Is it smart to invest in the smart?

The influence of governmental investment in education on the poverty risk of lower educated relative to the poverty risk of better educated.

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Preface

Hereby I present my research that will continue as my master thesis. With this thesis I will finish my master and thereby my student years. I have started these years with Bachelor in Applied Mathematics and after that I prolonged my studentship by starting the master in Public Administration. This broad spawn of studies was, in my experience, very educational and interesting. The combination of a technical and a management study was in line with my interests and hopefully useful in the future.

When I look back at my student years I see it as a period where I have picked up a great deal of knowledge. This knowledge was obtained throughout my studies, extracurricular activities and the living on my own. Besides the learning experience, I had a large amount of freedom and fun. All of this was not possible without the emotional and financial support of my parents. Therefore, I am very grateful to them. Also, the financial support of my granddad was very helpful. With these words I want to thank them again.

Making and writing the master thesis was an experience where I have learned several things. It improved my methodology skills and it was a good way to apply the knowledge gained from the study. In the process of making the thesis I encountered several challenges. My thesis supervisors, Rense and Ariana, were very cooperative and were always ready to help me with tackling the problems. Their help was crucial for running the process smoothly. I am very thankful for their helpful assistance.

At last, I want to thank all those who helped me by improving my thesis or worked with me during other courses or assignments in my student years.

I hope you enjoy reading my thesis,

Mik Schous

Abstract

Lower educated have higher poverty risk than people that are not lower educated, called the better educated. Only the difference between the poverty risks of these two categories is not the same in every country. In this study the poverty risks of 23 different OECD-countries are compared and examined. The study shows that governmental investment in education can be of influence on the poverty risks and examines its effects. The results show that when more is invested the poverty risk of the entire population is declining. It is mostly the poverty risk of the lower educated that is decreasing when there is invested more in education. The poverty risks are closing in when there is more invested in education. Investment in tertiary education has a strong negative effect on the poverty risks, even when there is controlled for the nation's wealth. When there is more invested in tertiary education the poverty risks of both the better as the lower educated is declining. Also here the poverty risk of the lower educated is declining steeper, what leads that the poverty risks come closer to each other.

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List with Abbreviations

GDP	Gross Domestic Product
ISCED	International Standard Classification of Education
LIS	Luxembourg Income Study
OECD	Organization for Economic Co-operation and Development
UOE	UNESCO-OECD-Eurostat

Countries:

AT	Austria
BE	Belgium
CA	Canada
CZ	Czech Republic
DK	Denmark
FI	Finland
FR	France
DE	Germany
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IT	Italy
KR	South Korea
LU	Luxembourg
NL	The Netherlands
NO	Norway
PL	Poland
ES	Spain
SE	Sweden
CH	Switzerland
UK	United Kingdom
US	United States

Introduction

Lower educated individuals are more likely of becoming poor than individuals who are not lower educated (Gesthuizen et al. 2011; Salverda, Nolan and Smeeding, 2009; Kerckhoff et al, 2001). For example, in the Czech Republic the risk to be poor relative to the risk to not be poor for a lower educated person, have the odds 0.15 to 1 (see table 1). So for almost every 7 individuals who are low educated and not poor is their one low educated person who is poor. In the same country the better educated, people who are not low educated, have the odds of 0.036 to 1. This suggests that there is a large difference in poverty risks between the lower and better educated. When the same risk is calculated for Denmark, the odds are 0.067 to 1 for lower educated and 0.045 to 1 for better educated. So, in Denmark the poverty risks of the two educational categories are closer together.

Table 1 shows for 25 OECD-countries (Organization for Economic Co-operation and Development) the poverty risk of the total population, the poverty risk of the low educated and the poverty risk of the better educated. This table shows that in some countries (such as Denmark), the poverty risk of low and better educated people are rather similar, while in other countries (such as Israel) there are large differences between the poverty risk of low and better education. This difference in poverty risk between low and better educated is the empirical regularity I aim to explain in this study. I will do this in a country-comparative study of 25 industrialized countries. In other words: I aim to compare the differences in the risks to be poor between low and better educated.

Governments invest in education to increase the education degree in the country. In literature is shown that investment in education has a positive effect for example when there is looked at decreasing crime levels and improving health levels (Salverda et al., 2009). But does the governmental investment also influences the poverty risks of the better and lower educated and the difference between them? Therefore, I especially want to look at the relationship between the levels of governmental investment in education and the difference in relative risks between countries.

Research question

Research shows that at the individual level, there is a strong association between educational attainment and labor force outcomes, like occupational status and earnings. People with a higher education get significantly higher earnings (Kerckhof et al., 2012; Salverda et al., 2009). It has become evident that education has become more important for getting jobs and has a higher value in the labor markets of many countries (Salverda, Nolan and Smeeding, 2009). There is an inequality between lower and better educated people. Leading to that better educated have a lower poverty risk than lower educated. This result is to be found back in the data of table 1. The difference in poverty risk in a country between the low educated and the better educated is in this the rest of this thesis called the 'relative poverty risk'.

This relative poverty risk is, like mentioned above, not the same in every country. The first goal of this thesis is to identify how large the differences in poverty risks are between the countries. So the first descriptive research question is:

Which differences between OECD-countries exist in the poverty risk of the lower educated relative to the better educated?

Table 1: the poverty risks expressed in odds of being poor to not poor in 25 OECD countries.

