Comparative Education Systems: Student Performance & Private and Public Funding, Management and Schools – A Case Study of Finland and Sweden

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Student performance has been used extensively in discussion about the quality of education systems in both academic and non-academic writing. This thesis examines the role of private and public provision of education in student performance. Using PISA data from 2003-2015 this thesis examines Finland and Sweden as most similar cases with a major difference in the role of market incentives in their education systems.

This thesis uses a multilevel regression model with student and school level variables. While private schools tend to correlate with higher student performance results for an individual student, the student level features such as socio-economic background have a more significant impact on student attainment. The analysis does not support the theoretical notion that through competition school quality will increase in both the private and public sector when measuring student performance. Further research into student selection can help in determining factors regarding the possible performance gap in private and public schools yet lower overall student performance in a system with a larger private sector.

Keywords*:* education systems, education policy, private provision, public provision

Contents

1. Introduction

In recent years education has been a growing topic for research in economics and social sciences and this trend has been attributed to several factors, among others increased education levels, concern for economic outcomes, availability of better and more data, methodological innovations and so on (e.g. Machin 2014). Results from comparative and international education research has been for example used as a tool in policy design (Mattheou 2014) and teacher training (Collet 2014). Since the Organization for Economic Co-operation and Development (OECD from now on) began conducting the Programme for International Student Attainment (PISA from now on) studies in 2000, the results on measuring international student attainment have drawn attention in discourse about education in media, politics and academic writing. This thesis will take an economic approach to education systems, and attempts to examine public and private provision of education and its effects on the level of student performance in comparing the Finnish and Swedish education systems.

In this thesis, the cases of Finland and Sweden will be highlighted as a most similar cases study, examining the relation between variables representing public and private provision of education and student performance through the method of multi-level analysis. Various international standardized tests and surveys have gathered information about student performance of numerous education systems in different countries and economies throughout the years, but the PISA studies remain the most extensive and largest in scope. This thesis will use the data of five PISA cycles from 2003 to 2015 to examine student performance and other control variables on country, school, and student level. Some additional data sources will also be used.

Whether the school is private or public does not necessarily affect the performance of the students or the quality of education in itself, but especially the presence of for-profit incentives can have an effect on the outcomes of a system. This has been illustrated in previous literature in terms of other public institutions such as health care (e.g. Sieberg & Shvetsova 2012) and criminal justice (Sieberg 2005) when private provision has created unexpected outcomes. Finland and Sweden both had largescale educational reforms in the 1990s, and thus the profit motive is a clear difference between the private actors in the current Finnish and Swedish school systems. This thesis will present a model on the incentives for the schools, and test this model using the PISA data.

The thesis will not attempt to offer a comprehensive review of the entire education system nor will it claim private and public actors as the only meaningful factor in an education system. However, a focus on a certain theme or topic can add to the existing literature, and Finland and Sweden have not been used in a most similar cases case study in this regard. The questions which the thesis looks at can be formulated as follows:

1) What kind of an effect, if any, does the private or public provision of education have on student performance in the Finnish and Swedish systems according to the PISA data?
2) Is there evidence for the theoretical model presented?

The focus of the thesis relates to these questions, but also secondary questions can be considered, and formulated as the following:

3) What other significant factors contribute to the student performance in the data?
4) How do the results compare with the established previous literature on student performance?

The same kind of questions about school competition have been posed in the literature previously regarding private and public schools and student attainment, but the empirical evidence has been either from different contexts (e.g. Urquoila 2016) or more broad (OECD report 2011) in scope, so this thesis will add to the issue by its focus and case design. The role of private and public providers in institutions, or indeed education, is by no means a new or original topic in the literature, but it is an essential and multilayered issue which requires and benefits from examination from different perspectives and contexts for research.

First I will discuss the myriad of ways in which education systems and private and public provision have been studied in the literature in different contexts, countries, and economies. In addition I will introduce how the effect of other factors on student performance have been studied as well. I will utilize this to identify the incentives involved, and a model based on the incentives of markets in education provision will be presented. Previous research using the PISA data will also be discussed, as well as the data I will utilize in the analysis. A multilevel analysis and its results will be discussed in the results, and finally concluding remarks as well as topics for further research will be discussed.

The results of the analysis show a positive correlation with public schools and student attainment, yet theory, including the model discussed, question whether the positive effect is due to improvement in the entire system or if this is due to a performance gap caused in part also by the decrease in quality of the public schools.

2. Literature review

This chapter will focus on the previous literature as well as the institutional role of education provision and the significance of various factors on student performance. This includes relevant literature on education from the economic perspective on education and the role of private and public provision, student performance, as well as use of PISA data and multi-level analysis in education research. Finland and Sweden are selected as a most similar case in the analysis, and the background of their educational systems will also be briefly discussed.

2.1. Theoretical Background

This section will first look at the role of private schools and how they are presented in the Finnish and Swedish systems. Although great variation obviously exists in education systems across countries, the purpose of an education system can be argued to be in many ways universal. Education is often seen as a service that to an extent (especially at the primary level) is provided for everyone, and as such has been discussed alongside health care, social welfare and criminal justice in the literature (e.g. Shemilt et al. 2010). Although not meeting the definition of a purely public good *per se* (e.g. Head & Shoup 1969), basic education in both Finland and Sweden have the public sector and public policy in a major role, and it is virtually impossible to exclude a pupil from receiving education. The PISA studies test students exactly at this stage of schooling system, as receivers of education with the non-excludable quality of a public good. Moreover, education has been characterized as "a fundamental human right and a core responsibility of governments (Singh 2015, 309)" as well as a tool in investing in human capital (Becker 1993).

The value from education for society can be viewed in economic terms. Guzavicius et al. (2015) see education as means to increase knowledge in the population, and that "knowledge should promote rational behavior (885)" and therefore lead to more optimal economic

outcomes. Even if one were to disregard the role of education as a human right and look at the issue from an entirely material perspective, there is a great deal of evidence to show that education plays a role in investing in human capital and well-being, and therefore contributes to the development of countries and economies. Regarding these benefits Becker (1993) states that

> "…few if any countries have achieved a sustained period of economic development without having invested substantial amounts in their labor force, and most studies that have attempted quantitative assessments of contributions to growth have assigned an important role to investment in human capital. Again, inequality in the distribution of earnings and income is generally positively related to inequality in education and other training. To take a final example, unemployment tends to be strongly related, usually inversely, to education. (12)"

The role of the public provision of schooling in society has been acknowledged in previous literature. Even with market incentives in mind the public provision of education can be seen as a beneficial outcome for society: for example with regard to the USA it has been noted that "the success of public schooling must be at least partially attributed to the social utility of the state intervening to deal with the difficulty of enforcing debt contracts backed by human capital, and to the positive externalities associated with a better educated and potentially more mobile populace (Black & Sokoloff 2006, 102)." Even on an individual level, increased education has been shown to have a positive impact on personal income (e.g. Becker 1993).

The literature shows how education is an institution which has benefits for both society as well as benefits for the individual. Education has an undeniable role in economies, and although it is not a public good it is often universal. Highlighting the benefits and advantages of education illustrates how every system would have an incentive to provide it, and how every individual in a society can have an incentive to obtain the best possible education. The role of student performance in education will be discussed in later parts, but for the purposes of the model it is important to show why any state system would have the incentive to maximize

education provision. The following will highlight the role a public or private provider has in distributing education, and the optimality of outcomes.

2.2. Private provision in education systems: theoretical approaches

There are multiple viewpoints on how private actors operate and what the outcome of their inclusion is for education systems in the literature. Before reviewing empirical evidence some theoretical approaches will be discussed, with both the theoretical benefits and disadvantages of private actors in a system.

In the literature focusing on the design of education systems there are various approaches, both descriptive (e.g. Agasiti 2014 examines the efficiency of public spending on education on a comparative level) as well as strongly prescriptive analyses (e.g. Friedman 1997). The call for privatization was seen by for example Friedman as a solution that:

> "…will unleash the drive, imagination and energy of competitive free enterprise to revolutionize the education process. The competition will force government schools to improve in order to retain their clientele. Except for a small group who have a vested interest in the present system, everyone would win: parents, students, teachers, taxpayers, private entrepreneurs and, above all, the residents of the central cities." (342, 1997).

Although this seems like a strong statement, it clearly shows that the provider of education is seen to have significance in the political discourse on education, and in this instance privatization is presented as an optimal solution for society as a whole. Relying on market theory, introducing private operators would in theory lead to a more preferred outcome for both the private and public schools as well as individuals in a society.

Private schools often tend to have public funding, and the money can be allocated through a voucher system for example. Defenders of private operators in education see market incentives leading to competition, and that for example in the case of school vouchers will "in addition to indirectly improving educational experiences for all public-school students by

exerting competitive pressure on public schools, vouchers should directly help the most disadvantaged children, allowing them the opportunity to exit unsafe and underperforming schools (Hart 2014, 186).” Per this rationale there should be both an increase in the quality of public schools, as well as migration of students away from underperforming schools. Student performance can be suggested to correlate with the quality of a school, so this hypothesis could be observable in the PISA studies.

There are other theoretical approaches which contradict the introduction of private operators in the education market and their effect on society. Urquoila (2016) discusses the implications of introducing a voucher system: as families have access to vouchers, this “lowers the cost of private schooling and may lead the private sector to grow as it enrolls more high-income households. If this happens, public schools choose to lower their effort to the level required to retain only low-income students. Hence competition may lower public school productivity (216).” This approach will be discussed more in the chapter about the theoretical model in this thesis, but it shows that the logic from competition has been suggested to yield also different outcomes than simply increase in quality at the country level of the system.

