30 individuals' income was recorded for the whole time period. Only state financed and full time education programs were evaluated. Those who participated in more than one type of education program were excluded, as well as those who had no reported income<sup>17</sup>. The equal costs assumption does not apply for those who participated in several different ISCED coded programs. The final sample contained data for 20,146 individuals in 46,229 observations for 34 education programs. The data for the education programs are available in Table 2 of the supplement. To conclude this section, the questions imposed by the literature will be answered by the following way:

- The country with the largest private investment in education will be found.

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<sup>14</sup>The financial portfolio theory asks what the optimal investment is if we have a given budget X. X is completely devoted to risky investment. If we apply this theory to education programs we must assume that every education program requires that we invest the same budget. This issue will be discussed in a later part of the paper.

<sup>15</sup>The price indices of KSH (2014) were used for real income calculations. The previous year is 100. Year/Price Index: 2009/104,2; 2010/104,9; 2011/103,9; 2012/105,7

<sup>16</sup>Their data is from the Hungarian Tax Authority

<sup>17</sup>See Supplement 4 for more on the decision to exclude observations with 0 income

- Its investment will be compared to other macroeconomic factors. If they are found to be relatively small, then Hypotheses 1 and 2 will be rejected.
- We fit Equation 2 to a Hungarian dataset. If the model has strong explanatory power then Hypothesis 3 will be rejected.

## Empirical results

First we look for countries where private investment in higher education can be a major macroeconomic factor. These countries should have a high investment in higher education and a large private investment as well. The first factor – high investment – is indicated in this paper by total spending on tertiary education per student. The second factor – private investment – is indicated by household spending, which is calculated from the ratio of household spending to total spending and the total spending value itself. In a country where higher education can be a risk factor many people should have invested in higher education. In Graph 2 the population with a tertiary level of education measures this. The 25-34 year old cohort is represented, because it is the closest to the micro sample that will be discussed later<sup>18</sup>, and because they might be the most interesting cohort in terms of future economic tendencies. Those countries are highlighted where total investment per student is high, as well as private investment, and a large portion of the population is involved in higher education.

The USA stands out as the largest circle with around 11,000 dollars spent per student from the household budget annually. Japan and the UK follow. Canada can be a major market if we look at total spending, but private spending is not that high. Tuition fees in Canada are lower. Canada and Korea are also taken for further examination based on the extensive involvement of the population. In Japan, Canada and Korea more than 50% of the age cohort obtain some kind of degree from the tertiary education. If we consider the other countries<sup>20</sup> it can be noted that education expenditure can be high but does not depend on household investment.<sup>21</sup> For the average citizen in most of the OECD countries, choosing higher education has no greater financial risk than buying a new TV or a notebook computer. Data for the countries are available in Supplement 1.

With Graph 2 we can identify mainly the United States, Canada, United Kingdom, Australia, Japan and Korea as the countries where private financing can be a major economic factor. To decide whether it is or not, the total tertiary education spending (both private and public together) should be compared to the size of various major factors such as total government spending, total government debt, total household debt and the size of the stock market.

Graph 3 shows that the total spending – private and public as well – are so small compared to major economic factors such as government and household indebtedness, government social

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<sup>18</sup>See Supplement 3

<sup>20</sup>Unnamed grey circles

<sup>21</sup>Chile is an interesting exception, but in Chile the total spending is much lower.

spending or the size of the stock market companies that it is condensed almost to a dot in the middle of the graph. The total spending on higher education is between 1 and 2.5% of the annual product whereas the social spending is around 20%, the stock market size is around 100% with large differences, and the debt statistics are even larger<sup>22</sup>. If we made an intertemporal comparison, we would find that a regular variance, for example in government debt, can cover the whole of higher education spending. This shows that in extreme cases the government has the ability to intervene in a smaller market such as higher education or the student loan debt market with a regular government bond issue.

In Graph 2 the United States stands out as the country with the largest higher education market. However, if we compare the compiled student loan with the total household debt we see that the share of student loans in the total level of debt has risen from 1% to 9% during the last decade, but it is still small compared to mortgage loans. When the total student loan debt hit the 1 trillion dollar mark in the United States there was intense debate in the press over whether student loan will be the next financial bubble, as was mentioned earlier. However, when we look at Graph 3 then it can be seen that even in the United States, where the tuition fees are the highest and the student lending has the longest tradition, only 9% of household debt is made up of student loans.

These loans are mostly federal loans, as can be seen on Graph 5. In the 2012-2013 educational year 110 billion dollars were lent, but only 8% of this was non-federal. Non-federal loans are not necessarily private loans; they include loans to students from US states and from institutions, in addition to private loans issued by banks, credit unions, and Sallie Mae (CollegeBoard, 2013). The main income of the state is not the repayment and the interest on these loans. The mortgage outstanding is in the balance sheet of private companies such as commercial and investment banks. The current tendency would have to continue for at least 2 decades (i.e. student loans should reach 30%) to become a major macroeconomic risk factor. So we can conclude that the student loan market and higher education spending are small in comparison with the markets that economic analysts pay most attention to when trying to assess the possibility of an economic downturn.