Country	Poverty risk Total population	Poverty risk low educated	Poverty risk better educated
Austria	0.067	0.144	0.052
Belgium	0.060	0.092	0.049
Canada	0.144	0.303	0.125
Czech Republic	0.090	0.148	0.036
Denmark	0.050	0.067	0.045
Finland	0.048	0.101	0.039
France	0.082	0.161	0.052
Germany	0.073	0.182	0.060
Greece	0.134	0.234	0.085
Hungary	0.092	0.212	0.066
Ireland	0.142	0.287	0.072
Israel	0.224	0.565	0.149
Italy	0.165	0.283	0.074
South Korea	0.116	0.230	0.099
Luxembourg	0.101	0.198	0.045
Mexico	0.217	0.293	0.035
Netherlands	0.075	0.105	0.066
Norway	0.050	0.085	0.047
Poland	0.134	0.339	0.106
Spain	0.162	0.248	0.098
Sweden	0.052	0.104	0.045
Switzerland	0.073	0.129	0.065
United Kingdom	0.131	0.264	0.094
United States	0.180	0.656	0.129

Source: Authors Calculations, data collected form Luxembourg Income Study. Lower educated means ISCED of 0-2. Better educated is ISCED of 3-7. How these odds are calculated is mentioned later in the thesis.

The results of this question are shown in table 1, how these risks are calculated will be discussed later. For this analyze not all countries are considered, but only the OECD-countries. The OECD is an organization of thirty-four countries. It is a forum of countries committed to democracy and the free-market economy, providing a platform to easily compare policy experiences, seek answers to common problems, identify good practices, and co-ordinate domestic and international policies of its members (OECD, 2013). The OECD has collected a great deal of data about the countries and this data is easily accessible. Moreover, the OECD countries are largely comparable because they are the same in terms of economic progress, form of government, market and market economy. These countries are for this reason included in the analysis. Making it better possible for finding a cause for this difference between countries. In this thesis the governmental investment in education will be considered as possible cause.

Governments invest in education to support individuals for getting a better market position (Glewwe, 1991). Governments can invest in different types of ways: they can transfer money to educational institutions or give monetary transfers to students or households. The investments in education are designed to raise rates of return to schooling by raising school quality en they will lower the financial threshold for individuals to study longer and get a higher degree. Government investments in education will increase the average education degree of the society. Research has shown that

government investment in education increases overall educational levels (Psacharopoulos, 1994). However, the study does not answer the question whether everybody benefits to the same extent of this investment? In this research I want to examine to what extent governmental investment in education influences the poverty risk of the better and the lower educated and the relative poverty risk. By comparing the relative poverty risk within OECD countries I aim to observe what the relationship is between the total volume of the governmental investment and the relative poverty risk. So the explanatory research question will be:

To what extent can variation between OECD-countries in poverty risk of the low educated relative to the better educated be explained by the volume of the governmental investment in education?

Studying the poverty risk and answering this question is highly important: from an academic perspective, for the perspective of the policy makers and socially (Salverda, Nolan and Smeeding, 2009). If there is a difference in the poverty risk between countries, there will be probably several factors that influence the poverty risk and policy can be one them. Policy makers are interested in how *policies* affect educational opportunities and how their policies affect the inequality in their country. By answering this question there will be more known about the consequences of policy.

Concluding, Figure 1 shows schematic what will be analyzed in this thesis. First we look at the risk of lower educated individuals to become poor and compare these with the risks of the better educated to become poor. In this thesis I make an analytical distinction between poverty risk and relative poverty risk. *Poverty risk* is the risk that the category of low educated or the category of better educated is poor. *Relative poverty risk* is the poverty risk of the lower educated relative to the poverty risk of the better educated. By comparing these relative poverty risks of the OECD-countries, and observing to what extent they vary with policies, I can answer the question to what extent governmental investments in education affect the relationship between education and the risk of poverty.

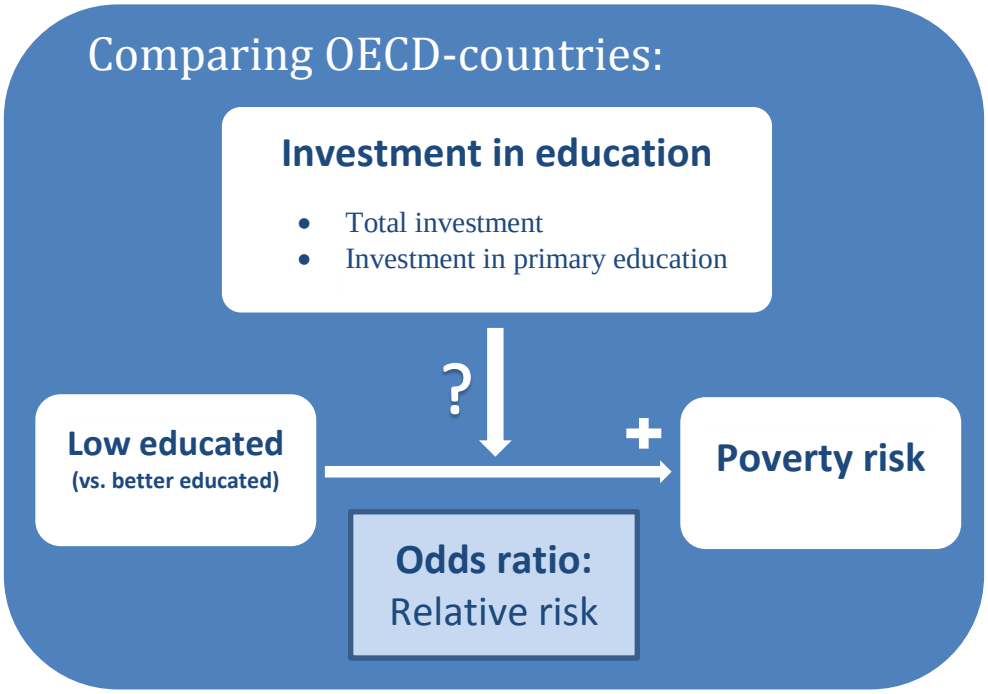


Figure 1: schematic overview of research question

Theory

In this chapter I will give a theoretical framework and formulate hypotheses that will be tested to answer the research question. In this chapter I will refer to theories that explain what will happen with the percentage better educated within a country when there is more government investment in education and how this increased ratio of better educated will influence the relative poverty risk. In this research I will analyze which of these theories and hypotheses best explain the differences in the relative poverty risk of the OECD-countries.