Epple and Romano (1996) present the ends-against-the-middle equilibrium in discussing private schools ran with a voucher system. Although a simplified model, it claims that “we find it plausible that, for education, high-income households are more willing to substitute public education for other goods than low-income households… …an equilibrium is characterized by a balancing of a middle-income coalition preferring higher public expenditure against a coalition of high- and low- income households preferring lower expenditure (323).” The ends-against-the-middle refers to exactly this unified opposition by both the high-income and low-income households, which have different reasons for their resentment but end up in the same opposition. This model suggests that on a theoretical level, introduction of private operators in an education system can lead to the decline in allocating resources to public actors,

and this theory contradict the notion that competition will increase the school quality in the public sector, too.

2.2.1. Private provision in education systems: empirical evidence

The theories on the introduction of private schools differ from their perspectives and implications, and the empiric research in this has produced a great deal of mixed results from various perspectives too, and this section will briefly present some of these findings. The role of student performance is emphasized for the purposes of this thesis, although other effects and implications are not ignored to provide context and to showcase the multiple aspects of education systems in different types of countries and economies, all of which can be affected in different ways when private providers are introduced.

There have been mixed results in discussing the competition of private and public schools. Urquiola (2016) notes that evidence in randomized experiments from the USA, and Colombia and India. Urquila mentions that for example the introduction of voucher schools to an education market has mixed results, as “on the one hand, the findings suggest that greater private participation can cause more sorting/stratification. On the other hand, the evidence on achievement effects is mixed (233).” In regards to students moving from public to private schools suggests that there can be benefits, but the data shows that this is the case mostly the students in Colombia, and for lower socioeconomic status students from the USA (232), implying that context also matters. In India, the study found that in a lottery for school vouchers, the lottery winners “did not have higher test scores than losers in Telugu (the local language), math, English, science, and social studies; in contrast, they did perform significantly better in Hindi” (221).

Overall, in the context of developing countries research suggests that "private schools were more productive (by being able to deliver similar learning outcomes in math and language at lower financial and time cost), but not necessarily more effective at raising test scores" (Glewwe & Muralidharan 2016, 725). In examining private and public schools in India, Muralidharan & Sundararaman find that "it may be possible to substantially increase human capital formation in developing countries like India by making more use of private provision in the delivery of education (1058)." Research suggests that private schools benefit students most in the context of developing countries.

The role of private schools in raising student performance in developed countries has been found to be somewhat mixed or non-existent in the literature. Experiments involving lottery-based attendance to private elite schools in China have shown no effect on the level of student performance (Zheng 2014). It should be noted that Zheng specifically looks at prestigious "elite" schools, so it could be argued that even in the top level private schools do not in itself increase student performance. In the USA similar results were found in Chicago involving lottery-based school vouchers (Cullen et al. 2006): student performance was not affected. In the USA the role of a special kind of private schools, charter schools, in terms of student attainment is found to be minimal: "Taken as a whole, the evidence suggests that, accounting for differences in population served, charter schools are not, on average, producing student achievement gains any better than TPSs [author's note: traditional public schools]. (Epple, Romano & Zimmer 2016, 203)." This evidence also seems to contradict the theoretic notion of improved student performance across private and public schools when introducing competition to the school market.

Whether a private school is a for-profit school or for example a school ran by a religious organization can be seen to affect the incentives of a school. Lee & Bryk (1989) analyze student achievement in US Catholic high schools and public schools, and discovered that the

organizational structure of Catholic high school curriculum, "a core academic program for all students, regardless of background and future educational aspiration (188)" could have produced higher level student attainment scores. Here however it is not a matter of who provides the education, but how the provision is structured on a curriculum level: whether the provider is private or public is not suggested to be relevant. It is also worth noting that this notion of a base-level for all resembles the Finnish *peruskoulu* curriculum structure developed in the 1990s, which will be discussed more in detail in later chapters.

In terms of competition the fact that students are free to select their school is essential. An argument could be made that in primary education it is rarely just the pupil making the choice about which school to attend, but the family as a unit plays a part in the selection process. There have been critical views on the reasons that the families have for opting for a private option in the competitive market. Hart (2014) suggests that "parents may opt into voucher use because their public options are very poor, and even mediocre private schools shine in comparison" (188) and for example survey data from the US in Florida (Forster & D'Andrea 2009) and Milwaukee (Witte 2000) supports this as families self-reported this as a reason for opting for school vouchers. This could create an incentive for private schools to only slightly outperform public schools, and in cases where the public schools do not fare well this difference does not have to be a massive one.

2.3. Education systems

As this thesis will focus on the Swedish and Finnish systems as most similar cases set-up, the education systems for both countries will be contrasted and briefly introduced. Some historical aspects are presented to show the differences in the systems. Finland and Sweden have been treated before as a most similar case (e.g. Gebhard 2013), "based on their shared Nordic heritage, established historical ties, cultural and ideological similarities (365)." Table 1 shows

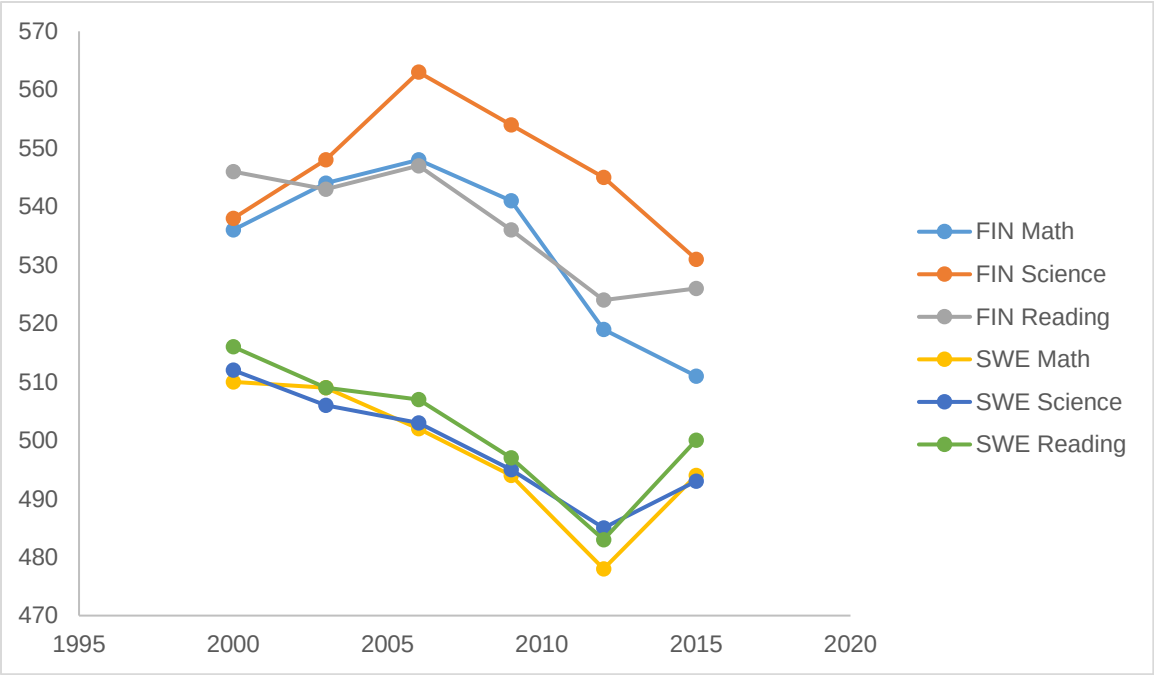
Eurostat indicators for Finland and Sweden from the category "Education" to illustrate similarities in education between the two countries.

Table 1: Eurostat Finland and Sweden (all data from 2012 unless otherwise indicated)

	Finland	Sweden
Eurostat variable (Education)		
School expectancy (Years)	20.5	19.9
Pupil/teacher ratio in primary education (Pupils per teacher)	13.6	11.8
Students - Tertiary education (1000)	308.9	453.3
Pupils learning English (% Upper secondary general education)	99.6	100.0
Employment rates of recent graduates (%	77.4 [2016]	86.7 [2016]
Share of women among tertiary students (%)	53.7	59.7
Public expenditure on education (% of GDP)	6.76 [2011]	6.82[2011]

It should be noted that the Eurostat data showcased in Table 1 is used to illustrate the most similar cases design used, and although the data used in the analysis includes country variables, they are not from the Eurostat data. Nevertheless, before discussing the differences in the systems it is beneficial to also identify similarities. The methodology section will discuss the most similar cases design, but the previous discussion showcases the basis for choosing Finland and Sweden as the two systems for the analysis. Figure 1 below shows the student performance scores in Finland and Sweden in math, reading and science from the beginning of the PISA studies in 2000 to the latest batch of results from 2015.

Figure 1. PISA scores from 2000-2015, FIN & SWE results.



The gap between the overall level of student performance in Sweden and Finland is evident. Worth noting is that the 2000 cycle is omitted from the analysis of this thesis, and the current trend for Finland has been in decline since 2006, while the Swedish results have seen an increase in test scores in the latest results. This thesis however does not discuss the direction of the trend but discusses the results in more descriptive manner.