Based on Graph 2 and Graph 3 we can reject Hypothesis 1 and 2. The next task is to evaluate Hypothesis 3 by testing Equation 2.

The first step is to fit Equation 2 to the data, but a return measure must be defined. Christiansen et al (2006) will be followed. Two types of return will be calculated: raw

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<sup>22</sup>Although we compare here various stock and flow variables, again we emphasise this to show the size differences, which is the real purpose behind the comparison.

logarithmic income and Mincer residuals. The first is calculated by Equation 3. The expected row logarithmic income of an education group is the average of the time average of the individual income. This means we evaluate a high salary as the return to education.

$$R_j = \frac{1}{n_j} \sum_{i=1}^{n_j} \frac{1}{n_i} \sum_{t=1}^{n_i} \ln W_{ijt} \quad (3)$$

$R_j$  – Expected return (row logarithmic income) for the education group  $j$

$n_j$  – Number of individuals in education group  $j$

$n_i$  – Number of observations for an individual  $i$

$W_{ijt}$  – Annual income for individual  $i$  in education group  $j$  in year  $t$ .

It can be argued that raw logarithmic income is not the actual rate of return because costs and foregone earnings are not represented. As was mentioned earlier the education programs are state-financed, so the tuition fee does not vary by education group. If equal living and travelling costs and the same foregone earnings for different education groups are assumed, then the only variable dependent on the education group in the rate of return calculation is the income<sup>23</sup>. It should also be assumed that income differences between the professions are more or less constant over time, or that the investors do not have better predictions than this assumption. It is essential to assume equal costs because the portfolio theory we are building upon asks how the budget  $X$  should be spent.

The second type of return we will calculate is the Mincer residuals, but first the Mincer equation should be introduced. As was expressed in the literature review chapter the rate of return calculation is very data hungry. Mincer (1958) introduced a very simple approach for the rate of return to education. The so called Mincer equation can be expressed in the form of Equation 4.

$$\ln W_i = \beta_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 \quad (4)$$

$s_i$  – Years of schooling for individual  $i$

$x_i$  – Experience of individual  $i$

It can be shown that, if certain conditions are met, the coefficient of schooling ( $\beta_1$ ) in the Mincer-equation (Eq. 4) is the rate of return to education (Hackman et al, 2005). The second return measure will be the expected residual of the Mincer equation for an education group. The individual Mincer residual is defined in Equation 5.

$$\varepsilon_{ijt} = \ln W_{ijt} - (\hat{\beta}_0 + \hat{\beta}_1 s_i + \hat{\beta}_2 x_i + \hat{\beta}_3 x_i^2) \quad (5)$$

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<sup>23</sup> In this paper there will be no emphasis on whether the industry the individual is working in is the same as the one she studied for. Job-matching is an existing dilemma, but we have no data to examine such a question.

$\varepsilon_{ijt}$  – Mincer residual

The Mincer residual can be understood as a redefinition of foregone earnings because it compares the earnings to the expected earnings with the same years of schooling. It asks whether the individual with a given education can earn more than what is expected purely on her years of education and experience. A Mincer residual for education group  $j$  can be obtained by substituting  $\varepsilon_{ijt}$  in Equation 3 in the place of  $\ln W_{ijt}$ .

Risk will be measured by the average standard deviation for an education group for both return measures. This is formulated by Equation 6

$$\sigma_j = \frac{1}{n_j} \sum_{i=1}^{n_j} \frac{1}{n_i - 1} \sqrt{\sum_{t=1}^{n_i} (\ln W_{ijt} - \ln W_{ij})^2} \quad (6)$$

Where:

$\ln W_{ij}$  – Expected logarithmic income for individual  $i$  in education group  $j$

$\sigma_j$  – Standard deviation of return for education group  $j$

Similarly to Equation 6, the standard deviation of the Mincer residual can be defined by substituting  $\varepsilon_{ijt}$  into Equation 6 in the place of  $\ln W_{ijt}$  and  $\varepsilon_{ij}$  in the place of  $\ln W_{ij}$ .  $\varepsilon_{ij}$  is the expected Mincer residual of the individual  $i$ .

Graph 6 shows the 34 educational groups in the mean-variance space, where the raw logarithmic income is the return and its standard deviation is indicated on the horizontal axis.