Like mentioned before Investments in education can lower the financial threshold for individuals to study longer and help them to get a higher degree. If there is more spend on education, it is for a larger group of children possible to go to secondary or higher education. A larger public investment will thus make higher education accessible for a larger number of people. The investment can help in increasing the average educational level of a society (Glewwe, 1991). So when a country invests more in education, the group of the lower educated decreases in size and the group of better educated thereby increases. It is the expectation that this is also visible when comparing the countries. The more a country invests, the larger the group of better educated is and the smaller the group of lower educated is.

A larger category of better educated does not in itself mean that there will be a change in the relative poverty risk. In the rest of the chapter some theories are summarized that will predict how the governmental investment in education, and thereby the category sizes, affect the poverty risks of the lower and better educated and thereby the relative poverty risk ratio.

In the 1980s the demand of higher educated workers also increased due the *'skill-biased technical change'*. This change is in the production technology and favors educated people over uneducated people by increasing its relative productivity, and so, its relative demand (Violante, 2008; Psacharopoulos, 2004). Technological developments in modern labor markets had led to a demand shift from a low-skilled to a high skilled labor force (Violante, 2008). Therefore the demand for higher educated graduates grew in the last decades. The supply of higher skilled workers increased due to *educational expansion* (Gesthuizen et al., 2011; Livingstone, 1998). The level of industrial development and educational expansion differs in countries and this altered the ratio between the supply and demand for higher educated labor between nations. If the supply of higher-educated persons is larger than the demand, there is a more intensified job competition among the higher-educated workers, but also between low- and higher-educated workers. The *displacement theory* is commonly used to explain the employment opportunities of the better and the lower educated. The theory states that when there are a fixed number of vacant jobs and the employer can choose, the employer is more likely take the employee with the highest educational degree (Gesthuizen et al., 2011). So when there are more higher educated people there is a risk that there are not enough vacant high-skill jobs. When there are more higher educated than that there are needed, the high-skill supply-demand ratio is high, the higher educated will climb down in the economic ladder and take the jobs of the intermediate-educated workers. These will take the jobs of the lower educated. The lower educated are more likely to loose their jobs (Hirsch, 1977; Wolbers, 2000). This would mean that a larger governmental investment the poverty risk of the lower educated increases compared to that of the better educated.

Gesthuizen et. al. (2011) suggest an alternative hypothesis when the lower educated have a higher poverty risk, but the better educated as well. By cascading downwards on the economic ladder the better-educated might also have a higher risk to earn an income that is below the poverty line. Hence, the displacement theory can support the idea for either an increase in the relative poverty risk as a decrease.

Displacement hypothesis A: A larger volume of governmental investment in education will increase the poverty risk of lower educated, and thereby increases the relative poverty risk.

Displacement hypothesis B: A larger volume of governmental investment in education will increase the poverty risk of better educated, and thereby decreases the relative poverty risk.

Statistical discrimination is also assumed to have a large influence of the employment opportunities of the low-educated. It implies that lower educated workers are seen as having poorer cognitive skills and have a low trainability than better-educated people (Gesthuizen et al., 2011). *Cognitive skill* is a term referring things like memory, the ability to learn new information, speech, and understanding of written material. A low educated worker is by the employer expected to have the average cognitive skill of all lower educated workers in a country. The lower the average cognitive skill of the low educated is, the larger the statistical discrimination will be (Gesthuizen et al., 2011). The brain is usually capable of learning new cognitive skills, typically in early childhood. Because most of the cognitive skills are learned at early age it is likely that a lot of these skills are learned in primary education. The expectation is that if a government invests more in primary education than other governments, it is more devoted in developing the cognitive skills of all students and increases thereby the average cognitive skill of the population, especially the average level of the low educated. Consequently, the poverty risks of the lower educated will be lower and thereby there will be a lower relative poverty risk. So the next hypothesis is:

Cognitive skills hypothesis: A larger volume of governmental investment in primary education will increase the cognitive skills of the lower educated, which will decrease the poverty risk of the lower educated and thereby decreases the relative poverty risk.

These three hypotheses derived from theory will be tested and answer the research question. In the table 2 the hypotheses are schematic displayed.

Table 2: schematic overview of the hypotheses related to the effect of government investments in education

	Poverty risk lower educated	Poverty risk better educated	Relative poverty risk
Displacement hypothesis A	+		+
Displacement hypothesis B		+	-
Cognitive hypothesis	-		-

'+' is a positive effect, '-' is a negative effect, nothing means that the hypothesis does not say anything about the correlation

Methods, operationalization and data

In this thesis we will empirically examine the consequences of *governmental investment* (independent variable) on the *relative poverty risk* (dependent variable). By comparing OECD-countries there will be seen if there is a correlation and, if so, what the direction of this correlation is.

Relative poverty risk

The *poverty risks* will be expressed in odds. To measure the *relative poverty risk* I use the odds-ratio. The *odds ratio* is a measure of effect size, describing the strength of association or non-independence between two binary variables. The odds ratio is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. In this case the odds of being poor when lower educated are compared to the odds of being poor when someone is better educated. The advantage of using the odds ratio is that it is not important how large the groups are and that gives a good relative measurement. Because the poverty odds of the better educated are expected to be lower than the poverty odds of the lower educated, the odd ratio will be 1 or higher. When the odds ratio is close to 1 the poverty odds of both categories are almost similar. The odds ratio will be larger if the poverty odds differ a lot.

This chapter first will discuss where the data is collected and which cases where selected. Then it shows how poverty and the education levels are measured in this thesis.