2.3.1. Education systems: Sweden

The foundation of the Swedish education system did not include a strong private presence, but "Sweden has a historical tradition of policies on educational equality that culminated in the 1960s in one of the most radical comprehensive school systems in Europe" and in post-War Sweden "the provision of education and social welfare was a deeply intertwined process" (Wiborg 2010, 3). For the system in place during the PISA studies there has been a more recent reform which contributes to the role of private provision of education, and a significant difference between the Finnish and Swedish models.

The Swedish education system went through a reform in 1991 in regards to private and public schools. The reform introduced more school choice, and allocation of public funding to any school the student attends, essentially introducing a voucher system. The schools "may be religious and/or operated for-profit. They are not allowed to charge tuition add-ons, and must be open to all students regardless of their municipality of origin, ethnicity, or religion (Urquiola 2016, 229)." There is a great deal of public funding involved in the schools, as the reform entitled "full public funding to be calculated on the basis of the number of students" (Wiborg 2010, 9) for the private schools. The share of private operators in the Swedish market boomed after the reform (Bettinger 2011, 559).

Urquiola also notes that although national comparisons have found the private schools to perform higher in Sweden, there is an issue of grading in the national test comparisons ("independent schools were more likely to have their grades lowered after a second examination. It is possible that the independent schools — perhaps under greater pressure to please parents and to compete — engaged in more grade inflation. (231)") and that in international comparisons the overall Swedish student performance "has seen significantly deteriorating performance in the years since vouchers were implemented" (231). On the surface level this would contradict the notion that through competition both public and private schools would increase their performance. Some studies have concluded that the overall level of Swedish schools was, in the public sector also, improved after the introduction of the voucher program (Bjorklund et al. 2004, Sandstrom & Bergstrom 2002). It should be noted that these studies do not consider PISA data, and use data from the early 2000s, when only the first ever PISA cycle from 2000 had been published.

2.3.2. Education systems: Finland

The Finnish education system has also went through a reform in the 1990s. Before the reform in terms of student performance "education in Finland was nothing special in international terms" (Sahlberg 2014, 2). Sahlberg attributes the early 1990s recession as a contributor to the "*peruskoulu* or the 9-year comprehensive basic school" (3) reform. This reform did not include a voucher system to independent schools, for-profit or other, but Sahlberg highlights among others three key issues which were introduced: equal opportunity principle, career guidance and counseling becoming compulsory at school, and merging teachers from both academic oriented grammar schools as well as work-oriented civic schools into working at the same school (29-30).

Since the beginning of the PISA studies Finnish students have shown high student achievement in the tests, however with declining results in recent years. Still, the Finnish model has been found to be a successful one, e.g. Agasisti notes that in terms of efficiency and public spending on education countries like Finland "represent the 'golden standard' (2014, 554)." In this regard a lack of competition has not yielded sub-par results in the education system.

Compared to Sweden there is a difference in the Finnish school system in terms of private and public provision. Regarding funding "there are only a small number of private foundations that provide funds to public education in Finland, and they have to operate under the close supervision of the authorities. Their influence on education policies or the direction of education reforms is next to none" (Sahlberg 2014, 143).

2.4. Student performance

It should be noted that student performance in itself is naturally not a result of a single factor: "Education outcomes, ranging from performance on standardized tests to high school and postsecondary attainment, are determined by many factors including parental inputs, school inputs and environmental factors. But perhaps just as important are inputs from students themselves (Lavecchia et al. 2016, 3)." Acknowledging that there are indeed many factors involved, this thesis and the following model will focus on the part public/private provision can have in this process.

2.5. The PISA studies

This part will briefly introduce the PISA studies as a measuring tool for student attainment, and discuss its use as a tool in the literature. The role of student performance in academic research and public discourse will be discussed as well as the previous studies relating to student performance both across countries as well as in individual cases.

The PISA studies are conducted in cycles every three years to measure the competency and performance of students in various OECD and partner countries. The first PISA study was conducted in 2000, and the latest results as of writing were published in 2015. Each PISA study measures the skills of 15-year-old students in three key subjects: reading, mathematics and science, with each cycle having a special focus on one of the subjects. In the latest PISA study conducted in 2015 over half a million students from 72 countries and economies were assessed (OECD.org).

The PISA studies conducted by the OECD have played a significant role in public discussion and opinion on education policies, and for example Rautalin (2014) discusses how the results and rankings are often used in the context of education policy design as a rhetoric

tool, for example used in arguments for or against reforms. Although measuring the success of an education system is challenging, and PISA rankings do not necessarily offer a comprehensive look at a given system, it is undeniably important in any discussion on education policies and thus provides a powerful tool for the purposes of this analysis.

Student performance is obviously not a conclusive indicator of a success of an education system. As previously mentioned however, as measurements such as PISA studies have become a part of the public discourse on education it has taken a considerable role in education policy and design. Ozga et al. 2011 note that this can lead to micro level incentives to teachers and schools, such as teaching for the test and schools "cream-skimming" students: where schools seek to find students who will perform well in student performance indicators (153). The role of evaluation also has been suggested to possibly have a larger macro-level effect, and if a great deal of meaning is placed on quality assurance and evaluation it can in part "redefine the goals of education" (153).

As mentioned, PISA studies have had an effect both in Finland and Sweden in public discourse related to education systems, so the notion of evaluation as a guiding tool in shaping education policies is not far-fetched: "the evaluation according to standardized criteria defined by international skill assessment programmes" has been suggested to be prone to moving from "only a political, pedagogical practice measuring the acquisition of knowledge" and into governance (Vega Gil 2013, 100). Too much emphasis on student attainment needs to be considered with a level of caution when drawing conclusions in comparisons between education systems. From this it could be deduced that it is important that student attainment results and surveys should be approached with criticism in terms of representing an education system.

Recognizing the fact that student performance is only one aspect of an education system, and that it can be suggested that placing too much focus on it can ultimately be used to govern the system itself, it is nevertheless a significant factor in studying education from the point of view of political science, economics and social sciences. Student performance has been used in several studies, and PISA data is often the primary source for it. In previous literature the PISA data has also been utilized in examining the role of private and public schools in student performance both across countries and within a particular system.

In the literature there are multiple viewpoints and perspectives from which student performance has been examined using different variables and approaches. Multi-level analysis has been utilized with PISA data before in cases such as individual countries, i.e. Martini & Ricci 2010, examining the province of Bolzano (Alto-Adige) in Italy in terms of science performance with 2006 PISA data, or Karakolidis, Pitsia & Emvalotis (2016) with 2012 PISA data on math performance in Greece. The results have shown the statistically significant effect of for example classroom language (Martini & Ricci) and student background factors such as gender, pre-primary education attendance and ESCS, that is the PISA index of economic, social and cultural status (Karakolidis, Pitsia & Emvalotis). It has been shown that student performance does not however depend on for example the spending, as research shows that "there is no linear relationship between expenditures and educational performance: there are examples of countries that obtain good results even when investing few resources, and others that obtain low performances despite their (relatively) large investments." (Agasiti 2014, 553).

A 2012 OECD report uses data on the 2009 PISA survey on the role of private and public schools, and concludes that private schools tend to yield better student performance results as "in most countries, privately managed schools tend to have more autonomy, better resources, and perform better on the PISA reading scale than publicly managed schools (7)." However the report also notes how "on average across OECD countries, over three-quarters of

the score-point difference in performance between publicly and privately managed schools can be attributed to the capacity of privately managed schools to attract socio-economically advantaged students (20).” This result is in accordance with the previous literature on school choice, but it should also be noted that the report found that “in those countries where privately managed schools receive higher proportions of public funding, there is less stratification between publicly and privately managed schools. (7)” Both Finland and Sweden are mentioned as countries where public funding is prevalent in private schools in the report: in fact, Sweden and Finland both have an above OECD average level of public funding in private schools and a share of students attending public schools (OECD 2012, 22).

3. The model

The analysis is used to test a model which represents the hypothesis of this thesis. The model is a theoretical economic model which attempts to show the differences in incentives when market incentives are introduced, and discuss possible equilibrium derived from these incentives by applying intuition from economics.

3.1. The basic model: incentives

The model presented draws from the intuition of the for-profit role of private schools in an education system and depicts the function of market incentives in the provision of education. Private schools are considered in terms of their incentives on what kind of students they would prefer, as well as the incentives of the families making a school choice between private and public institutions.

The model depicts the functions of education provision in a society of *N* individuals, choosing between public and private provider of education, with the education having varying levels of quality, $q \in [\underline{q}, \overline{q}]$. The quality of education in the public sector is *Q*, and is financed by general taxation. In the private sector, an individual can opt to choose private education for any level, *q*, that he wants. All values of *q* and *Q* include features such as quality of teachers, students, resources etc. Every student gets utility from choosing a school, and wants to choose a school with the best possible *Q/q* that they can afford with an assumed budget constraint. The consumer who pays a premium π for schooling or education will purchase the highest possible level $q = \overline{q}$, and the private school will provide it.

When the model discusses an individual making a choice it should be noted that this does not necessarily mean the student. In terms of behavioural economics, Lavecchia et al. (2016) state that for a student entering a school, even in terms of cognitive and neurological

development they are not likely to be able to make the optimal long-term decisions about education (2). Also, in terms of families, decision-making is not simple: "investing in education may be more costly for low-income parents, so choosing to invest less is optimal" but that also when parents make decisions they

> "…may simply value education differently, although that valuation may be similarly impacted by the same behavioural [sic] barriers that affect students (eg, the low salience of long-term benefits). Another explanation is that low-income parents are less involved because they have less information about how to effectively invest." (15-16)

This model treats factors such as these as the budget constraint, indicating that not all families will make decisions in the same manner, as factors such as cognitive development, valuing education and having access for information will restrict the selection. Nevertheless, individuals will still attempt to maximize their utility, the *q* of education, so the logic of the model does not contradict this.