If we examine the scatterplot in more detail the hyperbolic shape indicated by the theory can be seen. It can be noticed that MSc Social Sciences and Law and MSc Engineering<sup>24</sup> offer the highest return. It is also notable that MSc programs appear to stand out. Traditional college (TC) and some BSc studies, such as Humanities and Art<sup>25</sup> are more mixed around the top of the hyperbola. Vocational training courses<sup>26</sup> (VT) lie along a part of the frontier that is not optimal according to the theory because higher return-less risk combinations can be found. They are optimal only according to one criteria, by offering the minimum of risk for the given level of return. The opinion of the author is that there can be several explanations for this.

There can be some kind of human capital or financial barrier that does not allow individuals to choose longer education programs with favourable risk-return combinations. For instance, MSc Health is one of the best combinations in a risk-return sense. The theory would claim that people must prefer MSc Health over BSc Health or VT in Health Sciences. However the fact is that these programs exist, so this might suggest that, for example, somebody who

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<sup>24</sup>ISCED code 3 and 5 with 17 years of total education

<sup>25</sup>ISCED code 2 with 15 years of total education

<sup>26</sup>14 years of total education



studies to be a nurse does not have the human capital requirements to be a surgeon<sup>27</sup>. Another possibility is that foregone earnings might cause different levels of stress for different individuals. For example, someone might not be able to choose to stay out of the labour market for the extended time that a BSc+MSc combination demands, even if it is financially feasible by taking out a student loan.<sup>28</sup>

Another possible explanation is that most of these training courses are not the complete education investment people are planning to make, but simply the entry level for a higher level education. For instance, someone who does a BSc in Engineering is very likely to return for an MSc after a few years of work. Some of this theory would be testable by a thorough examination of the more interesting cases through primary data collection.

As can be seen in Table 1, which contains the results appropriate for Equation 2, the coefficients are significant on all usual significance levels, moreover the sign of the coefficients are those that Equation 2 predicted. The  $R^2$  statistic is quite high at 0.795. Most of the variance can be explained by the model. Table 1 suggests that the education programs fit to a model that is based on rational risk-minimalizing behaviour. For some reason, some of the education programs are non-optimal, because higher returns can be reached through longer education programs with the same level of risk. As was mentioned previously, there may be various non-financial barriers for some investors. Compared to the results of Christiansen et al (2006) they found more education programs that seemingly do not fit to the model. Some of their findings are inside the efficient frontier.

We introduced Mincer residuals as well<sup>29</sup>. If the same analysis is made, the education programs can be visualized in Graph 7.

Graph 7 offers the interesting suggestion that those who finished higher education after a Vocational training course tend to underperform compared to the Mincer-model prediction. BSc programs are spread widely, and MSc and Traditional 4 year college programs are concentrated more narrowly around the 0 line. This seems to suggest that the Mincer predictions might be better for longer education programs. This might be a convincing argument if we assume that education needs an extended period to make an impact on future productivity.<sup>30</sup>

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<sup>27</sup>If the sample included secondary education grades or IQ test results, then this theory would be testable.

<sup>28</sup>This theory would be testable if family income background were available

<sup>29</sup>The results for the Mincer-model are in the supplement

<sup>30</sup>Or it might suggest some kind of counter-signalling behaviour, but this would lead us away from the human capital theory. For more on counter-signalling see Feltoovich et al. (2001).

Table 2 summarizes the results used to fit Equation 2 to the data of Graph 2. The P-values suggest that the coefficients of the Mincer residual are not significant on the usual significance levels, but the squared residual is significant at 1% and the  $R^2$  is 52.6%, so the model should not be rejected; however, this model does not fit as well as the previous one.

The worse performance of the Mincer residual was observed by Christiansen et al (2006), as well. This may suggest that individual earnings and their security play a greater role in the choice of education than the comparative wage advantage over those who have the same level of education. We must also note that the Mincer model does not fit our data very well<sup>31</sup>. If it were possible to include more information on, for instance, family background, this might prove the explanatory power of Mincer-residual based model, as well. So the weak explanatory power of this model might be caused by a wrong prediction of the benchmark for wage advantage.

The connection between risk and return suggested by Graph 6 and Table 1 makes an interesting addition to the argument set out in Anderberg – Andersson (2003); da Costa – Maestri (2007); Anderberg (2009) and Jacobs et al (2009). It implies that education has an insurance effect up to a point. This is the minimum point of the mean-variance parabola estimated in Table 1. However, we should not immediately call for subsidization, because the lack of finance is not necessarily the reason behind non-optimal investment, as it was suggested earlier.

In this section we found some candidates for places where a drastic change in private spending on higher education or repayments of student loans can threaten the macroeconomic balance. It was shown that even in the United States student loan debt is not nearly as significant as mortgage loans. Student loans are on the state balance sheet, not on that of private companies. A sudden stop in the flow of private investment does not threaten the financing of higher education, because the state plays a major role in this as well.