Table 3: the year when the data is conducted and the number of participants per country

Country	Year	N
Austria	2004	5,552
Belgium	2000	3,020
Canada	2004	28,986
Czech Republic	2004	4,251
Denmark	2004	74,786
Finland	2004	11,827
France	2005	10,478
Germany	2004	11,482
Greece	2004	6,099
Hungary	2005	2,058
Ireland	2004	5,608
Israel	2005	7,795
Italy	2004	8,425
South Korea	2006	20,084
Luxembourg	2004	4,326
Mexico	2004	34,594
Netherlands	2004	10,502
Norway	2004	14,354
Poland	2004	42,461
Spain	2004	16,129
Sweden	2005	14,047
Switzerland	2004	3,588
United Kingdom	2004	25,815
United States	2004	89,612
TOTAL		**466,485**

Data collected from LIS.

Data sample

To determine the relative poverty risk the data from the Luxembourg Incomes Study (LIS) is used. *"LIS collects and harmonizes micro-datasets from upper- and middle income countries and places them on a secure server"* (LIS, 2013). In the LIS-data several income components are measured. Datasets in the database of the LIS are grouped in 5 year intervals. The last completed wave for most countries is *wave VI*. This wave contains data collected in the 5 year period around the year 2004. Since we are interested in labor market outcomes, we will restrict our attention to people between the age of 26 and 55, hereby controlling for country variations in duration of the education as well as for country differences in the transition age to retirement. The lower boundary will prevent that we select individuals that not yet finished their study. The upper boundary will prevent that we select people that are retired. This selection is commonly applied in the literature (Gesthuizen et al., 2011). The remaining number of valid cases in each country is shown in table 3.

Operationalization

Poverty

In order to get any measure of poverty it is necessary to make statements concerning the criteria based on which to define poverty. The method that is commonly implemented in other papers is that of creating a relative poverty line constructed on the level and distribution of household disposable income in a country. Poverty lines measure income poverty, the amount of people living below a certain low income level. The *OECD poverty line* is set at 50 percent of the median of the disposable household income (LIS, 2012); the poverty line used by the European Union is set at less than 60 percent of the median household income. I have chosen to take the measurement of the OECD because also the data of the OECD is used. This poverty line is suitable for this research because it is a relative measurement and thereby country dependent. If someone is labeled poor in one country can earn a good living in another country. Thereby, poverty is country dependent.

The household disposable income will be observed and not to the income of a single individual. This is because if someone has a working partner, who earns enough for the household, then that person is not considered poor. Households are classified as poor or not based on the criterion of their income being higher or lower than the relative poverty line. So, only when someone lives in a poor household the person is considered poor.

In order to get measures of poverty in a population it is necessary to compare across various kinds of households. It is not logical to bluntly compare total household income between households of different sizes and composition. You cannot state that a household with a certain income is better off than a household with income unless you know the two households are similar in composition. A childless couple with a certain income is difficult to compare with a family that earns twice as much but has three children. Dividing the household income by the number of household members is not a good solution for the problem, because not all expenditures are increased when a household gets larger. Instead, I will use the *LIS equivalence scale* and thereby correct for household size. The equivalence scale divides the disposable household income by the square root of the number of household members.

Education levels

The International Standard Classification of Education (ISCED) is used to determine if someone is lower educated or better educated. The ISCED is classification for establishing information on education and training maintained by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The world's education systems diverge widely in terms of structure and curricular content (UNESCO, 2013). Consequently, it can be difficult for researchers to associate the education systems of one country with those of another. The ISCED is thereby suitable for this thesis. I have classified ISCED levels 0-2 as low educated and ISCED levels 3-7 as better educated.

Governmental investment in education

In this chapter there is explained how the variable for governmental investment is determined. First there is shown how the data is collected and then how the variable is established.

Operationalization

The OECD publishes comparable statistics on a wide range of subjects. In this study the UNESCO-OECD-Eurostat (UOE) data collection on education statistics is used. This dataset is compiled on the

basis of national administrative sources, reported by Ministries of Education or National Statistical Offices (OECD stat, 2013). From this dataset the data for the level of governmental investment was collected.

Table 4: governmental investment in education expressed as Percentage of Gross Domestic Product (GDP). Average percentage over the years 1998-2004.

Country	Primary education	Secondary education	Tertiary education	Total investment
Austria	1.42	2.66	1.47	5.80
Belgium	1.92	2.46	1.30	5.67
Canada	..	..	..	5.11
Czech Republic	1.16	2.00	0.83	4.00
Denmark	2.80	2.96	2.49	8.33
Finland	1.74	2.45	2.03	6.19
France	1.87	2.85	1.07	5.75
Germany	1.25	1.60	1.22	4.61
Greece	1.21	1.23	1.12	3.49
Hungary	1.66	2.10	1.21	5.13
Ireland	1.47	1.53	1.34	4.33
Israel	3.40	1.99	1.22	6.74
Italy	1.63	2.15	0.85	4.63
South Korea	1.79	1.58	0.48	3.97
Luxembourg	1.89	1.74	..	3.77
Mexico	2.61	1.42	0.82	4.57
Netherlands	1.73	2.01	1.40	5.13
Norway	2.97	1.96	2.02	7.24
Poland	2.65	1.54	1.01	5.21
Spain	1.46	1.84	0.94	4.30
Sweden	2.47	2.73	2.04	7.23
Switzerland	1.83	2.07	1.35	5.41
United Kingdom	1.63	2.21	0.93	4.66
United States	2.27	1.87	1.32	5.21

Source: Authors' calculations, data collected from OECD stat.