The model does not assume that the students have a static level of skills, but the q of the school interacts with the students. The students and schools have a cumulative, interactive effect on each other: a school with good resources helps students perform better, and accumulating low-maintenance students can affect the quality of the school. In this model, not only students with already high ability but also the students with lower ability can benefit in several ways: they get help from classmates, hard-working students can make for a better working environment, the school can afford better teaching equipment, and attract a bigger pool of teachers the school can choose from. Conversely, a concentration of high-maintenance students who take up resources has an effect in the school, and the environment can become detrimental also for the students. A classroom can see a larger concentration of students with no resources, behavioural issues, worse class-room equipment and tools, the teacher can become stressed or the working environment might not attract teachers, or the school might not simply afford to compete with teacher salaries. In terms of conventional logic, even the performance of good students can suffer from poor resources and low-performing classmates and/ or school, and it

is difficult for the already low-performing students to get better. This logic of students' ability not only being an individual trait, but a combination of peer effect and schools' resources is also presented and discussed in a theoretical model in previous literature for example by Urquoila (2016).

In a system with for profit private schools, the schools can be suggested to have incentives to select students, either those who will pay a high premium π, or who will not use up resources (so called "cream skimming"). Student selection can then give them an advantage that the public sector does not generally have. If the private sector is in the position to skim the best student material this can lead to public schools being left with either less resources or more under-performing students, making them a less appealing alternative for both students and teachers. This can lead to a situation where *q* increases and *Q* decreases, and vice versa.

Individual who opts for private education is faced with the utility function $u(\overline{q}, y - \beta p)$, utility increases in *y* and *q*. In addition, the person opting for a private school gets utility from a level of prestige γ related to the particular school: this prestige can include anything from word of mouth reputation to student achievements to school location. As previous research shows, not all families do this selection process with the same consideration, so the constraints can be subjective. The value of γ can vary depending on the system already in place. γ can be seen to be included in the *q* of the school.

The utility from paying for a private school is

$$V^I(p, \overline{q}, y, \beta) = u(\overline{q}, y - \beta p)$$

And the utility from being in a public school system can be presented as:

$$V^p(Q, y) = u(Q, y)$$

3.2. Plausible outcomes

This can lead to two different outcomes: In Case 1 just enough people leave the public sector and join private schools by freeing up resources for the public ones. Especially the theoretical notion about markets and competition would suggest that students could leave low-performing schools, and this would support this outcome. Through competition the public schools would also have to allocate their resources better to maintain a certain level of students.

Case 2 however includes the idea of student selection, leading to private schools opting for students who bring more resources than they take, leaving public schools with no such strategies. In time this would make private schools a more appealing option for families, ending up with more resources disappearing from the public sector. Eventually also for example teachers would find the workplace at public sector less appealing, and a self-sustaining equilibrium is reached in which the level of public schools starts to decrease.

With no market incentives, it should be noted that the schools would not have as much of an incentive to select students due to resources as there would not be similar need to maximize the profit. As is the case of Finland, some other reason than the profit motive would be needed to establish a private school, such as curriculum or a pedagogical theory. This does not imply that the schools would not be seeking to maximize their utility: any school would still prefer more resources, and families would prefer schools with higher rather than lower q. Indifference could lower the variation between the schools for both, as there would be no school level incentives to select any particular school. In this case, the distribution of students can be suggested to be more random than in the case where competition drives school choice. This more random grouping will lead to more variation in the student material per school, taking away some of the peer effect which drastically improves or decreases student performance.

3.3. The limitations of the model

The model, as any model, relies on some assumptions. There are assumptions about both schools and students/ families as rational actors who want to maximize their utility. The students/ families can do this through selecting better-quality schools, and schools by preferring high-attainment students who bring more resources than they take. Interaction between high-performing and low-performing students and schools is assumed to occur, amplifying both the results for top performance as well as underperforming.

3.4. The implications of the model

The implications of this model are based on the incentive that the private schools have in picking and choosing students. Although they are not in the position to decline any student from enrolling, they have an incentive to target students in a different way than public schools. Previous literature shows that school choice does depend on the family or the student making the choice, and there are different constraints on this. It is not a stretch to suggest that families or students with no interest or resources in choosing a school will more likely end up in a public school in such a system.

The model would suggest two observable results: either a system where the private sector in a sense "picks up the slack" and frees resources for the public sector, improving quality of the entire system. On the other hand it can lead to a system where the private schools out-perform the public schools, but this does not increase the overall level of performance as the public sector can become worse. As any model, this also relies on assumptions about the incentives and resources of the students, the families as well as the schools, so it is possible that neither of the outcomes holds up when examining the data.

As mentioned previously, in both the Finnish and Swedish systems the private schools cannot decline a student from enrolling. However, the public schools are always the passive recipients of students, as students are assigned to them anyway, unlike in the case of private schools. It follows that although the institutional design does not enable outright student skimming, the public system is still in a different position. In Finland, the private schools also lack some of the market incentives as they are not allowed to turn in profit. It should be noted that they will still have some incentive to screen students, as their resources are limited and some students can take up more of that than others.

The hypothesis that competition will improve quality in both schools is a very fragile equilibrium here. Essentially this would require Case 1 to be the outcome. If however Case 2 is observed, then the quality of the public sector should be decreasing. The profit-motive would strengthen the private schools' incentive to acquire more low-maintenance students, since each student brings with them resources in the shape of funding, but will also take up resources. In turn this will leave the public sector with more students with lower student achievement. As the level of public sector decreases, the private schools do not need to perform substantially better as they will still remain a better alternative for the families making the school choice.

4. Methodology

This section will discuss the case study design incorporated in the thesis, the most similar cases approach. For the purposes of the research design and the analysis a multilevel model will be utilized. The justification for multi-level analysis and its pervasiveness in education research is highlighted.

4.1. Most similar cases

The approach to examining the relation between the structure of the education system and student performance requires other factors to also be considered. In a comparative analysis between two systems there is a need to consider the framework in which the two cases are contrasted. Case selection is essential in this matter, and this thesis employs the most similar systems method. In this system the attempt is to consider a question of similarity in the cases: "Does one select cases that are apparently the most similar, or should the researcher attempt to select cases that are the most different? Further, like much of the other logic of comparative analysis, this logic can be applied to both quantitative and qualitative work." (Peters 1998, 37).

In comparative analysis, as Peters notes, the attempt can be seen to be the attempt to "maximise experimental variance, minimise error variance, and control extraneous variance" (30). Research design can only attempt to minimize, maximize and control variance, but all of these variance types will still be present in some form. After all, experimenting on people or governments has "a huge number of practical and ethical limitations" (36) so selection of cases can have a part in controlling variation. For this reason, it is common for comparative analysis thus to display "purposeful, rather than random, selection of the cases" (37). This thesis follows this tradition, as the comparison between Finland and Sweden is based on conscious selection to ensure a plausible and practical comparison between education systems and providers of education.

One of the biggest concerns and limitations of comparative research is how to ensure that the variables actually have a relation and the observed correlation is not merely capturing something else. As Peters notes, it "may be that it is not possible to identify all the relevant factors that can produce differences among systems (38)." However, for the purposes of this thesis the difference is there on an institutional level, and the data enables the identification and examination of variables relating to this difference. Yet acknowledging the possible limitation of the comparative design is crucial and should be considered. Moreover, Przeworski & Teune (1970) state that even when observing differences "the efficiency of this strategy in providing knowledge that can be generalized is relatively limited (34)." Cautiousness in interpreting the results of this thesis for general context is undoubtedly important to note.

The benefits of utilizing most similar cases are evident in the literature. An important benefit is the framework it provides for comparative analysis. As previously discussed, comparative analysis has its challenges, but most similar systems can be seen to control for variance in the study, as "common systemic characteristics are conceived as 'controlled for' whereas intersystemic differences are viewed as explanatory variables" (Przeworski & Teune 1970, 33). The design is also widely used, as Peters (1998) notes how "most similar systems design is the usual method that researchers in comparative politics undertake" and how the design has been argued "to be *the* comparative design" (37-38).

4.2. Multilevel model

Hypotheses on education concern the effects of policies or practices in processes at not only at the level of the individual, but also schools or classes. As Raudenbush & Byrk (1986) point out, this means than when examining the variables "are typically measured at a higher level of aggregation than the outcome variables of interest" (1), and therefore "such hypotheses are inherently multilevel (1)."

An often-used method in measuring student performance is the multilevel model, or hierarchical model (e.g. Karakolidis et al. 2016, Martini & Ricci 2010). A multilevel model lends itself to school comparison since it considers the grouping of students: the students are grouped in a class, or a school so the chance for biased estimates is possible in a standard regression which does not take into account the hierarchical grouping. Since hierarchical groups are common in social sciences, it is essential to consider these groups in the analysis also, as for example Raudenbush & Bryck (2002) mention units such as workplaces and firms appearing in analysis (4). Indeed, education also is used as a frequent basic example on when a multilevel regression model is the most suitable method of analysis (Gelman & Hill 2007).

