Channels of Social Mobility, Education as a Promoter and Barrier in Chile

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Thesis Submitted to the University of Sheffield in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

Department of Economics

University of Sheffield

August, 2014

A mis padres, Jimena y Nicolás, por su abnegación y apoyo incondicional

(To my parents, Jimena and Nicolas for their abnegation and unconditional support)

Abstract

One of the main concerns and challenges of modern society is the level of equality of opportunity members of populations can enjoy. That becomes particularly important in societies where there is high income inequality. This research investigates the level of education and earnings mobility in Chile, finding relatively low intergenerational schooling dependency, but high in terms of intergenerational earnings compared to other countries. Schooling mobility seems to be lower than earnings mobility, which is opposite to what was expected in Chile. Considering this result, this research also analyses the effect of competition between schools on their average academic performance in the context of the Chilean educational reform implemented in the 1980s. In this respect, it is found that a larger number of public schools positively affects the quality of education of other schools located in an area, with the effect particularly pronounced amongst middle-class families and in middle-ranking schools. However, the number of voucher schools decreases the performance of neighbouring schools. The results are confirmed whilst ruling out endogenous location of voucher schools in areas with bad quality public schools, suggesting that sorting of students is driving the results. Finally, considering the possibility that schools might be a segregationalist environment, this investigation analyses the effects of assortative mating on the level of intergenerational earnings dependency in the country. It is found that assortative mating in terms of years of schooling explains around 20% of the intergenerational earnings dependency levels and that the educational reform increased the levels of assortative mating due to potential student sorting and a general increase of the educational attainment of the whole Chilean population.

Acknowledgements

First and foremost, I would like to express my sincere gratitude to my main supervisor Dr. Steven McIntosh for the continuous support during my Ph.D, for his patience, enthusiasm, and immense knowledge. But also for listening to me and understanding my worries, my exaggerations, my monologues and my non-sensical questions. His guidance helped me and encouraged me in all the time of research and writing of this thesis. I could not have imagined having a better advisor for my Ph.D study. Besides my main supervisor, I would like to thank Dr. David Cuberes, my second supervisor, who always gave me a different approach to my research, helped me to question myself, but also to believe in myself. My sincere thanks also go to Dr. Anita Ratcliffe, Prof. Karl Taylor, Prof. Peter Wright, Dr. Arne Risa Hole, and Dr. Jolian McHardy, for their comments and suggestions through out my research. I would also like to express my gratitude to my fellow PhD students: Meruyert, Berry, Hanan, Fatema, Maurizio, Elham, Ping, Manzur, Raslan, Laura, Uzma, Emily, Daniel, Christiana, Okan, Lu, Helen and Zainab, for all our conversations, in particular the ones related to our different backgrounds and culturesand for all the time they spent elaborating to me about my infinite questionsand listening to my ridicoulous stories.

Last but not the least; I would like to thank my family: my brother Alvaro, my parents Jimena and Nicolas, for supporting and believing in me all this time far from home, my grandparents who showed me with their own life that dedication, passion and hard work gives sense to our life, and to George, who not only acted as a patient proof-reader of this research, but also as my best friend and partner in all this process, with whom I discussed fervidly my ideas, my concerns and hopes, and who I love and to whom I will always be grateful.

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1 Introduction

One of the central aims of social policy makers is to promote opportunities for new generations, in particular for children from disadvantaged backgrounds. It is expected that increasing their educational achievement will not only give them hope, but also the necessary tools to have higher earnings in the future and have a better life than their parents. Education is therefore understood as a promoter of openness in society giving everyone the possibility to live a life independent of their initial condition. Nevertheless, educational systems in many parts of the world seem to reproduce inequality (Lannelli and Paterson 2005), or to create a deeper chasm between those who can achieve a good education and high quality of life and those who seem to be destined to remain less educated and, as a consequence, poor and socially excluded. Education can therefore be consideredas one of the main factors that promotes social mobility, but it is also the main factor that influences social reproduction (Hertz *et al.*, 2007). In Britain, for example, there is no evidence that income social mobility has increased over time, even though there has been an increase of educational provision during the last few decades of the twentieth century (Goldthorpe, 2004).

One explanation is that education challenges the process of social fluidity, but it does not generate mobility by itself. Behrman *et al.* (1999) have suggested what kinds of educational policy enhance social mobility in Latin-America, claiming that higher spending on primary education and better quality primary and secondary schooling are positively associated with intergenerational mobility, but that relatively greater public spending on tertiary education would reinforce the impact of family background and increase inequality reproduction. Hence, the role of educational policies seems to be important and it has been suggested that, in terms of mobility, the way the resources are spent is clearly more important than how much is spent (OECD, 2005).

In addition, in many countries, for example Panama, Peru and Ecuador (Parrado and Salvador, 2011), the lack of a fair process of selection in jobs makes it difficult to achieve meritocracy and makes social progress difficult because those who get a job might not be the best candidate, but the one with wider and stronger social networks. Also, many of those who have the intellectual capacity to study, but come from poorer backgrounds do not believe in the system, thereby education is, for them, largely a waste of time and potentially important resources are not used. Within these countries, even though many enjoy relative economic and political stability, only a small proportion of the population has access to the benefits that development and growth. The educational system is suffering a serious crisis and a meritocracy is far from existing (Brezis, 2010).

Therefore, the inequality of educational opportunities and the effect of parental background on children's educational attainment plays a very important role in the intergenerational reproduction of socio-economic status. Schooling is considered one of the main mechanisms through which intergenerational social mobility is affected. If schooling plays an important role in the generation of income and assuming that schooling is strongly influenced by family characteristics, the intergenerational mobility would be low. On the other hand, if family characteristics are not very important in determining schooling, then social income mobility should be high (Birdsall and Szekely, 1999). In addition, it has been suggested that because education plays an important role in explaining individual income, the reforms which alter total spending on education may have aggregate effects not only on intergenerational income mobility, but also on income distribution and growth (Fernandez and Rogerson, 1994).

Chile is an interesting case study because together with Mexico, they are the only Latin-American countries that are members of the OECD. Chile has experienced a general economic and political stability together with economic openness and enormous advances in terms of health, educational attainment, etc. Chile also presents low levels of unemployment and a GDP growth above the OECD average (OECD, 2014). Nevertheless in Chile, the process of development has not brought only benefits, in fact the country has the highest Gini Coefficient among OECD countries (OECD, 2012). Moreover, Chile has an educational system which is strongly market-based with a highly developed voucher programme. A voucher is a coupon that a student carries with them to school which they or their parents choose for them to attend. When the students enrol, the school gets the cash value of the voucher (Hoxby, 2003). Such a programme has, in other contexts, been shown to increase the educational efficiency and growth rate of a country (Cardak, 2001), but also increase its level of inequality (Chen, 2005). The Chilean voucher system was implemented nationwide during the early 80s, and has been very controversial, with some promoting the idea of expansion of choice and efficiency and others claiming that education should be public and with high standards and stating that educational market privatisation only creates segregation. In fact, Chile experiences high income inequality, and in particular, it has been suggested that inequality in the country can mostly be explained by a huge concentration of economic resources in the top income decile (Torche, 2005) and that its level of inequality could be correlated with the high levels of intergenerational earnings dependency. Therefore the Great Gatsby Curve becomes relevant (Corak, 2012), where the relationship between intergenerational mobility and income inequality is seen. Chile, together with Peru, Brazil and Argentina are examples of countries with high levels of inequality and high levels of intergenerational earnings dependency. On the other hand, Norway, Sweden, Denmark and Finland are examples of countries with low levels of inequality and intergenerational earnings dependency. The

Chilean situation seems to be contrary to high levels of educational attainment (at least compared to their neighbours) which could indicate that the transmission to equality in terms of income through education has not been very effective.

Hence, if voucher schools are associated with higher sorting and peer effects have some influence, it is likely that the distribution of educational benefits would not be particularly egalitarian (Epple and Romano, 2000). For example, high poverty levels seem to have increased the demand for voucher schools, because most of the poorest students are located in public schools; and higher income families are driven out of public schools into voucher schools (Winkler and Rounds, 1996). In this respect, Hsieh and Urquiola (2006) show that in municipalities where voucher schools have grown in number, the socioeconomic condition in public schools decreased. Furthermore, segregation would be reproduced athigher levels of education. In the Chilean case, in order to access tertiary education, students need to get good results in the PSU (Prueba de Seleccion Universitaria - University Selection Test), in this way they can have the opportunity to have higher earnings and increase upward social mobility in the case of poorer families.

Therefore the results of that test must be very important, and in order to pass it, the quality of education that students will receive will help equalise the opportunities of a better future. In Chile, only 15% of students at university come from the poorest 40% of families of the population, which is mainly explained by the selective process to access university. From the total number of students that take the PSU only 40% of them are accepted, only 25% of the accepted join the 'Consejo de Rectores' (Vice-Chancellors Council) Universities, and only 5% are accepted into the 2 most prestigious institutions: Universidad de Chile and Pontificia Universidad Catolica (Contreras and Macias, 2002).

On the other hand, publicly funded education is in general associated with equity. To increase intergenerational income mobility during the development process, the proportion of resources destined to public spending on education should be enough to offset the relative advantages that children with better educated parents have (Lyigun, 1999). However, the evidence is diverse, for example even though the Italian public system is egalitarian and provides a standardised quality, it does not attract the expected educational investment from poorer families, probably because the returns to schooling are also low and higher levels of education offered to the poorest families is meaningless to them (Checchi *et al.,*1999). Therefore, taking account that arguments in favour and against voucher and public educational systems are varied, it seems necessary to analyse the ideas behind the privatisation reforms of educational systems more closely.

Voucher systems may change the stratification of social patterns and the direction of the effect would depend on the characteristics of the voucher system that has been implemented (Epple and Romano, 2002). It is difficult to determine the causes of why a free market educational system would create social segregation, but they are probably related to: the design of the voucher programme (if the programme is focused on low income children, or just on girls, for example), the possibility for schools to select students, the limitations on attending a school outside the district of residence (which is not the case in Chile), the difference in parental preferences, or the demographic characteristics of children or school's reputation (Mickelson*et al.*, 2008). For the Chilean case, it has been claimed that the voucher system has been segregating the population and schools have become centres of social inequality reproduction where richer children do not have the opportunity to interact with poorer children, and where social networks and friendship are established, and even more where individuals could find their future spouses. The effect of 'assortative mating' therefore potentially seems relevant, understanding it as a high correlation of members of married couples in terms of education, which could reinforce the transmission of socioeconomic conditions from parents to childreneven more. In this respect, Weil (2005) suggests that the level of economic mobility in a society depends, among other things, on the nature of marriages, as when people get married to others that are part of their same social class or economic condition this limits the social flux in society. Therefore, if assortative mating is high, social mobility will be low.

For an analysis focused on Latin American countries, Torche (2010) finds that educational homogamy appears to be the rule in many of these countries. The proportion of couples with the same level of education corresponds to 60% in Brazil, 48% in Chile, and 50% in Mexico. These figures are even more significant if they include the proportion of couples where one of the individuals has a university degree and the partner only has some studies at university (but maybe did not finish), i.e., 81% for Brazil, 84% in Chile, and 86% in Mexico. At the other extreme, the proportion of couples that have one partner with university education and the other with no education is almost zero in all the countries mentioned above.

1.1 Motivation and Aims

The main motivation of this research is to face the high levels of inequality in Chile which have been historical and increased during the 80s (Torche, 2005), signalling a persistent intergenerational reproduction of the socioeconomic condition of individuals. This unfairness in society is believed to have been associated with old elitism originating in colonial times (De Ferrati *et al*., 2004) or with the economic progress that Chile has experienced during the last two decades and that even though this has brought benefits, it has also created significant social segregation with people that have been left behind, without opportunities and without hope. The idea that education could be the main tool that individuals could use in order to have a better life in terms of potential future incomes is essential for this research, but it is also scrutinised, as education could generate even more segregation in society if children from poorer backgrounds are always carrying an extra weight that hampers their educational attainment. Education could become differential between those that can access it and those that cannot. In particular, peer effects could not only have an effect decreasing the performance of pupils, but also influence the way individuals meet and match as couples. Therefore, education could reproduce inequality, and could effectively be an elitist stamp that describes and determines the future of people regardless of who is more able in academic terms. It is believed that this project is particularly exciting since it would raise the opportunity to tackle the problem of inequality in relation to education, considering that it should, one hopes, be an important channel in improving social mobility.

This research proposes to answer the question of whether or not education promotes or limits social mobility in Chile, considering first of all that it is necessary to measure the levels of intergenerational mobility on earnings and education (Chapter 2), which by itself is a controversial topic due to the lack of available data and life cycle effect issues. Secondly, the school competition effects must also be analysed (Chapter 3) as potential sorting among pupils is expected. Finally, the impact of assortative mating on the level of intergenerational earnings dependency seems necessary to research (Chapter 4), as an educational system that encourages socio-economic pupil segregation could affect the marriage structure in society. Chapters 2, 3, and 4 separately, but not independently analyse issues related to the main aim mentioned above. In addition, Chapter 5 includes a final discussion and conclusion of this thesis, providing a summary of the results and their implications, as well as mentioning the limitations of the thesis, and suggestions for further research.