The volume of the government investment can be calculated in several ways. The indicator that will be used in this thesis the percentage of the gross domestic product (GDP) that is invested in education by a government. This relative value gives a better view on how a country values education, than when using an absolute value. A relative measurement makes it possible to compare countries of different sizes and with different currencies. Moreover, a richer country can spend more money on education, but that would not mean it attaches more importance to education than a poorer country. The GDP can be seen as the sum total of incomes of individuals living in a country and the earnings of the company during one year. The percentage of the GDP will indicate what part of the total amount of income the government wants to or can spend on education. It is an indicator of how a government values education over other policy fields [1]. The total governmental investment in education is calculated, but also, for the third hypotheses, the investment is split up in three groups: investment in primary; secondary; and tertiary education. Also these measures are expressed as percentage of GDP. All these measurements are shown in table 4. Here must be mentioned that

the total governmental investment is not the same as the sum of the three groups. This because some investments are not to be categorized in one of these groups, other investments can be assigned to more groups.

When a country changes its policies it is not directly visible in the outcomes. To control for policy fluctuation the average percentage of GDP between the years 1998 and 2004 will be calculated.

Country selection

As mentioned above the OECD-countries were selected because they are largely comparable in terms of economic progress, form of government and market economy. There are 34 countries that are jointed in the OECD. Not all these countries are used in this research due to missing data. This chapter will explain why some OECD-countries were eliminated for the analysis and where other data is used than mentioned above.

LIS has no data for six OECD-countries, namely: Australia[2], Chile[3], Iceland, Japan, New Zealand, Portugal and Turkey[3]. These countries will not be used for this reason. Estonia, Slovak Republic and Slovenia have data that is not reliable due to fluctuation in GDP. According to the data they invest more in education than the GDP. These countries are also eliminated. This leaves 25 countries remaining for research. The 25 OECD-countries that are analyzed in this research are: Australia (AU), Austria (AT), Belgium (BE), Canada (CA), Czech Republic (CZ), Denmark (DK), Finland (FI), France (FR), Germany (DE), Greece (GR), Hungary (HU), Ireland (IE), Israel (IL), Italy (IT), South Korea (KR), Luxembourg (LU), Mexico (MX), the Netherlands (NL), Norway (NO), Poland (PL), Spain (ES), Sweden (SE), Switzerland (CH), the United Kingdom (UK), and the United States (US). The letters behind the countries will be used as labels in the figures

In the database of OECD the data of Canada did not further specify what amount is invested in primary, secondary and tertiary education. So, Canada cannot be included to test the cognitive hypothesis. For the cognitive hypothesis 24 countries are being used. Also in Luxembourg the amount that is invested in tertiary education is not further specified. For Canada the governmental investment of 2004 is missing, the closest year where there is data available is 2005. So the GDP and government investment of 2005 are used. For Luxembourg the governmental investment of 2004 is missing, the closest year is 2002. So for Luxembourg the GDP and government investment of 2002 are used. Belgium is not included in the VIth Wave of LIS, so only for Belgium the data of the Vth wave is used.

Results

In this chapter the results of the thesis will presented. First the poverty odds ratio of the different countries is analyzed. By detecting influential cases some of the countries are eliminated from the analysis. Next, the influence of the governmental investment on the poverty odds and odds ratio is analyzed. At last, the investment is split in the three different levels of education. In this chapter the hypotheses made in this thesis will be confirmed or refute.

Influential cases

Table 5 contains the poverty odds ratios for the 25 OECD countries are given. It is remarkable that all the odds ratios are higher than 1. The odds ratios lay between 1,485 (Denmark) and 8,332 (Mexico).

Table 5: the relative poverty.

Country	Relative risk
Austria	2.747
Belgium	1.856
Canada	2.430
Czech Republic	4.070
Denmark	1.485
Finland	2.572
France	3.122
Germany	3.043
Greece	2.744
Hungary	3.230
Ireland	4.010
Israel	3.802
Italy	3.815
South Korea	2.330
Luxembourg	4.418
Mexico	(8.332)
Netherlands	1.576
Norway	1.804
Poland	3.205
Spain	2.525
Sweden	2.284
Switzerland	2.001
United Kingdom	2.808
United States	5.085

Source: Authors calculation, same data as table 1 is used. The relative poverty is expressed as an odds-ratio.

Mexico is a lot higher than the other countries making it possible that this is an influential case. All cases used to estimate a regression model use some effect on the regression parameters. However, if one or a few cases have extremely high or low scores on the dependent variable relative to its expected value, then this case/ these cases may influence the regression parameters in such a way that it is pulling the estimated regression line towards itself (Nieuwenhuis et. al., 2012). Tests for influential data are commonly used on regression models, especially when estimates are based on a relatively small number of cases, like in this study. “The basic rationale behind measuring influential cases is based on the principle that when single cases are iteratively omitted from the data, models based on these data should not produce substantially different estimates. If the model parameters change substantially after a single case is excluded, this case may be regarded as too influential” (Nieuwenhuis et. al., 2012, p.1). Cook's distance is a frequently used estimate of the influence of a data point when performing least squares regression analysis. If the Cooks distance for a single is larger than certain cut-off value the case is seen as influential and is removed from the analysis. Using this tool it is shown that Mexico is seen as an influential case and is removed from the analysis [4]. This means that only 23 countries remained for the analysis and 22 for the cognitive skill hypothesis. These countries are all, instead of South Korea and Israel, located in Europe or North America.

Influence of total governmental investment

Odds and the odds-ratio are distributed on an exponential scale (Agresti, 1980; Agresti & Yin, 2002). By taking the natural logarithm of the odds a linear regression is possible. In this study the linear regression of the governmental investment on the natural logarithm of the odds is taken. In table 6 the influence of the total governmental investment on the (logarithm of the) poverty odds and the

odd-ratio are given. First it is important see that the poverty odds of the entire population are decreasing significantly when there is more invested in education (see also figure 2). So when a government invests more in education the number of people that are being poor is decreased. Since, we took poverty as a relative measurement it could be said that when there is more invested the wage gap becomes smaller. This does not mean that the overall income becomes higher. The poverty odds of the lower educated are decreasing when more is invested in education (see figure 4). This is the same for the poverty odds better educated, although this correlation is not significant (see figure 5). The results show that the lower educated profit more of the total decrease in poverty than the better educated. This outcome is also visible within the odds ratio. The odds-ratio is decreasing significantly when there is more invested in education (see also figure 5).