The traditional regression analysis has been criticized when used to analyze data from schools, as student performance tends to be clustered to groups, such as schools, classes etc. and the traditional linear models ignore this, and can "produce misleading results" and that this "increasing awareness of the mismatch between multilevel social processes and the traditional statistical models used to study them" has resulted in developing multilevel models (Raudenbush & Bryck 1986, 1). In measuring student attainment, this is especially useful: it is not difficult to see the patterns for levels of schools, classrooms etc.

However, there are issues and limitations to consider in the use of the multi-level model. It should be noted that, for example, Karakolidis et al. find that the multilevel model underestimation of standard errors and small p values, which can lead to rejection of the null hypothesis even when it might be the case (109). With any model, there are restrictions in its use and it is crucial to acknowledge possible shortcomings and risks. However, given the long tradition of multilevel models in education research and its suitability to the hierarchy of data on country and school level, it is an optimal method to be used in the analysis of this data.

5. The Data

This section will briefly introduce the data used, as well as detail the data gathering methods and the variables included in the analysis. Justification for the selection of variables is presented from previous research in the variable selection, but also some limitations which affected the data gathering as well as the availability to use certain variables are discussed. All methodological choices were ultimately made by the author.

5.1. Data gathering

The bulk of the data used in the analysis is from the PISA studies from 2003 to 2015, available directly from the OECD online database, unless otherwise indicated. As the school and student level data are separate datasets, the author has combined them in preparation for the analysis. In total the five cycles used contain a total of 39 182 observations. OECD sorts the data by the different three-year cycles, so the various cycles were combined with year added as a separate variable by the author. In the data gathering phase the extensive list of different PISA variables was narrowed down to the chosen variables, and additional variables for country level was chosen. The following section will examine more in detail the method of the inclusion of selected control variables as well as the limitations which affected the gathering and formatting of the data included.

The other school level and student level variables are compiled from the OECD PISA data available on the OECD PISA website. OECD lists the data in separate datasets by every cycle. Although the studies might ask the same questions and thus have common variables, every year there is slight variance in for example the order of the questions, the number of digits in the variables e.g. in 2003 the school ID is expressed in the format of 0001; in 2015 it includes the country number at the beginning of the numeric string, for example as 24600001. To enable the analysis of some of these differences, the formats were merged by the author when required.

The PISA data lists the variables with a code relating to a question in the school or student questionnaire (e.g. first question in the school questionnaire can be labeled as SC01Q01). The description of the variable informs the actual question, but as the order of the questions varies from cycle to cycle, this in numerous cases required renaming the variables in the raw data.

The data is listed by the OECD in two separate data sets for each year, a student data set and school data set. To compile all the data, first the school and student data sets were merged by using the school ID numbers and then the country level variables as well as the PISA year were added. This process was repeated for each cycle, and then the relevant variables were identified and retitled as necessary in the data. Finally, every year was merged in one dataset which includes all the relevant data for the PISA cycles between 2003 and 2015.

Certain answers needed to be recoded into different values as OECD can list for example a missing answer as ‘999’ so in order to avoid bias caused by leaving large numeric numbers in the datasets each variable needed to be evaluated for recoding. The fact that not only do the cycles vary in terms of the order of the questions, in some cycles certain variables were not included at all. These limitations considering data will be discussed later, after introducing the variables used for the analysis.

5.2. Variables

This section will outline the variables included in the analysis, as well as document the data from other sources than the PISA database. The control variables have been discussed in relation to student performance before, and some of the previous literature will be mentioned. Finally, some limitations for the data are discussed, stemming from the data sources, documentation and methodological issues.

The PISA questionnaire includes the school level data on private and public provision of education. There is a question on the institutions themselves as under a private or public management, as well as questions on where the school funding comes from (government, student fees, and beneficiaries). Funding is reported as percentages in the data, and as mentioned in the literature, due to the voucher system public funding is by far the biggest source of funding in private schools also. Three school types are also included: public, private government-dependent, and private independent. This thesis includes all these variables to offer a more comprehensive look at the issue of private and public schools. For the dummy variable of private/public, the portion of private schools in the data is 5.20 % for Finland and 10.14 % for Sweden, with the total of both countries as 7.05 % of all the schools in the data.

In addition to the private/public variables presented earlier, these variables include among others socio-economic factors, school location, gender, language spoken at home, immigration status, and the student performance as the dependent variable. Table 2 lists all the variables used in the analysis.

Table 2. the variables used for the analysis

Student Level
Female
Age
Immigrant
Non-Native Speaker
ESCS Index
School Level
Small town
Town
City
Large City
Private
Government Funded
Student Fee Funded
Benefactor Funded
School Type
School Size
Proportion of female students
Student-Teacher Ratio
Proportion of qualified teachers

Country Level
Sweden
PISA Survey year
GDP**
Satisfaction with Education*

Note: all the variables are from the OECD except * from World Bank and ** from ESS

5.2.1. Country level variables

The country level control variables are not from the OECD PISA data, but were gathered elsewhere. The GDP for each year was collected from the World Bank online data, and the variable "satisfaction with education system" from the European Social Survey (ESS) database. As the ESS rounds are done every other year, starting from 2002, there was no value for each specific year of the PISA cycles (2003, 2009, 2015) so in those cases data from the last available year was utilized (2002 for 2003, 2008 for 2009 and 2014 for 2015). Country is presented as a dummy variable (SWE=1) in the analysis.

5.2.2. School level variables

The location of the school has been discussed in relation to student performance in previous research. A 2013 OECD report on the 2009 PISA survey notes that there is a difference in student performance between urban and rural areas as "on average across OECD countries, students who attend schools in cities of more than 100 000 people perform better in PISA than students who attend schools in villages, rural areas, or towns with up to 100 000 inhabitants (OECD 2013, 1)." This difference is not independent of other factors, as the report notes that "while the performance difference is related to the socio-economic status of students, it is also associated with some of the characteristics that distinguish urban schools, such as having more and better resources, greater autonomy in how they allocate those resources, and

an adequate supply of teachers (4).” This analysis also includes the location of a school as a control variable, scaled from rural to urban.

School size is also included as a school level variable. Since classroom size was not included in all the PISA data (the chapter on limitations will cover this more in depth) the students per teacher ratio is included. Proportion of certified teachers is included to control for the qualifications of the teaching staff at the schools.

5.2.3. Student level variables

On the student level the variables included are sex, age, immigration status, whether the language spoken at home is the same as the test language, and ESCS. The ESCS is the PISA index of economic, social and cultural status, and it consists of:

> “the International Socio-Economic Index of Occupational Status (ISEI); the highest level of education of the student’s parents, converted into years of schooling; the PISA index of family wealth; the PISA index of home educational resources; and the PISA index of possessions related to “classical” culture in the family home.” (OECD Education at a Glance Glossary 2002, 10)

Immigration and education have been shown to connect in many ways. For example in the USA immigrant students have been shown to have less schooling on average (Smith 2006), and that there is “considerable diversity in the schooling accomplishments among different immigrant sub-groups (186).” The PISA data enables controlling for immigration and student’s language at home, which is expected to have an effect on the performance. A 2015 OECD report suggests that “PISA data have consistently shown a performance gap between students with an immigrant background and non-immigrant students (1).” In the case of Finland and Sweden the report shows that in Finland the performance gap in mathematics is actually wider than in Sweden between immigrant and non-immigrant students, and that the gap has widened between 2003 and 2012, while in Sweden it has decreased (3).

Although the significance of gender on student performance has been contested (for example Lindberg et al. 2010 find no gender difference in mathematics performance based on data from 242 studies and four large US national data sets), in some contexts however it has been found to be a statistically significant factor (Karakolidis et al. 2016). Thus gender is taken as a control variable in the analysis.

The actual student performance in the three tested subjects (math, science, and reading) are reported in the PISA data as plausible values. As the OECD PISA data analysis manual (2009) mentions, "it is unreasonable and perhaps undesirable to assess each sampled student with the whole item battery" since "after extended testing time, students' results start to be affected by fatigue" and "school principals would refuse to free their students for the very long testing period" (80), so the student scores are reported as plausible values, scaled using the Rasch model (OECD 2009, 118). The Rasch model is a type of logit model which "describes the probability that, when a group of individuals are asked a number of questions, individual *j* makes a mistake in answering question *k* (Upton & Cook 2016)." The Rasch model has been used in the literature in test performances (e.g. Beglar 2010) so it is not uncommon in literature on information about test scores.

Taking into consideration the recommendation of the OECD PISA data analysis manual (2009), the plausible values presenting the student performance have been calculated from five separate plausible values for each subject found in the data to avoid bias in the results. Then using this total value of each subject a separate multilevel model is calculated. In addition to this, the student weights from the PISA data were used in the multilevel regression model to avoid possible bias stemming from sample sizes.

5.3. Limitations

There were some limiting factors and issues when compiling the data from different PISA cycles. The data for the 2000 survey was excluded since the student performance was divided by each measured subject (i.e. math, science, reading) into separate data sets while other cycles list all three for each student. The number of cases varies between the three datasets, so in order to avoid a large amount of missing data the 2000 cycle was omitted by the author.

While previous literature on the analysis of student performance has included variables such as pre-primary education attendance and found them statistically significant to student performance (e.g. Karakolidis, Pitsia & Emvalotis, 2016), this analysis has not incorporated every possible variation from the PISA studies due to the difference of the data gathering in the survey cycles. For example, reporting class size was missing from the 2003 and 2009 cycles. In cases like this the variable can be suggested to be worth considering in the analysis, but to avoid missing data they too were omitted. However for example student to teacher ratio can be seen to help cover some of this missing data. Some missing information was completed by the author, i.e. 2015 school level data on "proportion of girls" was calculated from the reported total number of students and number of female students.