Some can argue that there are places where the government might not be powerful enough even to react to a smaller crisis in student lending and higher education financing. We have provided evidence that even in Hungary, where a lot of students participate in state-funded programs, those who borrowed money for education in a complex and dynamically changing environment were still rational. The typical patterns of a financially rational choice of education programs can be found.

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<sup>31</sup>See Supplement 2

The combination of a relatively small market and financially rational behaviour suggest that the risk of macroeconomic crisis caused by a student loan market bubble is quiet small.

## Conclusion

This paper tested three hypotheses introduced after a short literature review. It was stated that 1) there is an economically developed country where private investment in higher education is large enough compared to factors which cause regular macro cycles such as financial market value or government spending; 2) there is a country where the student loan debt market (the postponed costs of investment) is comparable to housing debt, which we know can cause a crisis; and 3) there is a reason to think that the behaviour of the average individual who borrows for education is not financially reasonable. First the education investment data of the OECD was examined and there were 6 countries which stood out where private investment in education plays major role, and higher education expenditure is high in global comparison. These are the United States, the United Kingdom, Canada, Australia, Japan and Korea. Based on Worldbank data, none of the above mentioned countries spends so much on higher education that it can be compared to the size of the financial market, or international debt markets. When different categories of the indebtedness of US households were compared it was found that student loan debt only accounts for 9% of the total indebtedness, and this is small compared to mortgage loans. This debt is owed to the central budget of the United States, as only 8% of the loans are non-federal.

When financial rationality was examined, a Hungarian borrower sample was chosen, because the Hungarian higher education culture has less experience in student loan financing and there were many new type of programs, with little labour feedback at the time of decision making. The sample included student loan borrowers, who participated in state-funded, full-time education programs. During the analysis the methodology of Christiansen et al (2006) was used. Two types of return, and their variance as risk measures were examined. The risk-return trade-off predicted by the financial theory of portfolio investments could be traced back. Based on this result, we stated that financial rationality is true for human capital investors even in a dynamically changing environment. There were education programs that fitted at the non-optimal part of the efficient frontier. Various possible explanations were mentioned for these very interesting cases, and they can be interesting topics for further research. If there are short term education programs on the non-optimal part of the efficient frontier, more studies could act as an insurance, but after the minimal variance point education is a risky investment. Interestingly, in the argument set out in the literature review it might be possible that both sides are right.

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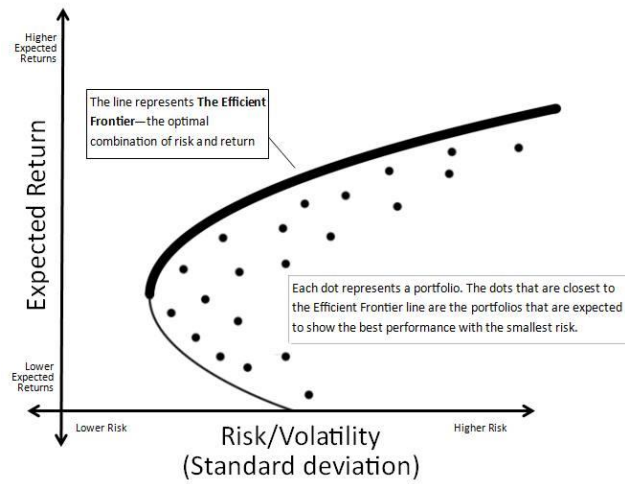
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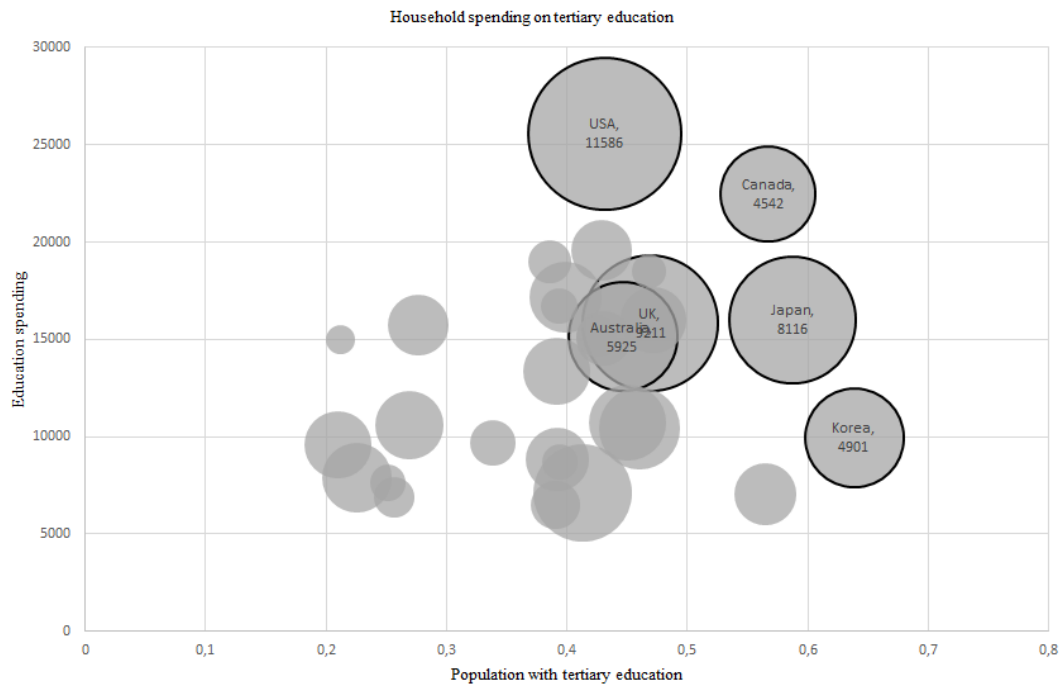
Tables and graphs