Hence, education becomes of particular interest as it could be a promoter or a barrier to enhance socio-economic mobility in society. The initial ideas behind the current Chilean educational system and a brief description of its main characteristics and criticism are presented below.

1.2 The Chilean Educational Reform of the 1980s

In Chile, the need to increase the provision of education, increase efficiency of the public sector and increase the quality of the educational service was planned through reforms regarding school choice, a kind of reform that was intended to increase the quality and efficiency of the service by increasing the competition among schools through privatisation of the educational market (OECD, 2003). The benefits of increasing school choice were promoted by opening the supply side provision to non-governmental institutions. This was intended to reduce the barriers to entry for organisations that can focus on students with different preferences and needs.

Since 1981, a voucher system was implemented on a large scale nationwide, influenced by Friedman's ideas[1] about choice and freedom, and in the context of a market-oriented transformation of the country, Chile's non-democratic military government decentralised public schools and started financing some private schools with a voucher system for each student. Private school vouchers were seen as one of the main solutions to low quality public education - they would offer education in a more efficient manner at a lower cost

[1] See Capitalism and Freedom (Friedman, 1962).

than public schools. After the reform, the enrolment into private subsidised (voucher) schools increased rapidly, mostly for non-religious and profit-maximising schools and to a lesser degree, an increase in Catholic schools, even though Chile is mostly a Catholic country (McEwan and Carnoy, 2000).

The rationale behind the reform is based upon five important points: First, the idea that increased school choice means that families that have children attending a school will be better off in terms of overall welfare. Second, social costs associated with increasing choices through privatisation of public schooling are very little. Third, the idea that subsidised privately-operated schools are more effective in terms of the cost and the quality offered, as public provision of education is seen as bureaucratic and wasteful. Fourth, competition between subsidised private and public schools for students (and their vouchers) will encourage schools, especially the latter, to offer a better service because privatisation involves funding according to the number of students enrolled in the school, and this funding would act as a way to pressure schools to perform better. In addition, the idea that privatised and competitive educational systems would likely allow more social mobility, especially for children from poorer backgrounds was also a motivation behind the reform (Carnoy, 1998).

The fact that funding is not guaranteed for the school and is tied to students, who decide where to attend, should motivate schools to compete for these students, increase the pressure to be more responsive to the requirements of parents and to use their resources in a more efficient way (Ladd and Fiske, 2003). On the other hand, efficiency would improve because of decentralisation due to the better use of information at the local level. Public service decentralisation has been generally claimed as a way to increase citizen participation, a way to improve resource allocation and a way to improve the equity in the distribution of services provided. In particular, "decentralisation refers to a variety of administrative, fiscal and political changes that involve the transfer of some combination of resources, responsibilities, or decision-making authority from the central government to lower-level units, being the sub-national governments, units of the central government, or state owned enterprises" (Kubal, 2006, p.108). This is why the decentralisation reform was considered an example of one of Pinochet's main government priorities, in order to decrease the public spending on social services.

However, it could be relevant to notice that in some respects decentralisation was not (and is not) a complete process as the operation and finance comes from the local government, but the main pedagogical aspects of education are still centralised.It is important to notice that because the two main reforms, decentralisation through municipalisation (local governments or municipalities were responsible for the provision of education in their area, including financing it) and privatisation (to distinguish their potential effects separately through vouchers) were implemented simultaneously, their separate effects are not obvious.

Before the reforms, Chilean governments traditionally provided a partial economic funding to some non-public schools - almost all of them were Catholic. However, the reforms extended the support to all other schools, independent of religion and increased the resources destined to non-public schools which started being called voucher schools. In practical terms, public and voucher schools receive the same voucher amount and it is unrestrictive so every student can participate. Voucher schools only receive students that want to make use of it; they are unlikely to accept students where parents want to pay the full extent of their education (these parents will likely send their children to private, fee paying schools).

The amount of the voucher received by the school is calculated as the value of the USE (Units of Educational Subsidy) and the average attendance of the last 3 months before the payment[2]. The value of USE varies depending on the level of education and the type of school (primary, secondary, vocational, adult, special needs, etc.) and considering if the school is an all-day school or not.

In addition to the reform itself, the teachers' union contracts were cancelled, therefore schools got more flexibility in terms of hiring and firing teachers. In particular, public school teachers lost their for-life contracts and were not considered public employees anymore. Moreover, national curriculum standards were relaxed, giving schools more flexibility about the topics they teach. Hence, the main idea was that competition would create more quality for fewer resources, and that was all that was necessary in order to improve the service provided. Therefore, the spending on education fell in the decade following the reform (see Graph 1.1), with the deepest fall for secondary schools. Chile then became, "a virtual laboratory for a relatively unregulated, decentralised, competitive market in primary and secondary education" (Bravo, *et al.*, 2010, p. 2), where parents could choose between public, voucher or fee-paying (private) schools. Finally, private and voucher schools could be selective, but public schools had the choice of being be selective only if there is an excess of demand[3] (mostly applying entry tests and considering past academic performance).

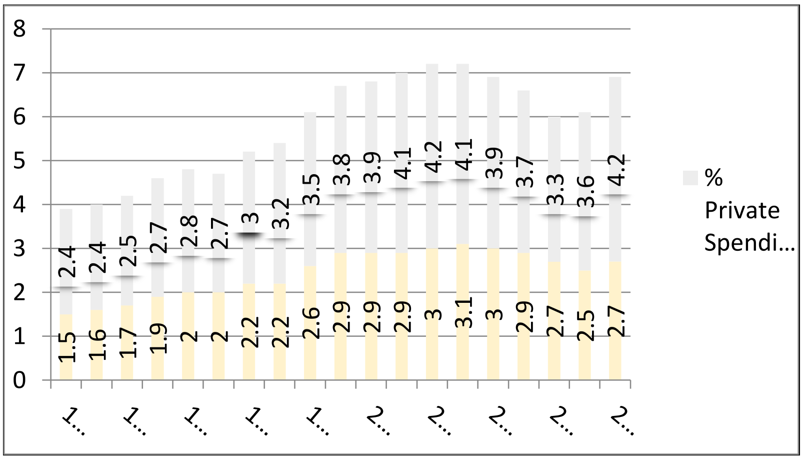
The educational reform mentioned above was not reversed by the government in the return to democracy in 1990, which was a political strategy to

[2] Teachers' salaries are totally independent of this funding.

[3] The only constraint for public schools is that the number of students per class cannot be more than 45.

sustain the volatile 'ceasefire' between the left and the right in the country (OECD, 2004). However, successive changes have been implemented by the subsequent democratic governments (including increasing the available resources to spend on education). In 1991, a special labour code was established for public teachers, which gave them more stability in terms of salary, contract hours, holidays, benefits, etc., which in a way limited the efficiency of the system but helped get support from the teaching union for the whole process of transition to democracy (Cox, 1997). The number of textbooks available for each school was also increased as were the teachers' salaries by around 54.4% compared to 1990, among other improvements.

Graph 1.1: % Private and Public Spending on Education as a Proportion of GDP (1990-2008)



Source: Ministry of Education (2008)

Until 1994, voucher schools and public schools were financed mostly by the government budget. Subsequently, "topping up" was introduced which meant that the voucher schools were allowed to charge students tuition fees on top of the voucher value for students[4].

[4] Public schools were also allowed to top up their public funding but only at the level of secondary education.

The maximum amount allowed to charge parents is 0.5 times the public-financed original voucher. A progressive discount is applied to schools if they charge more than that amount[5]. It has been suggested that this decision increased the segmentation by income levels because those who can pay fees are accumulated in certain institutions where the poorest cannot go (Narodowski and Nores, 2002). To try to alleviate this effect, scholarships were given to the best students in voucher schools that cover their fees, in order to support students with fewer economic resources. These scholarships are financed by the government and by the schools' owners.

In 1995, with an already stable democracy established in the country, the government decided that schools should use more technology, in particular computers, and the increase of spending on education became the priority in terms of social policy, including increasing the value of the voucher, which in 1990 was 23% lower than the value in 1982, and creating a higher value voucher for rural areas (in order to cover fixed costs). From 1996 a new explicit reform started being implemented, including the 'Jornada Escolar Completa' (Full Day School) and a curriculum reform, to support the poorest schools and a programme to increase quality and equity in the education provided.

In 2008, the government realised that it was more expensive to educate disadvantaged students (before that, there was no higher value voucher to compensate poorer children, in fact the only compensation up until that point was through free school meals). Therefore an increase of 50% of the value of

[5] If a voucher school decides to charge a fee per student, they can charge a maximum of 4 USEper month. If the fee corresponds to less than 0.5 USE, then the value of the original voucher given from the government does not decrease, for values between 0.5 and 1 USE there is a decrease of 10% of the voucher, between 1 and 2 USE, the decrease is 20%, and for between 2 and 4 USE, the decrease is 35%.

the voucher per students classified as vulnerable by the Ministry of Development and Planning was agreed (this decision was based on individual and household surveys collected by the Chilean government)[6]. Schools can opt for this benefit if they apply with a programme of improvement and a financial plan for spending the extra money with the only condition that the schools receiving differential vouchers are not allowed to select or expel their students based on interviews with their parents. It is possible that this could mitigate the stratification effects.

In terms of the consequences of the reform implementation, one of the immediate effects of the privatisation was the increase of education coverage (although an increase in educational coverage could have of course multiple causes), for example, in 2006, 1 in 3 children between the ages of 0 and 5 attended a nursery or similar in contrast to 1990 when only 1 of 5 were attending. In secondary school only 50% of the children of the respective age were attending secondary school in 1990, but by 2006, 7 out of 10 were attending. In terms, of tertiary education, 7 out of 10 students are the first in their families to attend university in 2006 (nevertheless, there are some issues related to over-education in this respect)[7]. In addition, Graph 1.2 shows the completion rates of students for the years 1990, 2006 and 2009 which have been increasing over time, especially for poorer children.

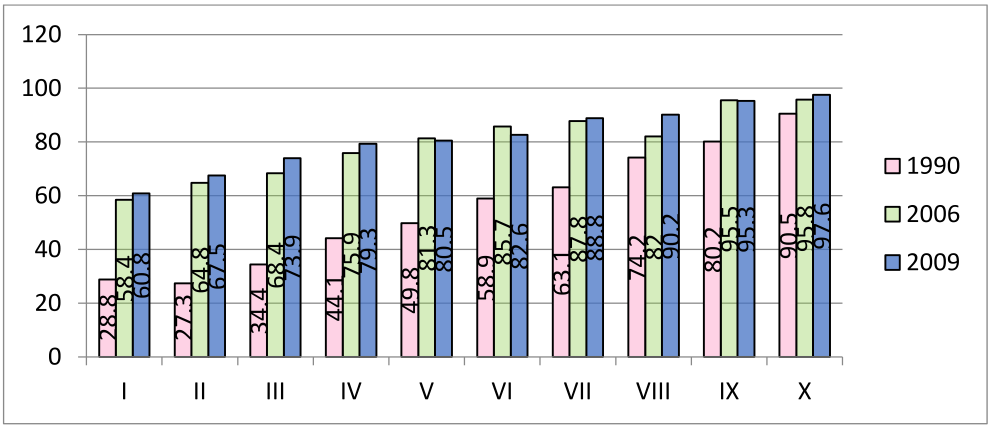
The second effect was that more than a thousand new voucher schools were opened in the first five years after the reform. In 1980 there were 1,627

[6] Vulnerable children are those that are defined as members of families that face socioeconomic problems, which make it difficult for them to participate in the educational process (Darville and Rodriguez, 2007).

[7] Understanding over-education as a positive difference between the actual education of an individual and the mean level of education among workers in the individual occupation (Lindley and McIntosh, 2009).

voucher schools and by 1985, there were 2,643 schools of the same kind (Hsieh and Urquiola, 2006). Enrolment in Catholic voucher schools increased from around 5% before the reform to around 14% in 2002[8] and in 10% of the municipalities there were more than 50% voucher schools[9]. In fact, there was a general increase in voucher school enrolment, which overtook public school enrolment in 2008 (see Graph 1.3).