Still, the variables did include some missing data: for example in the 2015 Swedish data all of the schools did not report whether they are public or private, nor did the percentages of their sources of funding. However, these cases of missing data were exceptions rather than a recurring issue and the analysis itself was successfully completed despite this. In the results section some of the missing data was accounted for by checking for robustness. In addition to the limitations in the data gathering process, to circumvent possible issues of co-linearity additional analysis was carried out to ensure robustness in the school type and private/ public dummy variable.

The variables about education are much more complex than single variables can often capture, and certain level of simplification is a requirement for any data analysis. Issues such as teacher quality are much more complex than simply whether the teacher is qualified or not. Some aspects which can be argued to affect student performance such as homework, classroom environment, teaching material etc. are not included partly because of their availability in the PISA data and partly because of the focus of the analysis. The so-called kitchen sink -approach is not beneficial to a complex matter such as education system, as arguments can be made about many choices in the variables selection. All additional data however can be utilized when considering possible future research into the topic.

In conclusion, future research can aim to incorporate a higher number of relevant variables in the model, but for the purposes of this thesis the chosen variables provide sufficient number of variables on country level, school level as well as student level. Although some of the variable selection had to be made due to technical constraints, the PISA data provides a comparable and comprehensive set of information for all the selected variables for all the cycles from 2003 to 2015. Some issues about missing data and robustness will be accounted for in additional analysis.

6. Results

The results obtained from the PISA data are presented below. Three separate multi-level analysis was conducted, one for each test subject. The main focus of the discussion will be on interpreting the results for the private and public provision of education, but as the theoretical background shows, and given the complex nature of factors involved in student performance, other variables will also be considered. The results are presented below in addition to further discussion on them.

Table 2: Multilevel Estimates of Student Performance

	Science	Math	Reading
Student Level			
Female	5.45***	-3.31***	46.78***
	(1.039)	(0.974)	(0.949)
Age	10.19***	12.29***	10.56***
	(1.674)	(1.587)	(1.734)
Immigrant	-43.63***	-31.07***	-32.79***
	(3.051)	(2.854)	(2.721)
Non-Native Speaker	-8.06***	-7.63***	-7.78***
	(0.593)	(0.542)	(0.627)
ESCS Index	31.22***	30.77***	29.71***
	(0.835)	(0.757)	(0.849)
School Level			
Small town	1.18	-2.16	2.10
	(3.763)	(3.620)	(3.876)
Town	-1.03**	-0.55	5.82
	(3.956)	(3.641)	(3.988)
City	-2.40**	-3.46	4.77
	(4.917)	(4.660)	(4.732)
Large City	27.15***	23.12**	27.01**
	(8.047)	(10.780)	(10.504)
Private	13.48**	12.01**	19.40***
	(6.284)	(5.585)	(6.200)
Government Funded	1.98	-0.19	0.94
	(1.740)	(1.426)	(2.380)
Student Fee Funded	2.57	-0.40	-0.48
	(2.577)	(2.073)	(2.940)
Benefactor Funded	-2.41	-4.33**	-2.63
	(2.065)	(1.918)	(2.913)
School Type	1.12	-2.06	0.18
	(5.166)	(4.771)	(5.013)
School Size	0.02***	-0.03***	0.03***
	(0.006)	(0.005)	(0.006)
Proportion of Female Students	0.03	0.19	-0.02

	(0.205)	(0.186)	(0.194)
Student-Teacher Ratio	0.22	0.04	0.40*
	(0.495)	(0.503)	(0.559)
Proportion of Certified Teachers	13.08	11.24	16.87
	(8.960)	(8.636)	(10.295)
Country Level			
Sweden	-46.96**	-27.49	-30.91*
	(18.556)	(18.873)	(18.767)
PISA Survey year	-4.01***	-5.83***	-4.19***
	(0.866)	(0.872)	(0.975)
GDP	12.74***	12.56***	6.52
	(4.122)	(4.034)	(4.423)
Satisfaction with Education	4.14	7.94	3.67
	(8.529)	(8.724)	(8.556)
Constant	8125.349***	11931.78***	8575.05***
	(1705.111)	(1725.805)	(1928.933)
Observations	39182	-"-	-"-
Number of Schools	405	-"-	-"-
Number of Countries	611	-"-	-"-
Log Likelihood	-3264755.8	-3221558.1	-3236331.6
Wald Chi-Square	4190.90***	4894.04***	6159.06***

Notes: Standard errors are reported in parentheses * indicates p<0.1; ** p<0.05; *** p<0.01.

6.1. Private and public actors

Overall, the dummy variable for private/public shows that private schools do have a statistically significant positive impact on student performance in all the three subjects. The significance in especially reading is strong, and in science the coefficient is the also the largest. The school type variable is not statistically significant in any case, and has mixed results as in mathematics the coefficient is negative. Also, it has a smaller positive coefficient than the private/public dummy variable.

Funding aspect gives mixed, insignificant results in all the cases. It should be noted that government funding covers most of the private schools also, so it does not separate between the private and public school performance. Although the results are not statistically significant, student fees have a negative coefficient in all but science results, while benefactor funding has a negative coefficient across the board. However, the share of non-governmental funding is a small part of all the observations: out of the total number of observations, only 8.97% of the

cases report less than 99,99% of their funding from government. This shows that even in the for-profit private schools the largest part of resources for the school come from the government, which is in accordance to the background literature.

6.1.2. Private and public actors: implications for the model

Making a definitive statement about the results would not be justified, but some cautious theoretical assumptions on the mechanisms can be made. There are at least two alternatives which can be discussed: either the private schools have managed to attract resources and students, leaving the public sector with lower-performing students, which contributes to the gap between private and public school student performance. As the student level variables are statistically significant in every case, with all the p-values <0.01, this seems to suggest that student features have more pronounced of an impact than the school. From this follows the assumption that a school would have incentives to select students in some manner; students who bring in more resources than they use.

It should be noted in this case also that in Finland the share of private schools in the data (5.2 %) is smaller than in Sweden (10.14 %), so the claim can be made that perhaps the largest part of the effect comes from Sweden. Although the coefficient is a positive one, Sweden has lower overall student attainment scores than Finland for all the subjects in all the PISA cycles. The fact that in Sweden most of the schools are still public yet the private schools are correlated with better student attainment makes it questionable to assume that the schools do not only gain better results through increased performance level, but the students leaving public schools might decrease attainment at those schools.

One matter to keep in mind when discussing the results is that the distribution of the results is not apparent in the regression. In future studies the distribution could be argued to be

a worthwhile topic of consideration: indeed, in discussing student performance it is crucial to bear in mind that the spread of the results across the board can help in discussing the system as a whole. A system with wide performance gap amongst the schools can still yield a high mean score. Furthermore, as discussed earlier the gap might not be only due to improvement in one set of results but also a decline in the other.

A certain issue of causation occurs when theorizing for the efficiency of private schools: are they in themselves better than public schools due to innovation, freedom and de-centralization, or have they managed to gather the resources and students to obtain a high level of not only q but also the prestige γ, and thus becoming a choice with better utility for the families choosing the schools? The incentives as presented in the model could suggest the latter, but any definitive statement would need more data and background research, such as comparable data on the level of student performance in Sweden and Finland before the reforms of the 1990s to compare if there was a difference in the results before that.

One theoretical assumption from the literature on private schools which the results do not seem to support is that the quality and performance of public schools would increase as well with competition: although the private schools correlate with higher student performance, the Swedish results are also significantly lower than in Finland, where the reform did not lead to market competition in regards to schools. It can be the case Swedish students are lower performers for other reasons, but the effect of private schools and competition still seems to be minimal in raising quality across the board in private and public sector.

This would have indication in the policy suggestions about the effectiveness and efficiency or market incentives. It seems that at least on the level of student performance private schools do perform better than the public ones. How this develops the public sector is not evident from the data, but the model would suggest that not only do the private schools perform better, but the public schools' quality can deteriorate as a result of this. Although the results in

within a single system can seem like a preferred one, the comparison offers some perspective on the impact of the system.

According to the model, there is an incentive for the private schools to outperform the public schools: but as they improve, the resources move with the students, and the schools might for example become a more appealing workplace for teachers etc. This can lead to the self-sustaining equilibrium of resources escaping the public sector mentioned in the model. The strong increasing impact of the proportion of certified teachers (although it is not statistically significant) suggests that the teachers matter also, but whether this is once again a result of e.g. private schools having more effective methods of teaching, or stemming from attracting more resources (such as better teachers) is worth pointing out.

Since the PISA data does not differentiate between strictly for-profit schools from for example schools set up by religious organizations or for example schools set up for other reasons (e.g. Rudolph Steiner schools) it is not possible to make a too strong of a statement regarding the role of private schools. Although the profit motive might have an impact, it is likely that not all private schools in Sweden exist for the profit motive in the same manner. Moreover, the families choosing a school run by a religious organization, or one with a different pedagogical theory than other schools, might not care only about the actual q of the school, but prefer and emphasize different rationale in the selection process. Nevertheless, as in Finland that market-based incentive is not even an option for the schools it can be suggested to be more prevalent and have an impact in the Swedish student attainment results.