Graph 1: Efficient frontier



Source: Illustration

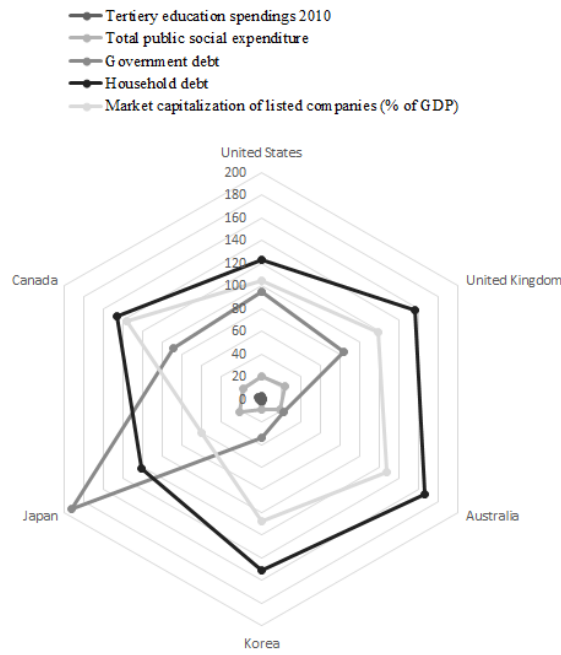
Graph 2: Population with a tertiary level of education, 25-34 years old, % in same age group (horizontal axis); Total spending on tertiary education, US dollars/student (vertical axis); Household spending on tertiary education, US dollars/student, calculated<sup>32</sup> (size)



Source: OECD, Education at Glance (2013)

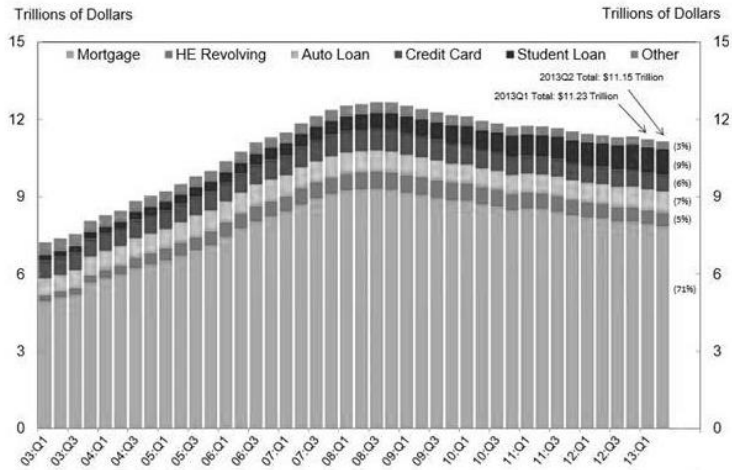
<sup>32</sup> Total spending multiplied by the ratio of household spending and total spending

Graph 3: Total government spending, total government debt, total household debt and the size of the stock market



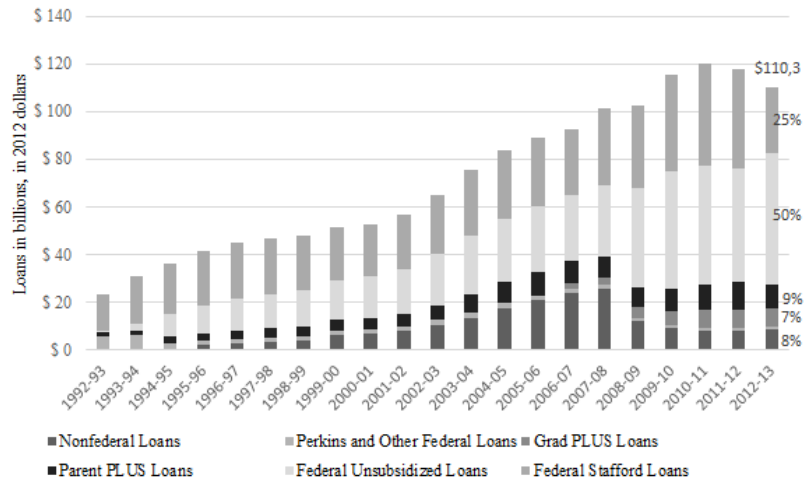
Source: Worldbank (2013), Eurostat (2013)