Graph 1.2: Population between 20 to 24 years Completed Secondary Education by Income Decile of Households

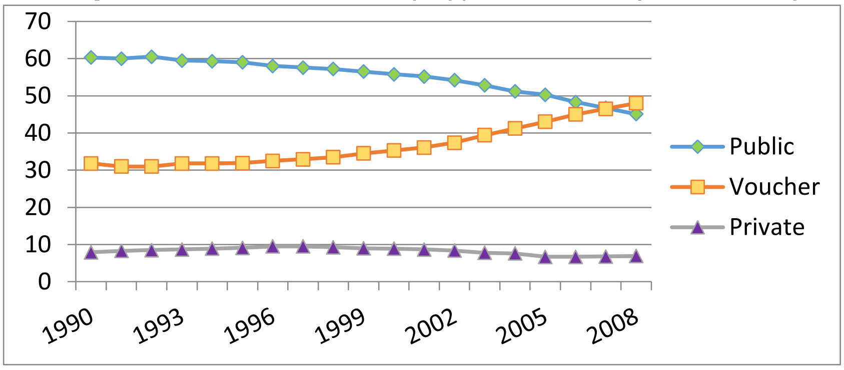


Source: CASEN 1990, 2006 and 2009, MIDEPLAN, Chilean Government.

[8] It is important to note that a school is considered a Catholic school when the church directly chooses the head of the school or when the church approves the election of the head of the school. Therefore, many schools are related to the Catholic Church but they are not considered officially as Catholic schools.

[9] However, 20% of municipalities do not have voucher schools at all (Gallego, 2006).

Graph 1.3: % Enrolment by type of school (1990-2008)



Source: Ministry of Education (2008)

1.3 The Current Chilean Educational System

In summary, after the 1980 educational reform, the Chilean educational system was characterised by having 3 types of educational institutions at the primary and secondary level: public, voucher and private schools. Public schools are state-financed and municipality-administrated, receiving a determined amount of money per student attending the school, which varies depending on the type of education that the school provides. The voucher is paid monthly, directly to the school for voucher schools and to the municipalities in the case of public schools.

Voucher schools are privately administrated, with or without profit purposes and in some cases administrated by religious institutions. In terms of finance, the schools are financed by voucher per student attending the school, which is provided by the government, and has the same value as the one obtained by the public school. However, they could also receive funding from charity organisations, as for example Catholic schools receive funding from the Catholic Church. In addition, these schools can charge a small tuition fee to each student to increase their budget. Voucher schools present larger class sizes relative to public schools and normally public schools service the poorest families. On the other hand, private tuition fee schools are those that are fully funded by parents' payments and private resources. The tuition fee schools obviously attract the richest students. In Table 1.1 the distribution of students among different kinds of schools is presented and Table 1.2 and Table 1.3 show the characteristics of schools by type, parents and students.

Table 1.1: Distribution of Primary School Students across School Categories, (2008)

School Type	% of Schools	% of Enrolment
Public	54.8	46.0
Voucher (For-Profit Franchise)	5.7	7.3
Voucher (For-Profit Independent)	24.6	23.6
Voucher (Non-Profit Catholic)	6.3	12.3
Voucher (Non-Profit Protestant)	0.9	1.4
Voucher (Non-Profit Secular)	1.0	1.6
Private	6.7	7.4
Total	100	100
Number of Schools/Students	10,299	3,420,594

Source: Elacqua (2009a)

Table 1.2: Primary Schools by Ownership Type: Descriptive Summary (2008)

School Type	N	% Rural	Avg. School Size[10]	% Metropolitan Region	% Vulnerable Students	Avg. Mothers' Years of Education
Public	**5,129**	**65**	**560**	**13**	**61**	**8.6**
Voucher (For-Profit Total)	**2,441**	**29**	**519**	**32**	**37**	**10.5**
Voucher (For-Profit Franchise)	444	30	651	41	44	10.2
Voucher (For-Profit Independent)	1,997	29	490	30	45	10.0
Voucher (Non-Profit Total)	**803**	**21**	**738**	**27**	**31**	**11.1**
Voucher (Non-Profit Catholic)	575	24	839	26	37	11.3
Voucher (Non-Profit Protestant)	88	18	563	16	39	10.8
Voucher (Non-Profit Secular)	80	13	561	44	33	11.1
Private	**442**	**3**	**555**	**37**	**0**	**14.8**

Source: Elacqua (2009a)

Table 1.3: Primary Schools by Ownership Type: Descriptive Summary (2008)

School Type	N	Class Size[11]	% Charge Tuition	% Full Day Program	Teacher Productivity Award %
Public	**5,129**	**30.1**	**0**	**86**	**22**
Voucher (For-Profit Total)	**2,441**	**29.2**	**48**	**60**	**19**
Voucher (For-Profit Franchise)	444	31.1	46	62	22
Voucher (For-Profit Independent)	1,997	28.8	46	59	18
Voucher (Non-Profit Total)	**803**	**34.9**	**46**	**73**	**42**
Voucher (Non-Profit Catholic)	575	37.1	48	82	46
Voucher (Non-Profit Protestant)	88	35.1	62	53	30
Voucher (Non-Profit Secular)	80	27.6	35	61	27
Private	**442**	**20.7**	**100**	**No Information**	**No Information**

Source: Elacqua (2009a)

[10] Only Urban Primary Schools are included as rural schools tend to be very small.

[11] Only Urban Primary Schools are included as classes are, on average, smaller in public schools but that is because they are often located in rural areas where the population density is lower and they cannot use economies of scale to increase efficiency (Carnoy and McEwan, 2000).

The heads of school of public schools do not have control over expenditure decisions; however they can be influenced through lobbies. In the case of public schools, the potential earnings are returned to the municipality and similarly, any losses incurred are also dealt with by the municipality. Hence, teachers do not bear the costs of failure or recoup the benefits of efficiency, which could reduce the incentives to provide a better service.

In terms of levels of education, there is pre-school education which is not compulsory (up until 5 years old), and is offered by fee-paying private institutions, but also by the state; primary education (8 years of schooling); secondary education which can be scientific-humanistic or technical (4 years of schooling);[12] and tertiary education (anywhere between 2 and 6 years of schooling). Secondary education is available to students who have successfully finished primary education and is the vehicle through which people enter tertiary education[13] (if they achieve a determined academic test performance).

Parents have the freedom to choose the school they want without restrictions based on their residence. Voucher schools can have a selection process based on academic tests, parental interviews, or religion (for example some religious voucher schools restrict the entrance, allowing only Catholic families) that could produce some sorting problems[14]. Public schools have a first-come-first-served system to enrol students until they reach their maximum school provision, and they cannot use any selection criteria (as for example, proximity of residence) with the exception of schools with excess demand which

[12] In 2003, secondary level education became compulsory.

[13] This includes private and state universities, professional institutes and technical centres.

[14] In Sweden, where the privately subsidised system also plays an important role, schools cannot choose their students (Contreras*, et al*., 2010).

normally select students using parental interviews and academic tests, using them as a proxy for students' quality. So parents can theoretically choose to educate their children wherever they want even though they will base their decision largely on transportation costs, time etc.

In addition, teachers in public schools are not public employees, but they cannot be removed from their positions easily (although since 1995 they can be transferred to other schools within the same municipality) and have flat wage schedules. After the return to democracy, teachers' unions gained important political influence, obtaining benefits that voucher school teacher do not have (for example, voucher schools pay lower teachers' wages than public schools) and also campaigning actively against merging or closing schools and against teachers' movements from one school to another (Gallego, 2006). Perhaps this is one importat reason why the number of teachers in public schools is higher than in voucher schools.

1.4 Critiques of the Reform

The implications of the 1980 reform are diverse, and it seems that it is not evident the idea of competition actually works in reality, especially because the implementation of the reform implies so many details that could become essential in order to encourage schools to compete and that in case policy makers do not take the right decisions, competition could provoke "unexpected and maybe perverse responses" (Parry-Rounds, 1997, p.121).

The quality of service could be affected by the fact that public schools would have fewer resources (even though if competition is effective and increases efficiency, this effect could be cancelled out), in particular because voucher schools can select students, leaving the students that have the most difficulties to the public schools (‘sorting’). In addition, voucher schools have focused on status elements such as fancy names or luxury uniforms, and working conditions for teachers have declined in the wake of the reform including low salaries and high overwork. This caused a shortage of teachers and a drop in the quality of university students that were accepted into educational programmes, often being the students that could not access more demanding programmes in terms of academic performance results on the university entrance test. Also, after the reform teachers did not have the job quality of central government employees and that affected their job security and reduced other benefits, producing strikes and limiting the normal functioning of public schools.

1.4.1 Sorting and Lack of Real Competition

Students can enrol in any school, not necessarily the ones that are in the same area where their families live, therefore public schools in wealthier municipalities have expanded and enrolled a larger proportion of students (more than 50%) than in poorer municipalities probably because of bad performance or lower prestige than public schools have in poorer municipalities. Nevertheless, those higher quality schools are becoming income selective (because they are over-demanded, they can afford to do so), and are not considering the residence of potential students but base selection on entrance examinations and/or using parental interviews, where students with higher income parents tend to be selected (see Table 1.4). So, public schools that perform better become selective and the effect of ‘sorting’ starts to play a role.

In addition, voucher schools have the right to select students with or without over-demand, adding an extra sorting effect, that pull better students out from public schools to voucher schools (cream-skimming). This would negatively affect the public schools' performance as the best students from public schools are drained to voucher schools (Tokman, 2002). Therefore, this situation can create a segmented educational system as similar families tend to attend similar educational institutions and they would not mix with students that face other kinds of realities, especially because schools can build a reputation into communities and attract better teachers. Also, public school incentives could be reduced since if the worst students remain in the same schools their chances of entering voucher schools are reduced, reducing the competition effect between public and voucher schools, so the competition effect can be cancelled out. On the other hand, even though the effect of competition is not totally cancelled out, it is not clear that schools would compete using the quality of education provided as their differential point.

Table 1.4: Parent-reported requirements for school enrolment (%)[15]

Parent-reported requirements for school enrolment	Public	Voucher	Private
Civil Marriage Certificate	4.8%	8.8%	23.1%
Church Marriage Certificate or Certificate of Baptism	1.2%	17.4%	34.7%
Child attended play session	1.8%	5.7%	27.6%
Child took entrance exam	7.6%	43.4%	62.7%
Parent interview	12.1%	33.8%	74.7%

Source: McEwan, *et al.* (2008)

In terms of competition for the voucher value, even though some voucher schools are non-profit, they are supposed to compete for donations to add to the school budget. However, public schools face less competition, because when their enrolment fails they receive some transfers from the municipality to pay their expenses, so they do not really internalise the consequences of losing

[15] 4th grade information (2005).

students due to bad service provided, as a consequence "if failing schools are to be protected from bankruptcy their inefficiency is perpetuated" (West, 1991, pp. 163). In addition, even though there has been a large private (voucher) school expansion and a continuous decline in public school enrolment, the number of public schools have not changed significantly. It therefore seems that decision makers in municipalities have not been willing to close them, so public schools do not actually feel the effects of competition very strongly[16]. Therefore, public schools do not have a direct incentive to provide quality education beyond a minimum standard, but voucher schools face explicit competitive incentives (Gallego, 2006).

1.4.2 Parents' Choice and Lack of Information

Economic theory suggests that competition works only under some ideal conditions: many buyers and sellers, perfect information, the quality of the product is easily identified and easy entry and exit of providers. It seems that for the Chilean case, only the first condition is achieved. Voucher schools could potentially waste their funds, and parents do not have a direct way to check their efficiency. On the other hand, if voucher schools do not perform as efficiently as was expected, it does not mean that monopolistic public schools do a better job (Neal, 2002).

In terms of parents' choice, many parents do not take decisions based upon the explicit academic performance of schools. Instead, they may consider other characteristics of the school as a proxy of the quality provided, for example

[16] Actually closing a public school is quite unlikely (around 6% were closed between 2005 and 2009 - calculus based on the Directory of Schools, Ministry of Education).

cleanliness, technological equipment and green spaces[17]. Overall there is no empirical evidence suggesting that the unique and most important thing that parents consider in choosing a school is the quality of education. Parents could support specific values (religious, for example), or they could care about better school facilities, or they could seek to have a higher status or expect to increase their social network and avoid immigrants or disadvantaged children, or simply because they do not agree with a more open and heterogeneous public school environment (Checchi and Jappelli, 2002). Merchandising (fancy uniforms or English names, even though they do not even teach in English) is a common practice among Chilean voucher (and fee based private) schools to give some kind of status to the level of service provided, and this could distract and misinform parents on their choice of school. Therefore, it has been claimed that parents are not able to make a good choice - the impact of this could be more serious among low income families. Lack of information could therefore be an issue of concern, because parents would not make the best decision, again this issue could be worse for poorer families. In particular, this issue becomes more problematic if it is considered that Chilean public schools have historically suffered a bad reputation (Arenas, 2004) and that a school's reputation is built depending on the added value that it provides and the composition of students that attend. So, instead of preferring the schools with the highest added value, parents might choose the school with the best student composition (Mizala and Urquiola, 2009).