The displacement hypothesis stated that the poverty odds ratio is increasing or decreasing due to an increase in the poverty odds of the better educated or an increase in the poverty odds of the lower educated. This is both not the case. Both poverty odds decrease and so both displacement hypotheses cannot explain the influence of governmental investment on the poverty risks of both categories.

Table 6: influence of total governmental investment.

	Poverty odds Entire population		Poverty odds Lower educated		Poverty odds Better educated		Odds-ratio	
	B	Std. Error	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	-1.280**	.379	-.520	.511	-2.242*	.383	1.722**	.280
Tot. Gov. Invest	-.200*	.070	-.217*	.094	-.084	.070	-.133*	.052

* = p < .05 ** = p <.01
Source: Authors' calculations, data from Luxembourg income Study & OECD stat. n=23

A possible explanation for this phenomenon is that countries that are wealthier and thereby have less poverty invest more in education than countries that are less wealthy. Only the correlation remained statistically significant when there is controlled for GDP per capita.

Figure 2: influence of governmental investment on poverty odds of entire population (significant ($p < 0.05$)).

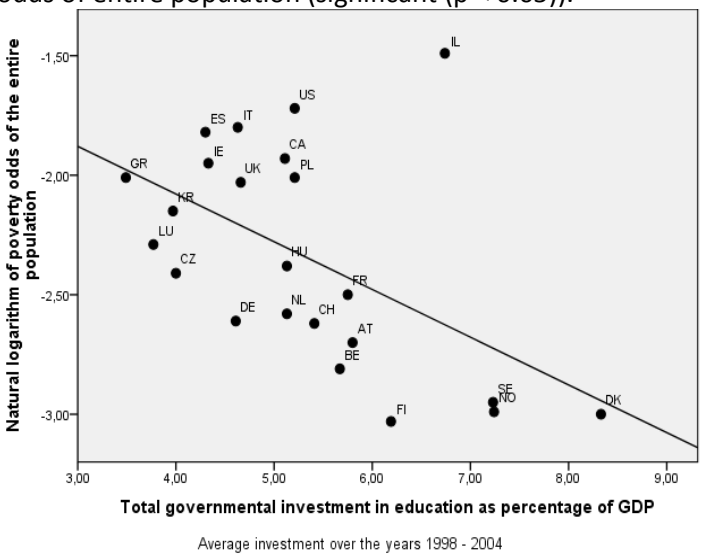


Figure 3: influence of governmental investment on poverty odds of better educated (not significant).

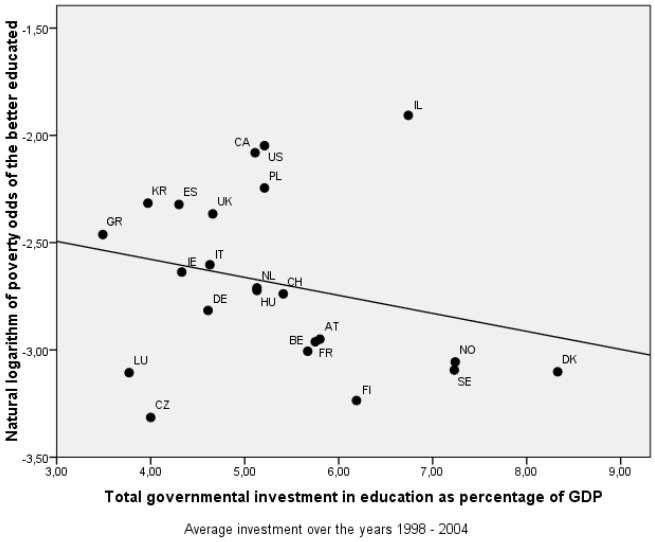


Figure 4: influence of governmental investment on poverty odds of lower educated (significant ($p < 0.05$)).

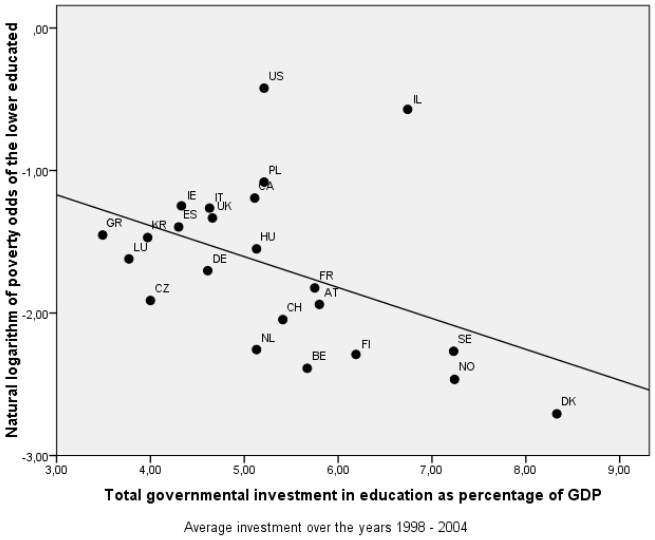
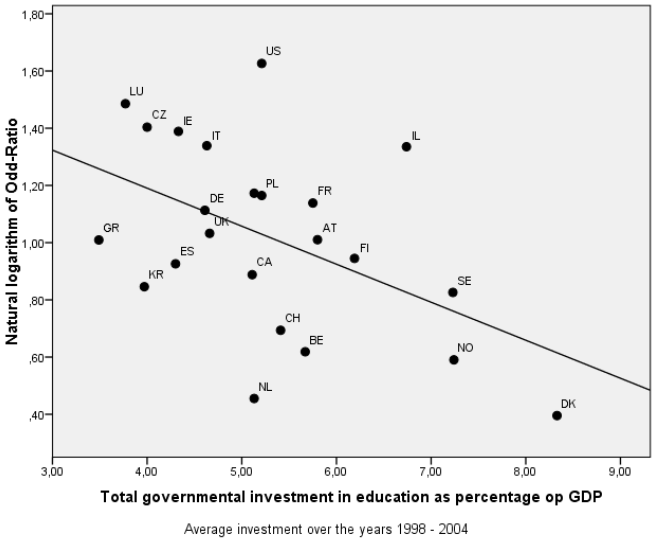


Figure 5: influence of governmental investment on odds ratio (significant ($p < 0.05$)).