Graph 4: Debt balance of households of the United States, 2003-2013



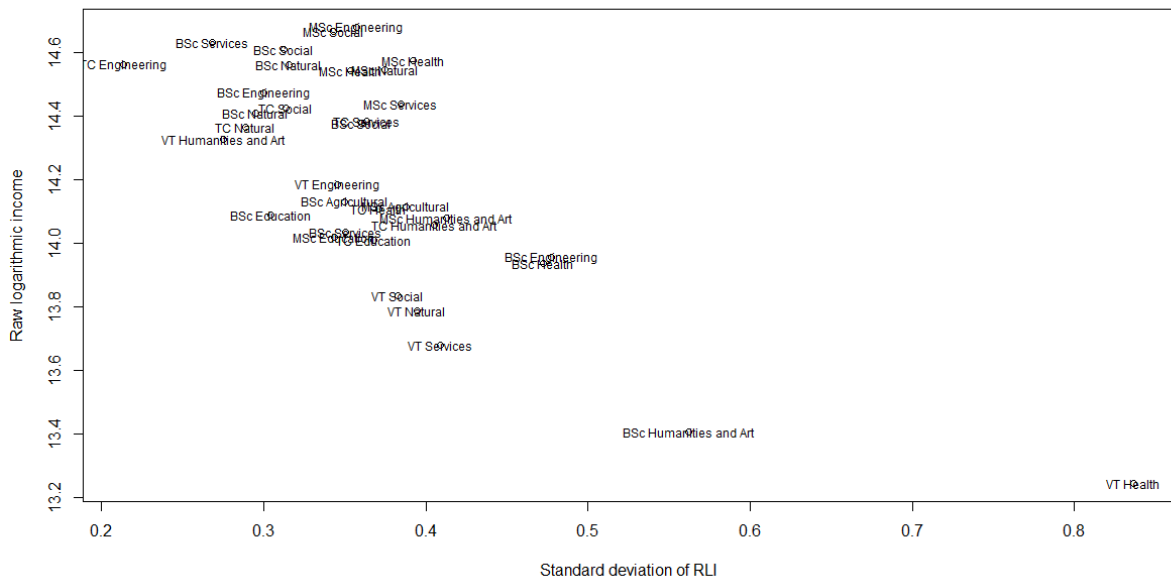
Source: nyfed.org (2013)

Graph 5: Growth of Federal and Non-federal Loan Dollars in 2012 Dollars, 1992-93 to 2012-13



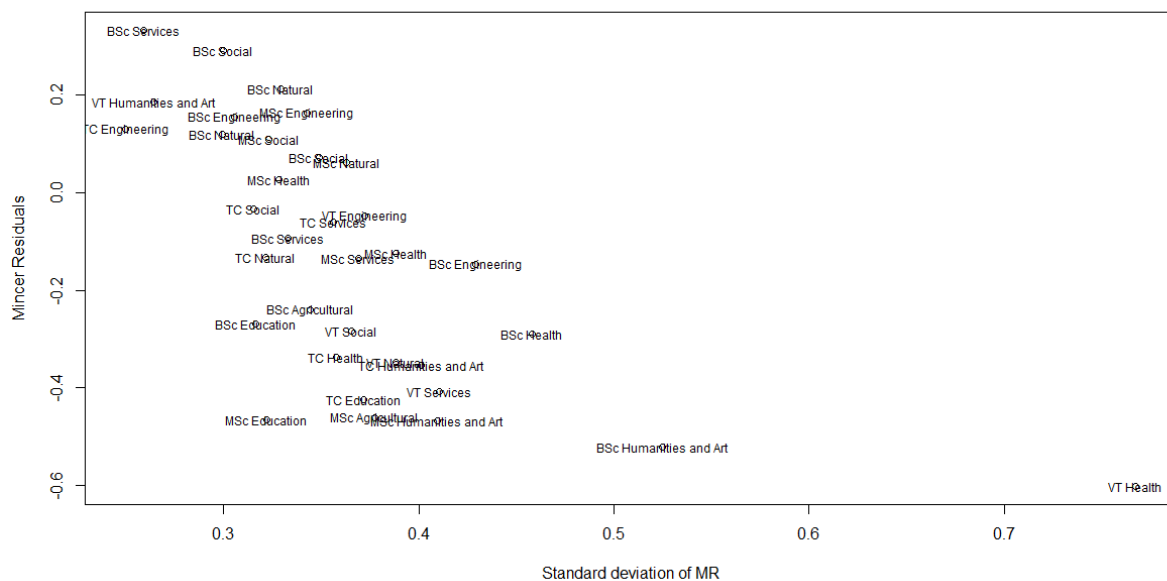
Source: CollegeBoard (2013)