In addition, stratification could occur as a consequence of the fact that high income families would care more for the academic results of the school and

[17] It seems that if the general performance of a school is very good and suddenly there is a small decline in test scores, the parents may decide to move their children to a different school. On the other hand, if in general the schools in the neighbourhood have low scores, parents will tend to put more attention on other characteristics of schools (Elacqua, 2009b).

the impact of peer effects, especially when richer families try to avoid the schools that they perceive as poorer (Elacqua, *et al*., 2006). Moreover, high performance schools have families that are very responsive in terms of the quality of the service that students are receiving, in contrast families attending lower performance schools are less responsive and the low performance public schools become local monopolies that are not very responsive to pressure, or that in fact do not face any major threats (Hastings *et al*., 2005). Finally, voucher profit schools will try to retain students that are less cost demanding, on the other hand non-profit voucher schools might have the commitment to educate the most disadvantaged. However, that does seem to happen in Chile, probably because of the decline in religious teachers (priests and nuns), so now regular teachers demand more salaries and benefits and religious schools are much more budget constrained to achieve their mission (Elacqua, 2009b).

Moreover, using economic theory, it is possible to suppose that competition will influence the allocation of resources positively and consumers would play an active role in choosing their favourite supplier. However, free provision does not seem to be equal to free consumption as families have to incur some private costs such as transportation, and it is precisely these additional costs which make poorer families use educational services less than richer families. In this respect, Gallego and Hernando (2002) explain that the ability to move to any school, independent of its location, would be a positive aspect for poorer students, at least for those that can move to more desirable schools outside their neighbourhood.

On the other hand, segregation would increase if a geographic restriction was to be imposed. However, the selection of a school close to their residence would realistically be more important for the youngest children as they are more dependent on their parents and it would be more costly if they considered that they have to pay the transportation costs every day which would of course affect poorer families more (Tokman, 2002).

Despite the costs involved in moving to a school outside the neighbourhood, the Chilean reality seems to indicate that there is a certain level of mobility between place of residence and the chosen school. According to Chumancero, *et al.* (2009) only 17.6% of students attend their nearest schools (24.4% of the students that attend public schools go to their nearest school, 15.5% of children in voucher schools go to their nearest schools and 8.9% of students of private schools go to their nearest)[18], using the information from about 34 municipalities in the Metropolitan Region[19].

Table 1.5 shows the average distance and the average academic performance (quality), where the average distance that students travel to their school is around 3 kilometres. This information would be particularly relevant for Chapter 3 of this research, as it would allow creating a school neighbourhood where educational institutions compete for attracting students.

[18] Using data from CASEN (National Socio-economic Characterisation Survey) it is possible to identify the school that children are attending, and the student's address. Using the name of the school it is possible to find the school in the geographic location data set for schools. However, this research does not attempt to do that, because each school has many names that are similar, but not exactly the same, and matching them correctly would be not easy. The author of the paper mentioned does try to do so, but only for the Metropolitan Region.

[19] Considering only schools of their same type: 36.3% of public school students choose the closest public school, 24.3% of the voucher school students go to the nearest school. So, choosing the closest school might be important, but not essential (Chumancero*, et al.*, 2009).

Table 1.5: Distance (Km) and Quality (SIMCE performance) by type of School Administration (Average) in the Metropolitan Area.

Variable	Total	Public	Voucher	Private
Distance of school chosen	**2.9**	**2.57**	**2.78**	**4.22**
Quality of school chosen	256	240	257	295
Distance of nearest school	0.52	0.46	0.55	0.53
Quality of nearest school	248	240	246	272
Distance of nearest public school	0.9	0.67	0.93	1.34
Quality of nearest public school	232	229	231	246
Distance of nearest voucher school	0.78	0.71	0.73	1.15
Quality of nearest voucher school	254	250	253	266
Distance of nearest private school	1.92	2.08	2.07	0.95
Quality of nearest private school	286	285	287	287
Number of schools (2 km radius)	20.8	21.1	21.3	18.2
Quality of schools (2 km radius)	255	252	253	270
Number of public schools (2 km radius)	4.4	5.2	4.4	2.2
Quality of public schools (2 km radius)	241	239	240	254
Number of voucher schools (2 km radius)[20]	13.6	14	15.3	6.3
Quality of voucher schools (2 km radius)	252	250	252	263
Number of private schools (2 km radius)	2.8	1.9	1.6	9.8
Quality of private schools (2 km radius)	286	285	286	287
Share of students that attend:				
nearest school	17.6	24.4	15.5	8.9
nearest school of the same type	26.9	36.3	24.3	13.8

*Source:*Chumancero, *et al.* (2009)

In terms of segregation related to school choice, Becker (1995) points out that poorer families, in particular, need better education to overcome their lack of family support and they are normally destined to accept the schools in their neighbourhood as they cannot afford to move house or the travelling costs. In addition, consumers face the limitation factor of costs associated with changing from one supplier to another. Switching costs seem to play a role when parents decide whether to change their children from one school to another, so even

[20] The proportion of voucher schools in Table 1.2 is lower than in Table 1.5, because the latter only includes schools from the Metropolitan region, which has a larger proportion of voucher and private schools.

though better quality schools might be available, there is some resistance of parents for changing children from school to school[21] caused, for example by the stress that the change implies on the children, and they will have the problem of comparing different suppliers of the educational service. However, in the case of Chile, the proportion of children that change school is not insignificant (16.73%), and around 19% of students attending public schools move to another school when they pass from primary to secondary education (considering only schools that offer both primary and secondary education). It seems that even though the switching cost can be quite high, there is a breaking point which decreases the probability of staying at the old school (Chumancero, *et al*., 2011), see Table 1.6.

Table 1.6: Number of Students that stay or switch schools (period 2000-2004) in the Metropolitan Area[22]

Stay	Total	%	Public	%	Voucher	%	Private	%
No	2,921	16.73	364	19.15	1,841	20.10	716	11.20
Yes	14,534	83.27	1,537	80.85	7,318	79.90	5,679	88.80
Total	17,455	100	1,901	100	9,159	100	6,395	100

Source: Chumancero, *et al.* (2011) using SIMCE data set.

Chumancero, *et al*., (2011), consider this evidence, and point out that on average students that move from one school to another obtain around 5.74 points less in academic test scores, than those that stay, suggesting that those that move around are moving to worse schools, and probably the movement was

[21] Part of the quality of the educational system is affected by the children's comfort at the school, if parents use their choices correctly in order to move their children, it would imply some sunk costs in the process of adaptation implicit when changing schools such as to meet new people, to adapt to new rules, changes in the colours of uniform, etc. (Glennerster, 1991).

[22] Considers students in the 4th grade in 2000 who were attending a school that imparts primary and secondary level education, so in 2004 (8th grade) they could move or stay.

not related to the parents attempting to find a better future, but it was more likely related to expulsion from schools in order to try to maintain certain standards (however this cannot be considered as certain, because maybe the students presented problems before the transfer). Nevertheless, the schools that improve their SIMCE (Sistema de Medición de la Calidad de la Educación or Education Quality Measurement System) results seem to have higher numbers of students leaving and those with a worse SIMCE performance attract most of the students who are moving. Therefore, school mobility may not be helping social cohesion (Zamora, 2011).

1.4.3 Academic Standards and the Teacher's Role

Concerns may be raised about whether or not voucher school parents would get exactly what they want, which for supporters of the voucher system could be called an increase of the opportunity of choice. However, the expansion of choice could give parents too much control over education, which could create repercussions for all society (Neal, 2002).

Competition to attract students should encourage teachers and administrators to do anything to make parents and students happy, i.e. reducing academic standards and discipline. Teachers are discouraged to give low grades that would upset parents and, especially in poorer areas, schools would start taking a charitable role rather than focus on consistency between the learning level of students and their marks and their level of education. In some schools, the decision to offer extracurricular activities rather than adjusting the curriculum in order to attract children, could cause teachers to become more overloaded and reduce the time that they can dedicate towards preparing their classes, which could be even more important in poorer schools where the conditions of working might be less than ideal (Carnoy, 1997).

Moreover, there is no real communication channels where the parents can explicitly point out what they think about the school, and if they are not satisfied, the only way to show that is by removing the students from the school. In that case, the school would never know the truth and would probably assume that they simply moved to another city, for example.

This research was born with the idea that the Chilean educational system could be provoking deep changes and damage to the level of opportunities given to new generations. The following sections present more clearly the motivation and main aims.

1.5 Structure and Contents of Thesis

1.5.1 Chapter 2: Does Education Change People's Economic Destiny? Intergenerational Mobility in Chile

There is a general agreement that social mobility in terms of income is mostly driven by education, but there is not much empirical evidence on this issue. Increasing opportunities in terms of education should be reflected by an increase of opportunities in the labour market, followed by an increase of mobility in terms of earnings in society, and in particular, a decrease of dependence between the parents' and children's income. The mechanism of transmission of the dependence between children in educational level or schooling on the education of their parents is generally given by better educated parents. They can help their children in terms of homework or advice for important decisions as better educated parents can give more value to investing in the education of their offspring. But also, education of parents possibly changes the bargaining power in the household, and the mother can be very important in order to invest more in children's human capital[23]. Therefore, taking into account that education is considered an important transmission mechanism of intergenerational income mobility, it should be appropriate to analyse intergenerational educational mobility more closely, by itself.

This chapter analyses one of the main concerns and challenges of modern society which is the level of equality of opportunity members of populations can enjoy. That becomes particularly important in societies where there is high income inequality as in Chile because if it experiences a high level of fluidity in income distribution, the hope of members of the next generation of families becoming better off will encourage people to exert their efforts in terms of investment in human capital, making the whole economy more productive. The main aim for this chapter is to measure the level of intergenerational earnings and educational mobility, trying to establish the level of dependency between individuals and their parent's earnings and years of schooling, using the Cross-sectional CASEN survey (National Socio-economic Characterisation Survey) of 1990 and 2009 and the Two-Sample Two-Stages Least Squares technique (TS2SLS).

1.5.2 Chapter 3: Does the Increase in Educational Provision and Competition between Schools Increase the Quality of the Service? The Role of the 1980s Educational Reform in Chile

The question of how the market of education should operate has been hotly debated, in many cases with decisions being taken based upon uninformed politics and markedly influenced by preconceived ideas based, most of the time

[23]In this discussion, intra-household allocation theories play an important role, see for example: Haddad and Kanbur (1990), Folbre (1984) and Thomas (1999).

on ideological foundations. Quality of education, competition between schools, integration, subsidies and potential reproduction of inequality at first seems complicated to study mainly because it includes many variables, including for example local segregation and lack of motivation of families to invest due to fear that it will not lead to a return on the investment they would have to make in education (Andersen, 2001). If students from poorer backgrounds invest less in education, education does not immediately become a good channel to reduce inequality and to promote social mobility and educational achievement of students and their eventual labour market success will be strongly determined by the background of their parents, their social class, ethnicity and residential stratification.

The most recent reforms of educational systems have focused on the idea that privatisation and decentralisation generate higher competition among schools, thereby improving the quality of service that they provide. Schools would compete for students to get public funding and that would produce a more efficient use of resources and would give them the incentive to improve and to innovate. However, it has been claimed that competition can have an effect on the level of social segregation as many other concerns may arise, in particular, lack of information for poorer families when they choose between schools; thus generating a negative effect to the more general idea of giving educational opportunities to children. This chapter investigates the effect of the Chilean voucher system, implemented during the 1980s educational reform, in terms of giving all pupils (independent of their socioeconomic condition) similar opportunities to face the future, understanding it as the quality of education that they receive. In this respect, Núñez and Gutierrez (2004) conclude that the individual's socioeconomic background, can be an important factor in the determination of earnings in the labour market and that this effect on earnings is more important than academic performance and that can be a consequence, among other things, of Chile's school system which is highly segregated (the majority of public schools enrol mostly lower-income students while voucher schools are attended by mostly well-off students). In addition, high levels of segregation can have a negative impact on the cognitive and non-cognitive (behavioural) outcome of students, especially the disadvantaged.

The aim of this chapter is to analyse the effect of spatial school competition on the quality of education that shools provide, trying to discover if voucher schools benefit or harm the Chilean educational system, in particular in terms of social segregation. The data utilised for this analysis is based on the SIMCE of year 2005 and 2009, but other data sets have also been included in order to obtain the exact geographic location of schools, characteristics of schools and their pupils, and characteristics of municipalities where schools are located among others.

1.5.3 Chapter 4: Is Assortative Mating a Limitation for Intergenerational Mobility? The Role of the Chilean Privatisation Educational Reform

It has been suggested that the level of economic mobility in a society depends, among other things, on the nature of marriages as, when people get married to others that are part of their same social class or economic condition, the phenomenon of assortative mating arises, limiting the social flux in society. This would be particularly important in Latin-American countries where the correlation between the education of spouses seems to be higher than in other societies (Weil, 2005) and where on top of that, high income inequality exacerbates the problem, which could also be the case in Chile. It is believed that the level of educational assortative mating among Chilean couples has been modified by the 1980's educational reform, as it encourages that pupils from poorer backgrounds attend public schools and richer children attend voucher schools, segregating the future generations according to their social class and limiting opportunities for individuals to have a better life when adults.