Influence of investment in primary education

For the cognitive skill hypothesis the governmental investment in education will be split into separate levels. The cognitive skill hypothesis states that a higher investment in primary education will lead that lower educated will develop better cognitive skills, which then would lead to a decrease of the poverty odds of the lower educated. The governmental investment in primary education is to be found in table 4. Also this value is expressed as a percentage of the GDP. Again the natural logarithm of the poverty odds and the odds ratio is used. The linear regression shows that there is not a correlation to be found between the investment in primary education and the poverty odds of both categories and thereby the odds ratio. So also the cognitive skill hypothesis cannot explain the influence of the governmental investment on the poverty odds and thus needs to be rejected.

Influence of investment in tertiary education

An interesting correlation is found when the effect of the investment in tertiary education on the poverty odds is observed. Investment in tertiary education can be seen as a reverse of the cognitive skill hypothesis. In this chapter the correlation of the investment in tertiary education and the poverty odds will be discussed. There is no hypothesis formulated about this correlation.

The investment in tertiary education is correlated with the wealth of country. Table 7 shows that the wealth of a country, expressed as GDP in US dollars per capita, is not strong and significant correlated with the investment in primary and secondary education, but it can explain the investment in tertiary education. Meaning wealthier countries invest a higher percentage of GDP in tertiary education. The GDP per capita is to be found back in the appendix.

Table 7: correlation of GDP with investment in educational levels.

		Investment primary education	Investment secondary education	Investment tertiair education
GDP per Capita	Pearson correlation	.156	.327	.506**

* = p < .05 ** = p <.01. 1-tailled
Source: Authors' calculations, data from Luxembourg income Study & OECD stat. N=21

Therefore, there is controlled for the wealth of a nation when the influence of governmental investment in tertiary education is calculated. Table 9 shows that tertiary education influences the poverty odds. The poverty odds of both the lower as the better educated decrease when there is invested more in tertiary education. The poverty odds of the lower educated decrease harder than those of the better educated. The odds ratio decreases, but because the difference in decrease of the poverty odds is not that large, the decrease of the odds ratio is not significant. From this data there can be concluded that investment in tertiary education decreases the poverty odds and that wealthy countries, which have less poverty, invest more in tertiary education. But when controlled for nations wealth the correlation between investment in tertiary education and the poverty odds of both categories remains.

Table 8: influence of governmental investment in tertiary education.

	Poverty odds Entire population		Poverty odds Lower educated		Poverty odds Better educated		Odds-ratio	
	B	Std. Error	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	-1.543**	.328	-.783	.461	-2.233**	.320	1.450**	.273
Investment Tert. Edu.	-.703**	.196	-.799**	.275	-.463*	.191	-.337	.163
GDP per Capita	4.236E-006	.000	5.497E-006	.000	5.715E-006	.000	-2.159E-007	.000

* = p < .05 ** = p <.01
Source: Authors' calculations, data from Luxembourg income Study & OECD stat. N=21

Conclusion and discussion

In the research I compared 23 OECD-countries and analyzed the difference in poverty risks between the lower and he better educated and their relative poverty risk. The first research question was: *Which differences between OECD countries exist in the poverty risk of the lower educated relative to the better educated?* First the poverty risks of the lower educated are larger than the poverty risks of the better educated in every country. So the lower educated have a higher risk becoming poor. But when the countries are compared the differences in poverty risks are large. The main goal of this thesis was to explain these differences with the governmental investment in education within these countries. Hence, the second research question. *To what extent can variation between OECD-countries in poverty risk of the low educated relative to the better educated be explained by the volume of the governmental investment in education?*

The governmental investment is calculated as a percentage of the GDP what makes it relative and not an absolute measurement. An individual is considered poor if his or her household earns less than a poverty line. This line is relative to the median of the disposable household income of a country and is thereby also a relative measurement. The educational level is defined by the ISCED. The results are obtained by a regression between the governmental investment in education and the poverty risks of the lower and better educated and its relative risk.

Looking at the results it is remarkable that when more is invested the poverty risk of the entire population is declining. It is mostly the poverty risk of the lower educated that is decreasing when there is invested more in education. The poverty risk of the better educated is not significantly declining. As a result the lower educated benefit more of the governmental investment in education. The relative poverty risk is also declining. Thus, the poverty odds are closing in when there is more invested in education. Investment in primary education has no influence of the poverty risks. Investment in tertiary education has a strong negative effect on the poverty risks, even when there is controlled for the nation's wealth. When there is more invested in tertiary education the poverty risks of both the better as the lower educated is declining. The poverty risk of the lower educated is declining steeper, what leads that the poverty risks come closer to each other.

The three hypotheses that were derived from theory did not explain these results and had to be rejected. The two displacement hypotheses stated that or the lower educated or the better educated or both should increase in poverty risk when the governmental investment in education should increase. This was not the case. On the contrary, the poverty risks of both groups decreased. The cognitive hypothesis is also not true, because when there is more invested in primary education, the poverty risks of both groups is increasing. The displacement theory and the cognitive skill theory explained by Gesthuizen et al. (2012) are inapplicable when comparing the poverty risks between OECD-countries.

A explanation for the influence of investment in tertiary education on the poverty risks can be that when there are more better educated the job competition between lower educated becomes lower what leads to higher incomes for low skilled jobs and less unemployment for lower educated. This prognosis is not been tested in this research and can be examined in future research.