Graph 6: Scatter-plot of Raw Logarithmic Income and its standard deviation



Source: Student Loan Centre Data

Graph 7: Scatter-plot of Mincer Residuals and their standard deviations



Source: Student Loan Centre Data

Table 1: Estimation of Equation 2

	Estimate	Std. Error	t value	P value
Intercept	77.91218	11.25213	6.924	9.13e-08
(Row Log Income) <sup>2</sup>	0.37754	0.05685	6.641	2.01e-07
Row Log Income	-10.84048	1.59992	-6.776	1.38e-07
R <sup>2</sup>	0.7908			
N	34			

Table 2: Estimation of Equation 2

	Estimate	Std. Error	t value	P value
Intercept	0.09218	0.01427	6.460	3.34e-07
(Mincer residual) <sup>2</sup>	0.52903	0.16469	3.212	0.00307
Mincer residual	-0.06042	0.06063	-0.997	0.32668
R <sup>2</sup>	0.5258			
N	34			

Supplement

Supplement 1: Data for Graph 3

	Population with tertiary education, 25-34 years old, % in same age group	Education spending, Tertiary, US dollars/student	Spending on tertiary education, Household, % of education spending
United States	0.4313	25575.89	11586
United Kingdom	0.4691	15862.3	9211
Japan	0.587	16014.84	8116
Australia	0.4461	15142	5925
Korea	0.6382	9971.53	4901
Chile	0.413	7100	4836
Canada	0.567	22475	4542
New Zealand	0.4604	10418.08	3343
Israel	0.4504	10729.74	2926
Netherlands	0.399	17161.34	2560
Mexico	0.2254	7872.39	2436
Portugal	0.269	10578.47	2358
Italy	0.2098	9579.76	2281
Spain	0.3915	13373.27	2244
Ireland	0.4719	16007.62	2207
Poland	0.392	8865.86	2019
Russian Federation	0.565	7039.31	1930
Germany	0.2767	15711	1854
Sweden	0.4286	19562.11	1839
France	0.4301	15067.12	1460
Estonia	0.3905	6500.85	1183
Slovenia	0.3381	9692.92	1043
Denmark	0.3858	18976.9	949
Belgium	0.4245	15178	832
Slovak Republic	0.2566	6903.67	805
Czech Republic	0.2513	7635	669
Finland	0.3937	16713.87	669
Iceland	0.3937	8727.82	641
Norway	0.468	18511.67	562
Austria	0.2116	15007	435

Supplement 2: Data for the Education programs

	EDUCATIONAL_GROUP	Raw Logarithmic Income	Standard Deviation of RLI	Mincer Residuals	Standard Deviation of MR	Number of Observations	Number of Persons	Length of education
1	VT Humanities and Art	14.33	0.28	0.20	0.28	74	36	14
2	VT Social	13.83	0.38	-0.28	0.37	1963	902	14
3	VT Natural	13.79	0.39	-0.34	0.39	277	127	14
4	VT Engineering	14.18	0.35	-0.04	0.37	146	61	14
5	VT Health	13.25	0.84	-0.63	0.76	90	42	14
6	VT Services	13.68	0.41	-0.41	0.42	867	405	14
7	BSc Education	14.09	0.30	-0.26	0.33	533	208	15
8	BSc Humanities and Art	13.41	0.56	-0.57	0.53	124	69	15
9	BSc Social	14.38	0.36	0.08	0.35	1817	746	15
10	BSc Natural	14.41	0.30	0.13	0.30	1653	712	15
11	BSc Engineering	14.47	0.30	0.17	0.31	3421	1455	15
12	BSc Agricultural	14.13	0.35	-0.22	0.34	432	177	15
13	BSc Health	13.94	0.47	-0.28	0.47	93	41	15
14	BSc Services	14.63	0.27	0.34	0.27	757	338	15
15	BSc Social	14.61	0.31	0.30	0.31	4750	2061	15.5
16	BSc Natural	14.56	0.32	0.22	0.33	577	233	15.5
17	BSc Engineering	13.96	0.48	-0.17	0.43	859	416	15.5
18	BSc Services	14.03	0.35	-0.13	0.34	196	100	15.5
19	TC Education	14.01	0.37	-0.41	0.38	3028	1309	16
20	TC Humanities and Art	14.06	0.41	-0.35	0.41	830	360	16
21	TC Social	14.42	0.31	-0.02	0.32	1323	577	16
22	TC Natural	14.36	0.29	-0.12	0.32	175	70	16
23	TC Engineering	14.56	0.21	0.14	0.26	181	90	16
24	TC Health	14.11	0.37	-0.33	0.36	1820	788	16
25	TC Services	14.38	0.36	-0.05	0.36	1518	659	16
26	MSc Education	14.02	0.34	-0.46	0.32	503	226	17
27	MSc Humanities and Art	14.08	0.41	-0.46	0.41	2376	1071	17
28	MSc Social	14.67	0.34	0.11	0.32	7218	3090	17
29	MSc Natural	14.55	0.37	0.06	0.37	2474	1102	17
30	MSc Engineering	14.68	0.36	0.17	0.35	3123	1346	17
31	MSc Agricultural	14.12	0.39	-0.45	0.38	764	330	17
32	MSc Health	14.54	0.35	0.03	0.33	579	262	17
33	MSc Services	14.44	0.38	-0.13	0.37	607	254	17
34	MSc Health	14.57	0.39	-0.12	0.39	1081	483	18