This chapter analyses the effects of assortative mating on the level of intergenerational earnings dependency in the context of the Chilean educational reform implemented in the 1980s. Firstly, a simple theoretical model is presented where the main aim is to express the intergenerational earnings level as a function of educational assortative mating among other things. Secondly, the impact of assortative mating in terms of years of schooling on the levels of intergenerational earnings dependency is measured. The aim is to try to show how important assortative mating can be in order to promote or limit social mobility in the country. The data used is the Cross-sectional CASEN survey of 1990 and 2009. This data set is the same utilised in chapter 2 of this research.

2 Does Education Change People's Economic Destiny? Intergenerational Mobility in Chile

2.1 Summary

- Education is claimed to be the most influential mechanism involved in the process of intergenerational income (but in fact very little evidence has been found).
- Perhaps intergenerational mobility in education is not being reflected in the level of intergenerational income mobility in a determined society (Fischer, 2009).
- Most studies on intergenerational mobility in industrialised countries focus on income; in developing nations the focus is on education due to lack of data availability.
- Chile has cross-sectional data sets which are widely used to generate and to implement social policies in the country (CASEN data set). They provide information about individuals and their children, but when the latter are too young to be part of the labour market or achieve their maximum level of education. Therefore, it is not possible to analyse the effect of parents on their children's earnings or education using the data as it is.
- In 2009, the CASEN data set include questions related to age, education and occupation of parents of individuals when individuals were 15 years old. This allows for the use of the Two Samples Two Stages Least Squares (TS2SLS) econometric technique, which can be used to predict income of parents uses a totally independent (but representative) cross-sectional data set and using the information given by individuals about their parents.

- It is found that income intergenerational mobility is higher than educational intergenerational mobility. This is the opposite to what was expected.
- The results also show that richer children seem to enjoy a higher transmission of income from their fathers than poor children. The opposite happens in terms of education.

2.2 Introduction

Inequality is one of the most widely studied social and economic concerns. Mostly this has been driven by the idea that a high dispersion of income can be a symptom of a society that suffers a lack of opportunities in terms of education or employment. For decades, inequality was measured and analysed through different lenses, but without considerations related to the flux, in terms of socioeconomic position, that individuals or families experience over time. This phenomenon was left out because it was thought that the transmission between economic conditions was a stochastic process mostly explained by luck and individual abilities (Becker and Tomes, 1976).

More recently, it has come to be accepted that social mobility and in particular intergenerational social mobility would depend on luck, but also other factors such as the level of inheritability of endowment from parents to children, the level of altruism of parents (propensity to invest in children's education), the rate of economic growth, taxes and subsidies, discrimination and family's connections or reputation among others. In addition, there is also a common agreement that living in a society with better levels of social mobility increases individual welfare (Fischer, 2009) and would involve a more efficient allocation of talents and skills.

In general, two main kinds of social mobility are identified, intra-generational and inter-generational social mobility. For the former, the main interest is about following individuals over time, analysing their movement in terms of social or economic status. For this case, in particular when long-run panel data are not available, it is common to compare the mobility experienced by different cohorts of the population, such as women or people born in the same year, and observing their evolution over time. For the latter, the focus is on the transmission of social or economic status from one generation to the next, mainly focusing on the impact that parents' background has on their children's outcome.

Earnings, educational and occupation are the most common types of parent/child relations analysed, such as father-son (the most common), mother-daughter or any other combination thereof. In addition, analysis of siblings and twins is becoming popular as larger longitudinal data are available to analyse the differences between "nature" and "nurture" to determine socio-economical outcomes (see for example, Björklund *et al.,* 2007). It is quite obvious that all the kinds of analyses mentioned above are probably related, but they do not measure the same thing. This research focuses on the analysis of intergenerational educational mobility and intergenerational income mobility. The former studies the impact of parents' education and their children's levels of education, the second corresponds to the study of the dependency of a child's income on the parents' income or earnings.

Becker and Tomes (1976) were the first to formally describe the social mobility process in economic terms, which would be mainly driven by social organisations rather than by genetic endowment inheritance. Roemer (2004) complements this suggestion and points out that there are four transmission mechanisms of parents' background to a child's income: Social connection;

beliefs and skills, or family culture or investment; genetics and giving aspirations to children. He suggests that public investment in education should compensate the inequalities in terms of culture and investment. However, one of the main issues related to educational intergenerational transmission, is that as Behrman *et al*. (2001) state "distributing opportunity is not only to expand schooling, because other factors seem to play an important role in the transference of intergenerational economic and social status". For example, better educated parents may put more pressure on children studying because they probably understand the benefits better, and also they probably provide more information to their children when they take their career decisions (Bjorklund and Salvanes, 2010). Additionally, more educated parents will have better information about which schools are best to attend. Parents decide how much to invest in their children's education considering the cost of education and the potential benefits. Therefore, the relationship between the schooling of parents and the schooling of children may also depend on the family size and the birth order of the children because they may not receive an equal proportion of the household income which is considered for education. Black *et al.* (2005) conclude that there is only a small causality of parents' education over children's education and that it is likely that the high correlation that is normally observed corresponds to family characteristics or inherited ability. On the other hand, Pronzato (2009) finds that the causality of parents' education on children's education is strong, independent of the countries analysed or the sample selection or the control variables used. However, when he includes ability or other unobserved characteristics as control variables, the results differed, finding that the fathers' education has a positive influence but not mother's education and in some cases the opposite results have been found.

In general, the intergenerational income mobility cross-country studies have been on industrialised countries focusing on the earnings aspect of mobility. i.e. USA and Germany (Couch and Dunn, 1997), USA and Sweden (Bjorklund and Jantti, 1997), Norway, Finland and Sweden (Bjorklund *et al.*, 2004) and Denmark, Finland, Norway, Sweden, the UK and the USA (Jantti *et al.*, 2006). Those countries that had parents-children data allowed researchers to evaluate the situation using Ordinary Least Squares (OLS) methods to measure the impact of parents' background on children's outcome. However, as will be explained in more detail in the following sections, the main problem with measures of earnings social mobility at the beginning was caused by the use of only 1 year of income as representative of permanent earnings, which would cause downward bias in the estimation.

Contrary to that, the majority of developing countries consider only information about educational social mobility with the idea that children with less educated parents, in general, are also less educated, therefore education of parents should be considered one of the most relevant factors that influence the level of education achieved by children (Piopiunik, 2011). The focus on education in developing countries, instead of on earnings, has been because there is far less information regarding earnings social mobility. However, during recent years there have been attempts to change this situation especially using new econometric techniques and new available data. Some of them have cross-sectional data sets that include questions about parents, such as age, education or occupation, but not earnings. Therefore an innovative approach was proposed, the Two Sample 2 Stage Least Squares (TS2SLS) technique. This basically allows the use of 2 independent surveys. In the first stage, the parent's earnings are estimated using the older survey, while in the second stage, the coefficient from in the first stage are used to predict the earnings of parents using the information on their characteristics reported by their children. Bjorklund and Jantti (1997) were the first to apply the TS2SLS for the case of intergenerational earnings mobility, in their highly cited work; they suggest that the economic background is more important to determine the earnings of people in the USA than in Sweden.

For the Chilean case, there have been some attempts to analyse the levels of intergenerational earnings and educational mobility. In this context, Nuñez and Riesco (2004) conclude that Chile presents less earnings mobility in comparison with other countries (finding 0.55 intergenerational earnings dependency). This situation has added to the high levels of income inequality in the country. Additionally, it is claimed that there has been a decrease in earnings dependency over time, which could be explained by the expansion of the educational system. The main issue with this research is that it uses only a Great Santiago area survey which can produce a homogenous sample, and therefore a biased estimation (Solon, 1989). Additionally, the significance of their results is not presented and when they use the TS2SLS technique, they only use schooling of parents as the instrumental variable. This study is followed by other two studies mentioned by Nuñez and Miranda (2011), but which are not found online and/or are available for other researches, these studies according to the author mentioned above found values of intergenerational earnings dependency of: 0.58 for the Greater Santiago and 0.67 for the Greater Santiago urban population both using schooling to predict father's earnings and 0.74 and 0.57 using nationwide data (using schooling and schooling and occupation for predicting father's earnings respectively).

Nuñez and Miranda (2011) also present their own results of intergenerational earnings mobility for the Greater Santiago region, considering as predictors parents' schooling and occupation, obtaining a similar elasticity to the previous papers (0.52-0.54). They additionally calculate the schooling elasticity, getting values around 0.20. In addition, they do not calculate both elasticities in a way that they can be compared (by standardising them). Finally, they measure intergenerational mobility using quantile transitions matrices over a log-linear regression model. Also, for the Chilean case, Nuñez and Tartakowsky (2009) analyse the relationship between inequality of incomes and inequality of opportunities concluding that income inequality indicators can be misleading for measuring the level of inequality of opportunities in a country. In addition, Contreras *et al*. (2008) researched the determinants of low intergenerational income mobility in Chile, concluding that the main ones are the access to quality education and access to skill accumulation.

The interest of this research area is driven by the desire to support the idea that if the earnings capacity of children is determined to a large extent by the background of their parents, then the allocation of resources and talent in a society would be inefficient, leading to a less than optimum productivity for the entire economy. Hence, the aims are to measure and compare intergenerational (mainly Father-Son) earnings and education dependency levels and to understand how important education is as a transmission mechanism to encourage equality of opportunity in Chile. This choice was made considering that, at least in Chile, male individuals are usually the main earners in the household. On the other hand, other possible combinations that could be used to measure the intergenerational earnings/schooling dependency have been considered, for example, Mother and Daughter relationships, which are presented in the appendix of this chapter.

This research will contribute to the current literature including nationwide data rather than only from the Metropolitan Region of Chile (which has already been done in the previous studies mentioned above), it will use occupation, schooling and age simultaneously as predictors of father's earnings and it will compare the levels of earnings and schooling mobility, measures that have been analysed in isolation by previous studies. In addition, it is of interest to analyse how intergenerational mobility can differ in magnitude with the socioeconomic status of families, therefore quantile estimation are included. Section 3 of this chapter will present a brief analysis of how intergenerational earnings and educational dependency is modelled, following by Section 4 where some issues related to the role played by age of individuals, in order to calculate a credible measure of intergenerational mobility is presented. Section 5 includes the data used description and section 6 the methodology utilised. Finally, in section 7 the results are analysed and discusses and in section 8 the conclusion are presented.

2.3 Modelling Intergenerational Income and EducationDependency

The intergenerational income elasticity is considered one of the best ways to represent the level of equality in opportunities in a country (Ichino *et al.*, 2010). In most of the research, the baseline model is the one suggested by Becker and Tomes (1976), which has alsobeen modified and reformulated by for example, Mulligan (1997), Solon (2004) and Holter (2011) among others.

Basically, all these models involve a very simple linear relationship, between children's earnings and parent's earnings:

$$(1)\ lnY_i^{Child} = \alpha + \beta lnY_i^{Parents} + \varepsilon_i$$

Where lnY_i^{Child} represents the natural log of the permanent earnings of the child *i* and $lnY_i^{Parents}$ represents the natural log of parents' permanent earnings of child *i*. Hence, β corresponds to the average earnings elasticity of children's earnings in relation to their parents' earnings. Finally, ε_i corresponds to the error term, therefore to the unobserved factors that affect the child's outcomes but which are assumed not directly related with parent's earnings.

The use of earnings rather than total income is considered more appropriate in the analysis,as receiving inheritance is not really opposed to openness in terms of mobility or meritocracy in society (Vogel, 2006). If other types of income, for example physical capital or income from rent, are included, for measuring intergenerational income mobility, this would make sense if this capital is inherited, but there would be a double counting if it is a consequence of the people's own savings (Bjorklund, 1993). In any case, the proportion of income that is represented by earnings is high (95% on average for the Chilean case), suggesting that only a small proportion is due to other kinds of incomes as rents.

In terms of interpretation, β corresponds to the intergenerational elasticity, measuring the % differential in sons' expected earnings with respect to a marginal percentage differential in the earningss of fathers (Bjorklund *et al.,* 2008). Therefore, if the intergenerational earnings elasticity is equal to 0.30, then for an increase of 1% in the father's earnings, this will indicate that on average the child's earnings will be 0.30% larger when he becomes an adult just due to the fact that his father was richer. This intergenerational earnings elasticity will increase according to Solon (2004) when genetic transmission of ability between parents and children increases, when human capital productivity is higher, when earnings returns to human capital are larger and when public investment is less progressive. The different levels of intergenerational mobility across countries could therefore be given for different values of the parameters before mentioned[24].

[24] Although, Solon (2004) has states himself that these could be only some of the factors that have an effect on intergenerational earnings dependency.