Worth noting is that the model or the results do not suggest so-called “cream skimming” where the private schools only accept or find strategies to acquire the top level students. The logic of wanting to get more resources than spending them however does not rely on this assumption or suggest that it is the only outcome of such an incentive.

In conclusion, from the data can be argued that private and public provision can be seen to have an effect. For the individual student attending private school seems to have a positive impact in student attainment, yet for the system in general it does not seem to yield overall improvement in the student performance. This is in accordance to some of the earlier theories and seems to offer more support towards the hypothesis of inequality in terms of the quality of schools than the overall improvement through competition.

6.2. Results and restrictions: Collinearity

An issue of possible collinearity in the results the school type (public- private, public management- private, private management) and the dummy variable for private school can be raised, as both concern the management of the school. To control for this, additional multilevel analysis was run with each variable left out. The exclusion of public/private dummy variable does increase the coefficient for school type, but there is no change in the significance of p-values for either of the variables. The table below illustrates the changes in all the subjects with both cases alongside a comparison with the original model. Nevertheless, in future analysis a more precise categorizing of the school management variables can be in order. As previously discussed, private schools can have different incentives for their operation, and lumping all of them under one banner might not be the most optimal manner to categorize and discuss them.

Table 3: Multilevel analysis for collinearity – School type and Private/ Public

	School type (og)	School type only	Private (og)	Private only
Subject				
Science	1.12	4.65	13.48**	13.88**
	(5.166)	(4.561)	(6.284)	(5.503)
Math	-2.06	1.09	12.01**	11.28**
	(4.771)	(4.317)	(5.585)	(4.893)
Reading	0.18	5.24	19.40***	19.46***
	(5.013)	(4.639)	(6.200)	(5.540)

Notes: og = original analysis, see Table 2. Standard errors are reported in parentheses * indicates p<0.1; ** p<0.05; *** p<0.01.

The fact that there seems to be little collinearity with school type and private/public dummy variable is hardly surprising. In both Finland and Sweden the funding comes mostly from the government, so there is not too much overlap between school type and private and public schools expected: after all, the private schools form both private – government dependent and private – government independent categories. As can be seen, leaving out the dummy variable for private and public does increase the coefficients for school type in all the subjects, but it still is not statistically significant. Leaving out school type however does not alter the significance of private/public as a variable, and the change in the coefficients is also small.

The PISA data records both the management and funding of schools. Although the analysis has incorporated all the possible variables concerning this it is possible to assume that also school type and school funding might have collinearity issues, as government-independent schools can be expected to use student fees more than government funding. To check for collinearity in this case a similar analysis as in the previous one was conducted, with dropping student fees and school type. The results are shown below in Table 4.

Table 4: Multilevel analysis for collinearity – School type and Student fees

	School type (og)	School type only	Student fees (og)	Student fees only
Subject				
Science	1.12	0.73	2.57	2.58
	(5.166)	(5.197)	(2.577)	(2.552)
Math	-2.06	-2.53	-0.40	-0.42
	(4.771)	(4.744)	(2.073)	(2.090)
Reading	0.18	0.07	-0.48	-0.48
	(5.013)	(5.007)	(2.940)	(2.935)

Notes: og = original analysis, see Table 2. Standard errors are reported in parentheses * indicates p<0.1; ** p<0.05; *** p<0.01.

In the case of Student fee funding and School type, the significances do not change dramatically in any case. Removing a variable does very little to the coefficients and rbust standard errors also. Especially in the case of student fees this is the case, but it does not seem surprising since student fees are a very rare source of funding in both countries.

6.3 Results and restrictions: Missing data

As mentioned in the data section, 2015 has many cases of schools not willing to report if they are a public or private school, their school type or the funding percentages for the data. Although encountering missing data is by no means a rare phenomenon in the analysis in the social sciences, and although it is a rare occurrence in this data also, it is nevertheless a notable issue which can be addressed. To account for the missing data and whether it influences the analysis, an additional multilevel analysis was conducted using only the 2003-2012 PISA cycles. The results are presented below in Table 5. The changes in significance of the variables has been highlighted, and the implications are discussed below.

Table 5: Multilevel Estimates of Student Performance (2003-2012 only)

	Science	Math	Reading
Student Level			
Female	4.78***	-3.71***	46.93***
	(1.083)	(1.022)	(0.997)
Age	9.87***	12.46***	10.22***
	(1.754)	(1.672)	(1.822)
Immigrant	-42.98***	-30.54***	-31.75***
	(3.136)	(2.934)	(2.787)
Non-Native Speaker	-8.06***	-7.62***	-7.78***
	(0.595)	(0.544)	(0.630)
ESCS Index	31.16***	30.78***	29.68***
	(0.872)	(0.791)	(0.890)
School Level			
Small town	1.30	-2.07	2.23
	(3.786)	(3.640)	(3.894)
Town	-0.95	-0.49	5.90
	(3.975)	(3.654)	(4.001)
City	-2.38	-3.42	4.81
	(4.940)	(4.670)	(4.751)
Large City	27.16***	23.10**	26.90**

	(8.042)	(10.720)	(10.475)
Private	13.44**	11.90**	19.28***
	(6.297)	(5.591)	(6.214)
Government Funded	2.03	-0.14	1.01
	(1.774)	(1.448)	(2.411)
Student Fee Funded	2.63	-0.35	-0.41
	(2.593)	(2.087)	(2.963)
Benefactor Funded	-2.37	-4.30**	-2.57
	(2.092)	(1.928)	(2.934)
School Type	1.03	-2.13	0.12
	(5.179)	(4.779)	(5.024)
School Size	0.02***	-0.03***	0.03***
	(0.006)	(0.005)	(0.006)
Proportion of Female Students	0.02	0.20	-0.01
	(0.207)	(0.187)	(0.195)
Student-Teacher Ratio	0.24	0.05	0.42
	(0.496)	(0.504)	(0.561)
Proportion of Certified Teachers	13.07	11.10	16.77
	(9.050)	(8.713)	(10.372)
Country Level			
Sweden	-42.39**	-19.59	-22.41
	(19.595)	(20.031)	(19.802)
PISA Survey year	-4.19***	-6.17***	-4.50***
	(0.969)	(0.985)	(1.074)
GDP	13.49***	13.91***	7.76
	(4.490)	(4.442)	(4.781)
Satisfaction with Education	5.12	9.74	5.31
	(8.842)	(9.078)	(8.846)
Constant	8489.995***	12579.67***	9180.599***
	(1901.634)	(1940.806)	(2115.775)
Observations	35607	-“-	-“-
Number of Schools	303	-“-	-“-
Number of Countries	509	-”-	-“-
Log Likelihood	-3063471.9	-3026667.8	-3038471.9
Wald Chi-Square	4100.90***	4821.60***	5750.23***

Notes: Standard errors are reported in parentheses * indicates p<0.1; ** p<0.05; *** p<0.01.

In the cases highlighted the coefficients' p-values changed enough to no longer be statistically significant (p<0.1). For science excluding the 2015 data increases the p-values for city and town, and for reading student-teacher ratio and dummy variable for Sweden are no longer statistically significant. For the case of mathematics, the significances do not change at all. For the focus of this thesis, the values relating to the significance of public/private dummy variable, school type or funding do not change in a statistically significant way for any of the subjects. This would seem to suggest that despite the missing data, the original analysis gives a

sufficient result concerning the variables chosen. Some variation in the coefficients and robust standard errors occurs, but this is to be expected as an entire cycle's worth of results is omitted.

Overall the private and public provision of education has a statistically significant part in student performance in several ways. The implications of the results can be discussed in the framework of the model presented, and although definitive statements are challenging to make based on the single analysis, at the very least the overall improvement of quality through competition does not seem to realize in the student performance. The following part will highlight other

6.4. Additional results: Country level variables

Table 6: Multilevel Estimates of Student Performance – Country Level

	Science	Math	Reading
Country Level			
Sweden	-46.96**	-27.49	-30.91*
	(18.556)	(18.873)	(18.767)
PISA Survey year	-4.01***	-5.83***	-4.19***
	(0.866)	(0.872)	(0.975)
GDP	12.74***	12.56***	6.52
	(4.122)	(4.034)	(4.423)
Satisfaction with Education	4.14	7.94	3.67
	(8.529)	(8.724)	(8.556)

The country level variables show statistical significance in the cases of GDP, PISA survey year and dummy variable for Sweden. Out of these only PISA survey year shows strong significance in all the cases, while Sweden in cases for science and reading, and GDP for science and math. Out of these, GDP has a strong statistical significance in science and math, but causation and correlation between these should not be assumed. Both Sweden and Finland are countries with relatively constant GDP through the cycles, so the direct effect is debatable. The PISA year shows a negative coefficient, but given Finland's decline in scores since 2006

and Swedish results only having improved in the latest set of results from 2015, it is hardly surprising and seems to merely show this correlation. The unit of country in the study is a huge group, so the explanatory power of even the statistically significant variables is unlikely.