### Supplement 3: Summary of the Mincer-equation

The results for Equation 4 are presented in the following table. The coefficients are significant, but the explanatory power of the model is very weak. Experience is calculated from the beginning of the loan repayment. The average experience is 2.74 years, so subjects are from the 25-34 age cohort, which was used in the international comparison. This does not necessarily correspond to work experience, but this is the best approximation that can be made on the available dataset. It is worth pointing out that the rate of return is 13.6%, which is a very plausible result.

	Estimate	Std. Error	t value	P value
Intercept	11.656059	0.067222	173.40	<2e-16 ***
Years of schooling	0.136602	0.004146	32.94	<2e-16 ***
Experience	0.401274	0.007101	56.51	<2e-16 ***
(Experience) <sup>2</sup>	-0.046715	0.001115	-41.91	<2e-16 ***
R <sup>2</sup>	0.1009			
N	46229			

## Supplement 4

The Student Loan Centre receives its income information for the repayment calculations from the tax authority (Nemzeti Adó és Vámhivatal<sup>33</sup>). However, if an individual has not prepared a tax return, this means he or she has 0 taxable income in Hungary. Many of the clients of who pay back their loan belong in this category. In fact, 14.37% was the average 0 income ratio<sup>34</sup> among the 34 education groups. There can be several reasons for this phenomenon, including the following:

- The borrower is inactive and does not receive any financial assistance, but uses his savings for repayment
- The borrower is inactive and does not receive any financial assistance, but the family or relatives repay
- The borrower works abroad and does a tax return there
- The borrower has income but does not report it.

The reasons for inactivity can be several; for instance, an individual graduates, but starts the repayment, or waits for better job opportunities, and in some cases it can be that they do not work because they are unable to. Interestingly, as Table 3 suggests, there is a strong negative linear connection between the raw log income of the education group and the ratio of 0 income. This suggests that 0 income is more of a decision than a risk. The option value of education is a rich field in educational economics as well (Eide – Waehrer 1998). 0 income can be an unexercised option if it is not the product of foreign earnings. Working abroad is very popular among young graduates<sup>35</sup>. The correlation between years of education and the 0 income ratio is -0.18, which means they might be independent, but unemployment and the length of education usually shows a strong relationship. As Graph 8 suggests, there is no connection between the type of education and the 0 income ratio, except maybe that for ISCED type 2, i.e. humanities and arts, where it is higher than for ISCED type 3, i.e. social sciences and arts.

Based on the fact that 0 income does not necessarily mean unemployment or inactivity because of inability to work, it appears preferable to clear the sample from the 0 income data, because it might cause less distortion to leave out some unintentionally unemployed workers than to hugely overestimate the risk and underestimate the return by retaining a lot of the 0

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<sup>33</sup>National Tax and Customs Administration of Hungary (NTCA)

<sup>34</sup>The number of 0 income observations was compared to the total number of observations

<sup>35</sup>See for example the following article:

[http://eduline.hu/felnottkepzes/2014/2/7/A\\_BGFes\\_friss\\_diplomasok\\_harmada\\_tervez\\_kul\\_E18VDA](http://eduline.hu/felnottkepzes/2014/2/7/A_BGFes_friss_diplomasok_harmada_tervez_kul_E18VDA)



incomes of those who might have an income or still be studying. All the further calculations are for non-zero income individuals.

Table 5: Connection between Raw Logarithmic Income and the Ratio of 0 income

	Estimate	Std. Error	t value	P value
Intercept	1.80375	0.24337	7.412	1.97e-08
(Mincer residual) <sup>2</sup>	-0.11680	0.01712	-6.823	1.02e-07
R <sup>2</sup>	0.5258			
N	34			

Graph 8: Boxplot of the 0 income ratio by ISCED categories