There are some aspects that should be taking into account when using the results. By combining several datasets some countries were removed from the analysis. Israel, South Korea, countries in North America and Europe remained in the selection. The OECD countries Australia, Japan, Chile, Turkey, Australia and Mexico were not taking in the analysis. The countries that remained are mainly concentrated on two continents. The results could differ when the countries that are removed are added to the analysis, this because the location of these countries and thereby their possible cultural differences. Furthermore, it is important to question if the results are causal. Does the governmental investment in education influence the poverty risks or can it be that a government invests less in education because it has to invest more in other policy issues due to the high poverty rate? Future research could tackle this problem by examining the level of investment in welfare programs and unemployment benefits and if these investments are correlated with the investment in education. The last remark is that the data that is used is already almost a decade old. For example, the data that is used is from before the economic crisis of 2008 and what could lead in a change in the *skill-biased technical change* and the *educational expansion,* which were mentioned above. These factors could have a positive or negative effect on the poverty risks of the lower and better educated and can have changed the influence of the governmental investment. So, the results of this research were based on data of 2004, but this will probably have only an effect on the amplitude of the influence, not on the direction.

To conclude, governmental investment in education declines the poverty of a country and the poverty risks of both the lower as the better educated. In particularly investment in tertiary education declines the poverty risks of both categories. So the investment in the smart is a smart investment. Investment in higher education leads to less poverty and decreases the relative poverty risk. This does not mean that it is wise to remove investment from primary education and invest the amount in tertiary education, but it states that capital invested in the higher educated is not only beneficial for the higher educated, but as well for the lower educated. Poverty-wise: It is smart to invest in the smart.

Notes

1. Note that I only looked at the percentage that a government invests in education. Private actors can as well invest in education but this measurement fluctuates more over the years. It is difficult to trace what actors invest and which groups benefit of these investments.

Besides, this is not what this research is about. I want to see what the consequences are of policies. This is why there is only looked at governmental investment.

2. The data of Australia exists of 10606 cases. Of these cases only 3 cases are considered as low educated. This makes it not reliable to generalize this data for the entire lower educated population. Australia is for this reason removed from the analysis.
3. Chile and Japan are included in Wave VII of LIS but not in previous waves. The data of wave VII is for a lot of countries not yet available for research. This is also the case for these two countries. Thereby Chile and Turkey are removed from the analysis.
4. There are different ideas regarding what cut-off values to use for spotting highly influential points. A common used cut-off value for the Cooks distance is 4/n (Nieuwenhuis et. al., 2012; Bollen et. al. 1990). Here is n the number of observations. In this analysis the n is 24, because Australia was already removed. So the cut-off value is $4/24 = 1/6 \approx 0.1667$. Mexico is the only country that scores higher than this value and is removed. The Cooks distances of the countries can be found in appendix B.

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Appendix A: Code

This is the code that is used the extract the data from the database of the Luxembourg Income Study (LIS). This specific code extracts its data from the dataset of the United States in the year 2004.

```
match files file = us04p
        /table = us04h
        /keep= did hid dhi age relation ppopwgt educ nhhmem hpopwgt
        /by hid.
*** select only prime age
select if age ge 25 and age le 54 .

aggregate outfile= *
        mode = addvariables
        /break = did
        /mediandhi= median(dhi).

***equivalise income
compute edhi = dhi / (nhhmem**0.5).
compute populat = hpopwgt * nhhmem.
weight by populat.

aggregate outfile= *
        mode = addvariables
        /break = did
        /medianedhi= median(edhi).

***poverty line
compute povline = medianedhi * 0.5.
compute poor = 0.
if (edhi lt povline) poor = 1.
compute lowedu = 0.
if (educ lt 2) lowedu = 1 .
* Output is created only below this line
*descriptives variables = povline .
crosstabs poor by lowedu
        /statistics = risk chisq .
```

Appendix B: Cook's distance

In the appendix the Cook's Distances are summed up. The Cooks distance is used to see if some single cases are influential. The Cooks distance is calculated for the linear regression of the governmental investment on the poverty odds ratio.

Table 9: The Cook's distance.

Country	Cook's Distance
Austria	.02978
Belgium	.00736
Canada	.00901
Czech Republic	.10852
Denmark	.00016
Finland	.00473
France	.00066
Germany	.07891
Greece	.00140
Hungary	.01017
Ireland	.13205
Israel	.00747
Italy	.07791
South Korea	.01997
Luxembourg	.07245
Mexico	.22627
Netherlands	.07245
Norway	.02562
Poland	.00152
Spain	.02643
Sweden	.00368
Switzerland	.02214
United Kingdom	.00365
United States	.05527

Source: Authors calculation, data collected from LIS & OECD Stat

Appendix C: GDP per Capita

In this table the Gross Domestic Product per capita is expressed in US dollars. To take away small fluctuation between years the average GDP per capita is taken of the years 1998 and 2004.

Table 10: GDP per Capita expressed in US Dollars.

Country	GDP per Capita
Austria	$ 29423.56
Belgium	$ 28201.90
Canada	$ 29217.11
Czech Republic	$ 16851.06
Denmark	$ 29253.07
Finland	$ 26200.18
France	$ 26647.20
Germany	$ 26729.73
Greece	$ 19856.08
Hungary	$ 13310.95
Ireland	$ 30588.33
Israel	$ 22653.02
Italy	$ 26142.73
South Korea	$ 18056.16
Luxembourg	$ 54716.63
Netherlands	$ 29916.92
Norway	$ 35462.71
Poland	$ 11077.75
Spain	$ 22485.21
Sweden	$ 28397.05
Switzerland	$ 33133.36
United Kingdom	$ 27405.29
United States	$ 35907.13

Source: Authors calculation, data collected from OECD Stat.