The case of β=0 corresponds to a society with perfect mobility, as there would not be dependency between children's earnings and their parents' earnings. On the other hand, $\beta = 1$ corresponds to the case of perfect immobility as earnings of children will depend totally upon their parents' earnings. Normally, β takes values between 0 and 1. However, in mathematical terms it is also possible to get β>1. As Mulligan (pp. 24-25, 1997) states "β can also be larger than one if parental income differences (in % terms) are associated with even larger income differences among children. Although β could conceivably be any real number, the vast majority of empirical estimates of β are actually between 0 and 1. Therefore, it is common to refer to the quantity (1 – β) as the degree of intergenerational mobility."

The simple model above (in equation (1)) has also been adapted by controlling for other variables that could affect the income of children. Gibbons (2010) explains that to control for life-cycle effects, the age of parents (and age squared) are used, and in some cases when the variation in age of children is very large, controlling for the child's age is also convenient. Normally studies use Least Squares estimation of log linear earnings of sons against parents controlling for the age of both generations (Solon, 2002). To control for other variables, such as children's education which is also related to parents' earnings, would be useful only if it were a goal to know how much these factors are affected by the parents' earnings (Gibbons, 2010).

The model can then be presented in the following form:

(2) $$lnY_i^{Child} = \alpha + \beta lnY_i^{Parents} + \varphi_1 Age^{Parents} + \varphi_2 Age^{2^{Parents}} + \varphi_3 Age^{Child} + \varphi_4 Age^{2^{Child}} + \varepsilon_i$$

Additionally, the intergenerational comparison between years of schooling or levels of education has also been used as an indicator of social mobility in a society, and in many developing countries this has been the unique way that it has been done, in particular because of the lack of income data availability. Years of schooling is generally used to see the relationship between parents and children in a similar way that earnings relationships are formulated, but replacing earnings by schooling (S) gives:

$$(3)\ S_i^{Child} = \alpha + \beta S_i^{Parents} + \vartheta Age^{Child} + \omega_i$$

In terms of control variables, Holmlund *et al.* (2008) point out that one of the reasons to include the age of parents in the intergenerational education regression is that the number of people studying higher levels of education has been increasing over time. This consideration has been taken into account by the majority of research. On the other hand, the age of parents may not be included in the intergenerational education regression because more schooled (potential) mothers are more likely to postpone motherhood. In addition, there is no agreement whether the mother's level of education should be a control variable in the regression of father and child education. If it is not used, the estimation of fathers' schooling effect will contain the direct influence of the father and the indirect effect of the mothers' schooling (Piopiunik, 2011).

2.4 Problems Associated with measuring Intergenerational Mobility

Age of individuals and their parents seems to be crucial in order to estimate the "true value" of social openness. The main problem is that it would be interesting to measure the level of earnings transmission of permanent earnings between individuals and their parents, but to obtain permanent earnings figures is not possible, because it would be necessary to know every shock affecting individuals that could increase or decreases their earnings in a transitory way. Therefore, if permanent earnings are not identified at the most accurate possible level, intergenerational earnings transmission estimation can be downward biased (Solon, 1989). For example, Solon (1992) shows that the use of only one or a few years of earnings as a proxy for permanent earnings can make a big difference in terms of measuring the intergenerational earnings elasticity. In particular, for the case of the United States, he shows that when more years are averaged to estimate the "permanent" earnings of parents, the intergenerational earnings elasticity goes from 0.2 (when a single year is used) to around 0.40 when 5 years are used to calculate it using OLS techniques, a result that is confirmed by Zimmerman (1992) using another data set.

The solution could then be to use instruments that allow prediction of the permanent earnings of parents instead of using limited numbers of years by applying OLS. For example, education could be considered as an instrument for permanent earnings (Dunn, 2007). In particular, years of schooling could be a good candidate (Solon, 1992). Occupation could be another instrument that allows researchers to predict permanent future earnings as suggested by Fortin and Lefbvre (1998) and Checchi (1997). However, the father's occupation and education (which vary less through the life cycle and will better represent permanent earnings) are not only correlated with the father's earnings, but can also be a predictor of children's earnings.

The education of parents has two effects on a child's earnings: it increases their educational level (they can help them with their school homework) which is a direct effect, and it affects the father's earnings which in turn impacts the children's earnings. Thus, if parents' education and occupation are used only to predict parents' permanent earnings in the first stage, this will cause an upward inconsistency in the instrumental variable (IV) estimator.

Therefore, using IV or two stage estimations or considering education, occupation or social class to predict fathers' earnings, generates an upward bias because father's education, occupation and social class are not only correlated with the father's earnings, but also might be positive predictors of the son's earning even after conditioning on father's long-run earnings. Thus, the solution could be to control for these factors as separate explanatory exogenous variables (Solon, 1992). However, that would take away the effect of parents' earningsover controlling for the aim ofmeassuring the level of intergenerational earningselasticity. On the other hand, it is possible to use the OLS estimation based on current earnings as the lower bound of the true intergenerational earnings dependency level and the IV estimation as the upper bound (Blanden and Machin, 2007) believing that the true value should be among these two extremes. When the father's earning are predicted using information from another data set, the estimator will be also have upward bias in the same way as a common IV estimator, and the size of the bias will depend on how much the earnings of the children are influenced by the factors that were used to predict the father's earnings. Therefore, life cycle earnings are very important in terms of arriving at the correct earnings elasticity calculation. In particular, the age of son and parents can impact largely on the intergenerational elasticity that is calculated. Grawe (2006) explains that the average fathers' age is negatively correlated with the level of earning persistence estimated (then positively correlated with the level of intergenerational earning mobility).

Therefore, if the age at which fathers are observed increases (holding the age at which sons are observed constant) the intergenerational earnings elasticity would decrease due to larger variation in earnings observed for the older fathers and the same variation in earnings for the sons who were left unchanged would need to be explained. This is supported by Bjorklund (1993) who finds that earnings are more correlated with permanent earnings later in life and that earning mobility decreases with the father's age. The opposite would happen if the son's age increases (leaving fathers' earnings constant): An increase in sons' age would increase the intergenerational earnings elasticity due to the fact that there is more variation in earnings observed across the older sons that can be related to the unchanged variation in earnings across fathers. Hence, comparing two data sets where both fathers and sons are younger than another one, the direction of the bias cannot be determined in a straight forward way and there are two opposite effects playing a role. That would potentially explain the variation among different researches that use samples with different ages.

In addition, Haider and Solon (2006) point out that intergenerational earnings mobility literature often pays attention to the right-side measurement error. However, it has ignored the problems associated with permanent earnings. This has likely been produced by the idea that measurement error in the dependent variable does not affect the consistency of the estimator which according to Haider and Solon would be the case if sons' earnings were observed when they are between their early thirties and mid-forties, rather than in their earlier years as in many studies. This kind of measurement error is commonly known as 'mean reverting' because even though the earnings could be high in the early stages they would converge to their long-run mean. Solon (2002) explains that young sons that have a high socioeconomic level have a more rapid growth in earnings than the ones that will be poorer in the future.

So, for those that would have high permanent earnings, when they are young the current earnings are lower compared to their permanent earnings. On the other hand for those that will have lower permanent earnings; their younger earnings will be relatively higher in comparison with their permanent earnings. Thus, this kind of error is associated with a bias in the estimation and the direction will be determined by the age at which earnings are observed. A tentative solution for this problem would be to use the latest earnings figures available or to average earnings over time. However, if the average is done on too early years, then the problem mentioned above will become worse.

Therefore, father-age dependency might be very important in explaining the differences in results from similar data sets. So the question of who is right is impossible to answer as it is impossible to obtain the real permanent earnings of an individual. However, it is possible to try to be closer to the best answer, which includes the use of the mid-life year (studies considering parents in their forties and children in their late twenties and early thirties would be more accurate) for parents and children considering similar ages for both of them. However, normally surveys contain younger children, so it is likely that there would be an underestimation of the intergenerational earning elasticity. The decisions in relation to issues mentioned above makes international comparisons more difficult. Lefranc and Trannoy (2004) propose that children's surveys should only consider people between 30 to 40 years old and in the case of the parents they should be between 25 and 30 years old when their children were born. On the other hand, Haider and Solon (2006) explain that to have a sample with young children and old parents creates a noticeable downward bias but to use a subgroup of the sample, for example, to consider parents and children with a range of age between 30 and 40 years old, causes a downward bias due to homogeneity in the sample selection. In particular, using a small sample increases the error in the bias estimation of variables. Therefore, the best solution would be to control by age and age squared of both parents if parent's and child's earnings are observed at different periods of time (Comi, 2004). Finally, Comi (2004) criticises the way that permanent earningsare calculated in some research, keeping only fathers and sons who are continuously observed to be employed, in this way fathers and sons with zero earnings are removed from the sample. However, excluding these data will increase the average earnings of the whole sample. Therefore selection bias will be included, in particular, if unemployment is a national phenomenon.

2.5 Data

This research uses two Chilean data sets: the cross-sectional National Characterisation Socio-economic Survey (CASEN) of 1990 and 2009. They are nationally representative surveys (rural and urban areas in the country's 15 regions) collected by the Ministry of Social Development (Chilean government) and used as the main data sources to design and evaluate social policies in the country. The 2009 survey is particularly interesting because it asked individuals information for when they were 15 years old about their parents. This included information about education, occupation and age (but not earnings). Therefore, the survey in 1990 will be used as the 'synthetic parents' sample' which has information about parent's education, occupation, age and also earnings and they will be linked (in a process that will be explained in the methodology section) to the information that children in 2009 gave about their own real parents.

Only individuals that have information (about education, occupation status and age) of their parents have been used to predict their earnings and used to evaluate their impact on children's earnings[25]. In addition, as will be explained later in more detail, parents in the first survey (1990) should be representative of the parents that children report in 2009, in terms of age, occupation category and educational level. In particular, as mentioned in the

[25] Notice that the concept of earnings used corresponds to the one after tax reductions.

previous section, the age of parents and children is very important to avoid bias in the estimation of intergenerational mobility.

Therefore, it was considered that individuals in the parents' survey should be between 25 to 65 years old for males and between 25 and 60 years old for females, this taking account that university degrees take between 5 to 6 years to complete after secondary school which finishes around the age of 18 and that the age of retirement is 65 and 60 years old for male and female respectively. In Table 2.1 the figures for both samples are presented comparing them in the year 2009 for the case of fathers-sons relationship (adding 19 years to the figures obtained with the 1990 survey). So, the minimum age in 1990 was 25 years old as mentioned before, but adding 19 years corresponds to 44 years old, the maximum was 65 plus 19 years is 84 years old, giving an average of 59.7 years old which is congruent with the age of fathers reported by their sons in 2009 (average of 60.27). For fathers' average age, this match was achieved by contracting the sample of sons by the age of their fathers, being between 44 and 68 years old instead of the 44 and 84 years old available in the data set, resulting also in a contraction in the age of sons in 2009 to 56 (compared to 65 that was initially attempted).

Table 2.1: Father's Age in 2009 (reported) versus 1990

Age of Father in 2009			
2009 (reported by sons): t=0		**1990 (synthetic fathers): t1=t+19**	
Mean Age	60.27	Mean Age	59.7
Min Age	44	Min Age	44
Max Age	68	Max Age	84
St Dev.[26]	5.8	St Dev.	11.45

Source: CASEN Surveys, 2009 and 1990

[26] The smaller standard deviation for the reported information in 2009 will decrease the variance of the father's earnings in the second stage estimation. Therefore, it will increase the standard errors of the intergenerational earnings coefficient which will only reduce the significance of the estimation. It therefore cannot cause spurious significant effects.

The child's age is also important, and it should also be congruent with the age of their parents. Table 2.2 shows that the average age of sons in the 2009 sample was 34.97 years old; this figure should be congruent with the expected average age of sons if fathers in the 1990 sample are considered. That is, if the synthetic fathers in 2009 (the ones obtained using the sample 1990 lagged 19 years) were on average 59.7 years old, they were born in 2009-59.7=1949 and it is supposed that they have a child at the age of 25 years old (which also was checked as the most popular age on average to have children in the survey) then, the sons were born on average around 1949+25=1974. Therefore, sons in the year 2009 would be 2009-1974=35 years old, which is also the average age of children in the 2009 data set (34.97).