6.5. Additional Results: School level variables

Table 7: Multilevel Estimates of Student Performance – School Level

	Science	Math	Reading
School Level			
Small town	1.18	-2.16	2.10
	(3.763)	(3.620)	(3.876)
Town	-1.03**	-0.55	5.82
	(3.956)	(3.641)	(3.988)
City	-2.40**	-3.46	4.77
	(4.917)	(4.660)	(4.732)
Large City	27.15***	23.12**	27.01**
	(8.047)	(10.780)	(10.504)
Private	13.48**	12.01**	19.40***
	(6.284)	(5.585)	(6.200)
Government Funded	1.98	-0.19	0.94
	(1.740)	(1.426)	(2.380)
Student Fee Funded	2.57	-0.40	-0.48
	(2.577)	(2.073)	(2.940)
Benefactor Funded	-2.41	-4.33**	-2.63
	(2.065)	(1.918)	(2.913)
School Type	1.12	-2.06	0.18
	(5.166)	(4.771)	(5.013)
School Size	0.02***	-0.03***	0.03***
	(0.006)	(0.005)	(0.006)
Proportion of Female Students	0.03	0.19	-0.02
	(0.205)	(0.186)	(0.194)
Student-Teacher Ratio	0.22	0.04	0.40*
	(0.495)	(0.503)	(0.559)
Proportion of Certified Teachers	13.08	11.24	16.87
	(8.960)	(8.636)	(10.295)

Out of the school level variables, other than the private dummy variables, school size and location have statistical significance. This thesis does not focus on these issues per se, and it should be noted that especially in the cases of school location the variable for “A large city” includes only Stockholm and Helsinki, so it should be kept in mind when considering the

results. Whether the causation tells about the schools of the area or the student material is again debatable. Metropolitan areas can be seen to have access to plenty of resources so the schools themselves can have better access for resources such as funding, qualified teachers etc. but cities can also attract for example families with better socio-economic background.

One implication of the positive effect of the schools in a large city is that a difference between urban and rural areas can be seen. The coefficients for town and city which are negative in both science and math, but it should be noted that only in the case of science they are statistically significant.

School size is another consistently significant school level factor, but the coefficient is very small in all the subjects, and has somewhat mixed results ranging from -0.03 to 0.02. This could suggest that school, although significant, has a minimal effect on an institutional level in either systems.

In future analysis focusing the scope of the research by comparing for example only schools in large city areas can add to the details about student performance across systems, and make a most similar cases design stronger. The interaction between variables is very possible, so accounting for differences in them can lead to more precise results in the future.

6.6. Additional Results: Student level variables

Table 8: Multilevel Estimates of Student Performance – Student Level

	Science	Math	Reading
Student Level			
Female	5.45***	-3.31***	46.78***
	(1.039)	(0.974)	(0.949)
Age	10.19***	12.29***	10.56***
	(1.674)	(1.587)	(1.734)
Immigrant	-43.63***	-31.07***	-32.79***
	(3.051)	(2.854)	(2.721)
Non-Native Speaker	-8.06***	-7.63***	-7.78***
	(0.593)	(0.542)	(0.627)

ESCS Index	31.22***	30.77***	29.71***
	(0.835)	(0.757)	(0.849)

Most of the significant coefficients are at the student level variables. Each of the five variables is statistically significant, with especially immigration and socio-economic features affecting the PISA score. This can be seen to suggest that the student material has a larger effect on the student performance than the school as an institution. However, as it seems to matter who provides the education and there is variation between institutional elements it is not only a matter of the features of a population. To ensure a more comprehensive hypothesis a comparable data from a period before the 1990s reforms from both countries should be examined to make a comparative argument.

The PISA studies test the skills of 15-year-olds, so the fact that age has a positive coefficient does not seem to contradict conventional wisdom about schooling: after all the older students might have one year more of schooling depending on when they began school: for example a 15-year-old born very late in the year might still attend the eighth grade.

The differences between the three subjects show notable results. As the previous literature has been mixed about female versus male students in terms of student attainment, in this analysis it seemed to have a significant, although somewhat mixed effect. The effect varies across subjects: female students tend to perform slightly better in science, and slightly worse in math. For math previous studies have shown that depending on the context sex may matter ion the results, but it should be noted that in terms of math results the coefficient is smaller than the other negative coefficients. But in terms of reading the female students outperform the male students by a very large coefficient, 46.78, which is in fact the largest coefficient of all the data. This raises questions on the possible causes for this, but seems to be a common phenomenon in students.

This trend could make having female students more desirable for schools as they seem likely to yield higher test scores in standardized tests. It can suggest that male students are either not as well adjusted to the demands of school in all the topics, or that they will require more resources to improve the results. As they outperform female students in math, this coefficient is substantially is smaller than the performance gap in reading, and indeed in science also. The proportion of female students does not have a significant role at the school level, so the effect is largely on student level.

Immigration has the most substantial negative coefficients in all the data, with especially science. The fact that immigration has a strong negative coefficient on student attainment seems logical: as the PISA studies measures 15-year-olds it is not clear what kinds of backgrounds the students have, or how long they have been attending the current system they are in. Non-immigrants have been accustomed to the education system possibly from pre-school already, while the data does not differentiate the background for the immigrant students. The statistically significant factor of not being a native speaker of the school language shows also that there is a language barrier which plays a part in the student attainment.

Socio-economic background as measured in the ESCS index shows a statistically significant positive coefficient: in fact, out of all the positive coefficients it is the highest in all three disciplines. This is in line with the previous literature, as socio-economic factors have a substantial role in student attainment. Out of all the single factors, it should be noted that the student level variables interact with each other, and none of them by itself helps to explain all the entire phenomenon. OECD notes that for example in the performance gap in mathematics between immigrant and non-immigrant students in the 2003 and 2012 PISA data shrinks by almost half when accounting for socio-economic differences (OECD 2015, 4).

7. Conclusions and further research

The multilevel-analysis offered insight to student performance and the role of private and public providers of education in the Finnish and Swedish cases. A model considering the role of market incentives point to the possibility of either improvement through competition or inequality through deterioration of quality in the private sector. The notion that private school would want to select the most low-maintenance students cannot be seen in the analysis decisively, the evidence suggests that there is a difference in public and private actors. The multilevel model shows that the most significant coefficient results occurred in the student variables, but whether the school is a private or public one contributes to student performance as well.

In the results of the multilevel regression model private schools indicate higher scores in the PISA results with strong statistical significance. However, as Sweden has a larger share of private schools yet lower overall scores, it is possible that this indicates an increasing gap between the student performance instead of improving the results. In terms of the model presented this is plausible, as concentrating on student selection in any manner will leave the public sector as a passive recipient of students who do not perhaps have interest or resources to select schools.

Several issues need to be considered in the discussion about the results. Some matters of collinearity can be detected in the setup for the data, but checking for effects in the analysis turned out to have a very minimal effect on trends of any of the main results. In addition to this, the case of missing data for 2015 was found to have very little effect on the main findings, indicating that it did not create large problems with the analysis of the data, but the analysis is valid even with the cases of missing data.

Student level factors have a statistically significant result, and as previous literature suggests, the effects of socio-economic factors, immigration status and gender play a part in student performance. The student level variables are more statistically significant than the school level variables, so student features can be seen to affect the student attainment more than the institutional features, so the schools can have an incentive to choose students.

In terms of analysis the same data could be analyzed with different models, and adding relevant variables could improve the precision of the model. Previous literature has shown that there are other relevant factors to student attainment, and any strong claim for the importance of any of the individual factors must be approached with caution as the actual schooling does not happen in a vacuum but the result has many contributing factors which interact and influence each other in a myriad of ways.

The way nesting in a multilevel-data is perceived can affect not only the method but the results. The nesting can be seen to occur within students in a class, classes in a school, schools within an area etc. This analysis omits the variable of a classroom as the data does not support this type of grouping of observations, so another valid approach in the future can be attempting to examine also the class-room level of variables.

As the variables on all level are limited, a logical next step is in considering the availability and inclusion of additional variables and data. For further research going into more detail about the student material in both private and public schools would be beneficial. The results from an analysis including more information can also prove a fruitful source for models and suggestions about the function of private schools as an institution. Moreover, an extended analysis on several systems could be overtaken. This thesis uses only two systems as a case study, but for example the introduction of student fees in a system can prove a worthwhile element in discussing the incentives of the schools. The line between broadening the scope by

examining different international systems versus focusing more at the student level variables depends on the purposes and implications of studies on student attainment.

The fact that the PISA data does not allow to differentiate between private for-profit schools and other private schools is worth noting in future research. Speculation on whether this has any effect in the incentives can be made, but for this essay it will remain purely hypothetical as a clear distinction is not in the data. For example, a case could be made that schools operated by religious or charity organizations can have different incentives in the students they aim to attract, but as mentioned this cannot be seen in the current data. The rationale behind the incentive model would suggest that it can have an impact on both the incentives of a school and the families selecting a school.

An important aspect of the results is the interaction of different variables. Accounting for differences in for example socio-economic background, school location, immigration status etc. can be beneficial in future research if more comparable claims are to be made about a certain aspect between systems, or indeed even within a single one. Previous literature shows for example how socio-economic factors and immigration, although related, still show a statistically significant effect when taken into account.

Finally, it is crucial to note that as criticism towards student attainment as a measure of an education system points out the role of student performance in education systems can be overemphasized, and an argument can be made that it is not the only meaningful outcome of education for either individuals or society. The PISA cycle of 2015 for example is the first to map out students' wellbeing, and in future studies on the role of market incentives in education relating to concepts like wellbeing, inequality, and the performance gap between genders are possible to operationalize and consider in quantitative measures as dependent variables to examine the effect of policies and practices in each system. Both broadening the scope of the model and adding to its precision can be done through measures such as these, which aid in

creating a possible representation of the institutional effect that market incentives have in public policies. As interest in education systems in different disciplines continues it is no doubt a fruitful and important topic of research in the future.

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