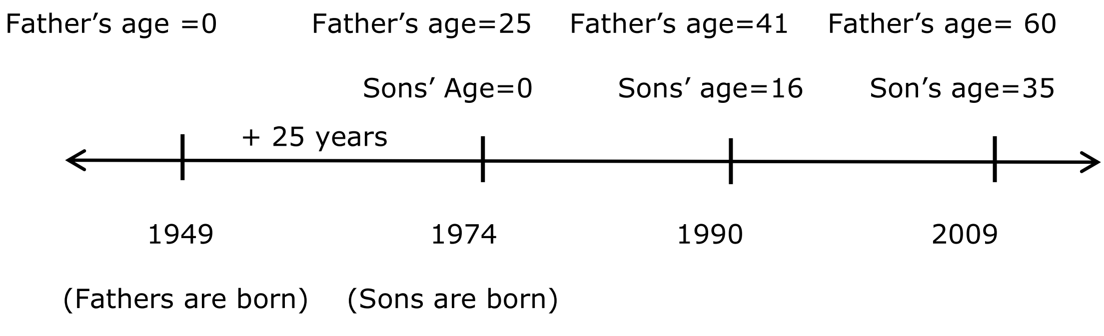
Table 2.2: Son's Age

Son's Age in 2009	
Mean	34.97
Min	25
Max	56
St Dev.	6.1

Source: CASEN Survey, 2009

Graphically, this relationship between the parent's and child's age can be understood using a time line:

Figure 2.1 Time Line



In terms of levels of education, the figures are similar (except on the percentage of people holding primary education and the ones having no degree).

Table 2.3: % Level of Education (Congruency)

2009 (reported by sons)		1990 (synthetic fathers)	
Education	**%**	**Education**	**%**
Nursery	0	Nursery	0
Primary (< 1965) Primary (> 1965)	22.09 31.76	Primary (<1965) Primary (> 1965)	23.55 14.62
Secondary (< 1965) Secondary (> 1965)	11.54 11.35	Secondary	20.38
Technical Secondary (< 1965) Technical Secondary (> 1965)	3.55 2.06	Technical Secondary	5.35
Professional Technician Professional Institute	0.87 0.67	Professional Technician & Institute	1.8
University	4.04	University	6.31
None	12.06	None	27.97

Source: CASEN Surveys, 2009 and 1990

In addition, to compare years of schooling of fathers reported by their sons and the synthetic fathers is necessary to convert the maximum level of education (reported by sons) into years of schooling using a direct assignation. This is necessary as the information about parents' education in the 2009 survey only contain details of levels of education and not years of schooling. The assignation procedure is described below:

Maximum level of education (converted to number of years of schooling):

- 0 years if father has no education as maximum level of education.[27]
- 6 years if father has primary education (and finished before the reform in 1965 was implemented[28]).

[27] Zero years of schooling helps to represent individuals that do not hold any certificate, in terms of education.

- 8 years if father has primary education (and finished after the reform in 1965 was implemented).
- 12 years if father has secondary (or technical secondary) education.
- 16 years if father has professional technical education.
- 18 years if father has university education.

In order to compare both surveys in terms of years of schooling, the conversion explained above is imperative, and is presented in Table 2.4 below:

Table 2.4: Years of Education (Congruency): Direct Assignation[29]

Year	**2009**	**1990**
Schooling (number of years)	**Assigned**	**Actual**
Mean	8.25	8.56
Min	0	0
Max	18	19
St Dev.	4.24	4.51

Source: CASEN Surveys, 2009 and 1990

Comparing the results of this direct assignation approach, they are very similar to the actual values obtained in the 1990 survey, therefore both surveys would be compatible at least in terms of fathers' years of schooling. In addition and as a check, levels of education for fathers in 2009 were converted to years of schooling using a different procedure. An estimation of years of schooling using the levels of education as predictors was performed using the 1990 sample (where years of schooling are available for the individuals). Therefore, using the sample 1990, years of schooling were predicted for each level of education of individuals (First Stage), after that, using the regression coefficient obtained, the

[28] The Educational reform of 1965 basically changed the number of years of schooling in primary education. Before the reform, primary education included 6 years of study, after that year, there was an increase in the number of years to 8 and the number of years of secondary school was reduced from 6 to 4, maintaining, if primary and secondary education are considered, the total number of years is the same.

[29] See Appendix 2A1. for Mother-Daughter details (Table 2A1.1 to Table 2A1.6).

educational level of fathers in year 2009 (reported by their sons) were predicted (Second Stage):

Using the 1990 sample: Years of schooling= Ω_0 + Ω_1Primary$_{beforeReform}$ + Ω_2Primary$_{afterReform}$ + Ω_3Secondary (or Technical_Secondary) + Ω_4Professional_Technical + Ω_5University

Considering this second approach the results presented in Table 2.5 are less consistent than the results obtained using direct assignation approach.

Table 2.5: Years of Education (Congruency): Predicted Values

Year	**2009**	**1990**
Schooling(number of years)	**Estimated**	**Actual**
Mean	10.98	8.56
Min	4.15	0
Max	17.22	19
St Dev.	3.48	4.51

Source: CASEN Surveys, 2009 and 1990

In terms of occupation, the main difference is in the percentage of people that are not of the working population. However, when they are excluded, the occupational categories are very similar in terms of proportion. Notice that 'without payment' represents some workers who even though they work, do not receive a formal salary as they work in family businesses (see Table 2.6).

Table 2.6: % Occupation (Congruency)

2009 (reported by sons)		**1990 (potential fathers)**	
Education	**%**	**Education**	**%**
Employer	3.44	Employer	3.33
Self-Employed	24.79	Self-Employed	25.9
Employee	69.35	Employee	68.7
Navy &Military &Police	2.28	Navy & Military& Police	1.26
Housekeeping	0.13	Housekeeping (inside) Housekeeping (outside)	0.04 0.1
		Without payment	0.65
Total	100	Total	100
Not Working	0.65	Not Working	15

Source: CASEN Surveys, 2009 and 1990

Normally, due to measurement error, particularly for reported earnings, self-employment is not considered in other similar research. However due to the large proportion of self-employment in Chile (23%), these individuals were considered in this research.

Using the samples mentioned above, in total it is possible to find 6,983 Father-Son pairs and 7,352 Mother-Daughter pairs. Some additional descriptive statistics are presented in the following in Table 2.7 and 2.8:

Table 2.7: Descriptive Statistics

	1990	**2009**
Father(1990)_Son(2009)	**Fathers**	**Sons**
Avg. Number of children in the household (St.Dev.)	2.1(1.5)	1.6 (1.1)
% Rural	29.8%	33.0%
Avg. Number years of Schooling	8.6 (4.5)	10.9 (3.4)
% Married	70.6%	57.9%
Proportion richest and poorest decile of income[30]	27.2	15.2
Avg. Number people in the household (St.Dev.)	4.65(2.05)	4.14 (1.66)
% Illiteracy	5.87%	1.70%

Source: CASEN Surveys, 2009 and 1990

Table 2.8: Sample Sizes with Information on Occupation, Education and Age of Fathers (Mothers)

Sub-Sample size	
Number of Father_Son Pairs	6,983
Number of Mother_Son Pairs	6,397
Number of Mother_Daughter Pairs	7,397

Source: CASEN Surveys, 2009 and 1990

[30] Average Income 10^{th} income decile /Average Income 1^{st} income decile.

2.6 Methodology

2.6.1 Two Sample Two Stage Least Squares

As mentioned before, the 2009 CASEN survey does not provide information regarding the income of parents, but it does about their educational levels (but not years of schooling), occupation and age. On the other hand, the 1990 survey which is totally independent to the survey in 2009 contains information related to levels of education, occupation, age and income of the individuals that were interviewed. Therefore, the main idea is to connect these twosurveys using Two Sample Two Stage Least Squares (TS2SLS),a methodology used by many empirical researchers following the Two Sample Instrumental Variable (TSIV) methodology originally proposed by Angrist and Krueger (1992) and Arellano and Meghir (1992) which required matrix manipulation being not so easily implemented using standard regression softwares. The main advantage of this technique is the possibility to use two independent surveys. The first one acts as the parents' survey and the second as the children's survey, children that report information about their parents.

Following Angrist and Krueger (1995), the sample is divided into two half-samples (S_1 and S_2) or two totally independent samples are used. Each sample consists of data matrices $\{Y_j, X_j, Z_j\}$, j=1,2. Y corresponds to the dependent variable, X includes the explanatory variables and Z includes the instrumental variables. Assume that the data matrices $\{Y_1, X_1, Z_1\}$ and matrices $\{Y_2, X_2, Z_2\}$ are jointly independent.

In S_2: X_2 is the father's earnings and Z_2 corresponds to the vector of exogenous variables composed of education, occupation, age and age squared.

Hence, S_2 is used to estimate the 1st stage equation to predict father's earnings, obtaining:

$$\widehat{\varphi_2} = (Z_2{}'Z_2)^{-1}Z_2{}'X_2$$

The 1st stage parameters obtained ($\widehat{\varphi_2}$) are then used together with observations on Z_1 ('the instruments' in S_1, also occupation, education, age, and age^2) to obtain fitted values for X_1 (parent's earnings) in S_1. After that, Y_1 (child's earnings) is regressed on these fitted values (and other exogenous regressors if required) using S_1. Algebraically, the estimator corresponds to an OLS version of a model with predicted exogenous variable, X_1:

$$\widehat{\beta_{TS2SLS}} = \left(\widehat{X_{21}}'\widehat{X_{21}}\right)^{-1}\widehat{X_{21}}'Y_1$$

Where $\widehat{X_{21}} = Z_1\widehat{\varphi_2} = Z_1(Z_2{}'Z_2)^{-1}Z_2{}'X_2$, the regressors obtained in the 1st stage multiplied by the 'instruments' in $S_{1.}$

Therefore:

$$\widehat{\beta_{Ts2SLS}} = [X_2{}'Z_2(Z_2{}'Z_2)^{-1}Z_1{}'Z_1(Z_2{}'Z_2)^{-1}Z_2{}'X_2]^{-1}[X_2{}'Z_2(Z_2{}'Z_2)^{-1}Z_1{}'Y_1]$$

In this way, the common problem of having information reported by children that does not include their parent's earnings, but does have information about educational level or occupational categories, is solved. This is why the survey congruency explained in the previous section is important).

It is important to consider that parents' and children'searnings should be permanent, which are difficult to obtain. However, the use of education and occupation as predictors of earnings[31] allows us to think that they will give a closer estimation of permanent earnings as these factors do not vary so much over time.

The father's occupation is found in 6 occupational categories and 5 dummy variables: 'employee' (the one which was excluded from the regressions), 'employer', 'self-employed', 'navy' (police or military), 'housekeeping' and 'not working'. It may seem strange to include the last category since one may suppose that the unemployed have no earnings. However, some of them present information for example self-production in small farms, which is considered as a kind of labour income by the survey.

The father's level of education is calculated in three ways. In the first alternative (Alt_1) 6 dummy variables are included to represent 7 different educational levels (maximum level of education achieved by the individual): Primary (before the 1965 educational reform), Primary (after the 1965 reform), Secondary, Secondary-Technical, Professional Technician, Without degree and University (where University was the variable excluded in the regression).

Also a direct and an indirect conversion of the educational level information were made. Namely, the level of education of parents was transformed into number of years of schooling considering 8 years for primary school, 12 years for secondary, etc. as explained in the previous section which was called Alt_2_d, and also, using a schooling regression based on the level of education of individuals using the survey in 1990. So, years of schooling were predicted using the different levels of education in the 1990 sample that was

[31] Earnings correspond to income from work in the last month after taxes.

called Alt_2_r. The same procedure was used to calculate mother-daughter relationships.

To be clearer, the way in which parent's earnings were calculated in the first stage is described below (all using robust standard errors):

i) Parent's permanent earnings calculated as: Y^p*=f(occupation, level of education, age, age*^{2}*), (Alt_1).*

ii) Parent's permanent earnings calculated as*:* Y^p*=f(occupation, years of schooling (derived directly from correspondent's level of education*[32]*), age, age*^{2}*), (Alt_2_d).*

iii) Parent's permanent earnings calculated as: Y^p*= f(occupation, schooling (derived from regression of level of education), age, age*^{2}*), (Alt_2_r)*

To calculate the levels of intergenerational educational dependency, information of schooling of individuals and their parents' levels of education are found in the same survey (2009). Therefore, in a first instance, TS2LS estimation is not necessary as an OLS version will be able to give an estimation of how parental education influences children's education. Therefore, the calculation follows:

i) Parents' education calculated as a series of dummy variables that correspond to the level of education of parents similar to Alt_1.

[32] Since the 2009 survey does not contain this information about parents.

$$S^S = \alpha + \beta_1 Dummy_{Primary<1965} + \beta_2 Dummy_{Secondary} + \beta_3 Dummy_{ProfessionalTech} + \ldots + \sum_i \beta_i Dummy_{Occupational\ Cateory\ i}$$

The estimation of the son's schooling is dependent on the level of education of his father distributed in six educational dummy variables and on the father's occupational category, also distributed in six dummy variables. The difficulty with this idea of measuring education of fathers is the need of obtaining only one measurement of educational dependency and not six as would be obtained using this alternative. In particular, this is problem when the idea is to compare the intergenerational earnings elasticity measurements with the respective educational mobility measurements.

Therefore, there are 2 alternative to solve this problem: To convert the parents' educational level into years of schooling (considering for example that if an individual finished primary education they must have 8 years of education as was done to predict earnings) and then use simple OLS to contrast with individual's schooling (ii). The second alternative is to use the TS2LS methodology to predict the years of schooling of parents, considering the information given in the 1990 data set (where educational level and years of schooling are found for each individual) (iii).

ii) Parent's education calculated as: Years of schooling derived directly from level of educational attainment. (Alt 2_d)

iii) Parent's education calculated as: Years of schooling derived from the regression of years of schooling in 1990. (Alt 2_r)

To compare both education and earning mobility, the standardised coefficient of parent's earnings (ρ^i) and parent'sschooling (ρ^e) and children's earnings (schooling) is calculated, adjusting the coefficients (β) by earnings (schooling) variance of both generations (Blanden, 2009):

$$\rho^{i} = \beta^{\mathrm{i\,(St)}} = \hat{\beta}^{\mathrm{i}} \frac{SDev(\ln Y^{Father})}{SDev(\ln Y^{Son})} \quad \text{or} \quad \rho^{e} = \beta^{\mathrm{e\,(St)}} = \hat{\beta}^{\mathrm{e}} \frac{SDev(S^{Father})}{SDev(S^{Son})}$$

This conversion is useful asit allows comparison of the results obtained about education and earnings mobility as predictors and outcomes are standardised to have a standar deviation equal to one. Therefore, it is possible to interpret the standardised coefficients as the change in the outcome, in standard deviation units, due to a change in standard deviation units, in the predictors or regressors (full standardisation)[33].

Bootstrap[34] standard errors (300 iterations) were applied in the second stage of the estimation for all the regressions utilised as they are more suitable when the distribution of one of the variables is not known as in this case, due to the prediction of parents' permanent earnings[35]. It is important to note that the data potentially present heteroskedasticity problems which can be solved using robust standard errors (parametrically estimated). However, using bootstrapping

[33] Using a standardised coefficient (also called full standardisation), both the explanatory variables and the dependent variable are standardised to have mean zero and standard deviation of one.

[34] Bootstrapping is a general approach to statistical inference based on building a sampling distribution for a statistic by re-sampling the data. It is a non-parametric approach that is based on computational iteration rather than on mathematical analysis and the distributional assumptions of traditional parametric inference (Mooney, 1996).

[35] Inoue and Solon (2010) pointed out some confusion in the literature in terms of the standard errors associated with the TS2SLS and with the Two Sample Instrumental Variable originally developed by Angrist and Krueger (1992), the first should be corrected in order to be compared with the second, as they are not equivalent.

(non-parametrically estimated) also solves the problem and therefore is also considered robust.

In addition to the OLS estimation using two independent samples, the analysis was extended using Quantile Regression (QR) to analyse the situationmore deeply. The details will follow in the next section.

2.6.2 Quantile Regression

It has been argued that the relationship between parents' and children's earnings is linear in the absence of obstacles to self-financing in investment in child human capital, but concave if poor families faces more borrowing constraints than richer families (Becker and Tomes, 1976). This fact would cause, as Grawe (2004) and Bratsberg (2006) explain, if poorer parents are constrained to finance the education of their children (likely due to a lack of access to credit markets), their children's earnings to fall below the earnings of a non-constrained child who has the same ability. Therefore, it is expected that earnings mobility will be lower among low income families predicting a concave relationship (assuming that parental income is a good proxy for access to credit). Furthermore, if the functional form of the intergenerational earnings relationship varies across countries, then international comparisons can be misleading.

Normally, all the studies that test nonlinearity do it in order to prove the concavity conjecture proposed by Becker and Tomes dividing the data set in percentiles of the distribution of parental earnings. Hertz (2008), for example, using U.S data, finds that β changes depending on which part of the income distribution is analysed, being very high for the poorest families and lower for the richest, mostly because poor families can be credit constrained to invest in their children's education. On the other hand, some studies have challenged this idea, finding a convex relationship. Bratsberg *et al.* (2006) show that applying log-linear relationships in the Nordic countries involves a serious specification error, because their patterns of social mobility (father-son earnings), are convex rather than linear. These nonlinear intergenerational earning mobility patterns were present in Denmark, Finland and Norway, being more mobile in the lower part of the earning distribution, in contrast with the UK and US. However, the authors utilise a polynomial approach, in terms of the more traditional quantile regression analysis. These approaches differ as the quantile analysis focuses on the distribution of the dependent variable (son's earnings). On the other hand, the polynomial analysis faces the non-linearity of intergenerational earnings dependency, focusing on the distribution of the independent variable (father's earnings).

Corak and Heisz (1998), using quantile regression, find a *S*-shaped earnings regression considering non-linearity in the parent-child earning relationship for the case of Canada. Finding higher beta coefficients among middle-income families and explaining this by saying that if low income earning parents have low ability children, they would not need much education, therefore access to credit to finance would be not a problem. Hyson (2003) also suggests the potential existence of an *S*-shaped pattern: where β is low for the poorest families, highest for middle income and low for the richest. Hence, Han and Mulligan (2001) suggest that this may be because high income families probably have children with more abilities, and then assuming that returns to human capital increase with ability and education is costly, they will also be credit constrained (Black and Devereux, 2011).

Therefore, considering potential non-linearity in the earnings and schooling intergenerational relationship, quantile regression techniques have also been considered. In simple terms, quantile regression, rather than fitting to a linear model for conditional means as done by OLS, fits to conditional quantiles (Angrist *et al.,* 2006). Therefore, quantile regression supplements the estimation of the conditional mean function, estimating the entire family of conditional quantile functions, providing a deeper understanding of the conditional dependent variable distribution including the possibility that the effects of a determined variable can change in magnitude and in direction across quantiles (Cameron and Trivedi, 2005).

Quantile regression has the advantage over mean regression of giving the possibility of a deeper analysis of the conditional distribution of the dependent variable as it allows for different direction of causality and magnitude of the regressors across the quantiles. However, it is computationally more demanding, including a non-analytical solution (which is solved using iteration methods) and the fact that it is not available in allsoftware packages (but it is in Stata).

As the OLS estimator, the quantile regression estimator also has some large sample properties:

- The estimator of β_τ is consistent and asymptotically normal with a known asymptotic distribution.
- The asymptotic distribution of β_τ depends on the unknown error density and for this reason is not easy to estimate. It is therefore common to use re-sampling techniques (boostrapping) to estimate the distribution.

Also, quantile regression incorporates some interesting properties: QR is robust to distributional assumptions (similar to OLS), it is robust with respect to outliers (in contrast to OLS) because only the sign of the residuals matters in determining the QR estimates but the magnitude does not and it is possible to detect heteroscedasticity with QR if the conditional quantile functions are not parallel.

In practical terms, the same methodology used for the linear case is applied. However, OLS is applied in the first stage (to predict parents' earnings), but in the second stage, quantile regression is used as was done by Mocetti (2007).

Therefore, quantile regression estimation allows differentiation between the levels of mobility among different types of children because the quantiles point towards the children's earnings distribution conditional on their father's earnings (Fertig, 2001).

In a formal representation following Cameron and Trivedi (2005):

Suppose Y (or lnY_i^{Child}) is a random variable with distribution function:

$$F_Y(y) = Prob(Y \leq y)$$

Where F_Y is the cumulative distribution function (c.d.f.) of Y, and $\tau \in (0,1)$ is a real number:

Then theτ^{th} quantile of F_Y is $q_Y(\tau)$ and therefore: $F_Y(q) = \tau$or $q_Y(\tau) = F_Y^{-1}(\tau) = \inf\{y: F_Y(y) \geq \tau\}$

The τ^{th} quantile of F_Y can be obtained by solving:

$$min_q \tau \int_{y>q} |y-q| dF_Y(y) + (1-\tau) \int_{y<q} |y-q| dF_Y(y)$$

$$\equiv min_q \tau \int_{y>q} (y-q)dF_Y(y) - (1-\tau)\int_{y<q} (y-q)dF_Y(y)$$

Applying the first order condition:

$$-\tau \int_{y>q} dF_Y(y) + (1-\tau)\int_{y<q} dF_Y(y) = 0$$

$$-\tau[1-F_Y(q)] + (1-\tau)F_Y(q) = -\tau + F_Y(q) = 0$$

The same reasoning can be extended to the conditional distribution

$$min_q \tau \int_{y>q} |y-q| dF_{Y/x}(y) + (1-\tau)\int_{y<q} |y-q| dF_{Y/x}(y)$$

And if $Q_{Y/X}(\tau)$ is a linear function xβ with unknown β, the maximisation problem above can be re-written as:

$$min_\beta \tau \int_{y>x\beta} |y-x\beta| dF_{Y/x}(y) + (1-\tau)\int_{y<x\beta} |y-x\beta| dF_{Y/x}(y)$$

Let the solution be denoted by β_τ (therefore the coefficient of the regression can vary withτ) and the τ^{th} conditional quantile is then:

$$Q_{Y/X}(\tau) \equiv x\beta_\tau$$

The τ^{th} quantile regression estimator of β can be obtained by minimizing the sample counterpart:

$$(**)\ M_{n(\beta;\tau)} = \frac{1}{n}[\tau \sum_{i:y_i > x_{i\beta}} |y_i - x_i\,\beta| + (1-\tau) \sum_{i:y_i < x_{i\beta}} |y_i - x_i\,\beta|]$$

This is the average of asymmetrically weighted absolute errors with weight τ on the positive errors and weight $(\tau - 1)$ on the negative errors.

A special case is the median function with $\tau = 0.5$, where the weights are symmetric and the objective function reduces to:

$$2M_{n(\beta;0.5)} = \frac{1}{n}\sum_i |y_i - x_i\,\beta|$$

Which is equivalent to minimising the sum of absolute errors and is also called the "Least Absolute Deviations" (LAD) estimator. OLS and LAD will differ if the error deviation is not symmetric.

For the general case now, let $\rho_\tau(a) = \tau a$ if $a > 0$ and $\rho_\tau(a) = (\tau - 1)a$ if $a \leq 0$, this piecewise function is called the "check function", then replacing in (**)

$$M_{n(\beta;\tau)} = \frac{1}{n}\sum_{i=1}^{n} \rho_\tau(y_i - x_i\beta)$$

$$M_{n(\beta;\tau)} = \frac{1}{n}\sum_{i=1}^{n}(\tau - 1)\,(y_i - x_i\beta) \quad \text{if} \quad y_i - x_i\beta < 0\ , \text{ and}$$

$$M_{n(\beta;\tau)} = \frac{1}{n}\sum_{i=1}^{n}\tau\,(y_i - x_i\beta) \quad \text{if} \quad y_i - x_i\beta > 0$$

It is worth noting that this function is not differentiable when $y = x\beta$, therefore the expression does not have an analytical solution and it has to be obtained using linear programming (simplex, interior point methods, etc.).

For the purposes of measuring the intergenerational earnings elasticity and partial correlation (Std. Coefficient), a child will be in the τ^{th} quantile ofthe income (earnings distribution) if he has earnings larger than the proportion τ of all the children with earnings and lower earnings than the quantity $1-\tau$ (Koenker and Hallock, 2001).

So basically, applying the quantile regression methods to the estimation of intergenerational income mobility[36]:

$$Q_{Y_{iChild}}(\tau|F_{Child}) = \beta_0(\tau) + \beta_\tau Y_{iFather}$$

In graphical terms, if the quantile coefficients are plotted in one diagram, similarly as the so-called Engel curves, and the quantile lines are all horizontal (β=0), there would be perfect mobility because the parent's income would not have any impact on the income of their children. On the other hand, if all the lines coincide with the 45 degrees line (slope=1), total immobility is presented (β=1). In addition, the non-parallelism among the lines can give signs of heteroskedasticity (Koenker and Hallock, 2001).

Notice there is no rule for selecting the number of quantiles to analyse and that when QR is applied, the same regressions have been used for the first stage as when the T2TSLS and OLS techniques were applied.

[36] It is possible to find more details in Koenker and Bassett (1978).

2.7 Results

2.7.1 Descriptive Results: Transition Matrices

The data can be seen in terms of transition matrices, describing the movements that sons experience relative to their father's situation, in terms of education (number of years of schooling) and earnings. These matrices of transition have been widely interpreted as the conditional probability that a son has a determined position given that his father was in another position (or the same, which would be the diagonal case). Therefore, all the figures on the right of the main matrix diagonal represent positive movements and the opposite for the figures presented on the left of the diagonal.

Table 2.9: Transition Matrix Earnings Deciles: Father-Sons (%)

Earnings Deciles		**Son**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Father	**1**	**18.5**	14.0	13.9	11.3	8.7	9.0	7.8	5.8	6.5	4.6	100
	2	14.0	**9.6**	8.4	13.0	9.3	13.0	8.5	9.7	8.0	6.5	100
	3	10.0	9.6	**12.1**	11.3	12.3	9.7	11.1	10.1	8.8	5.0	100
	4	12.2	14.0	10.3	**11.4**	9.5	9.5	10.2	9.2	7.4	6.2	100
	5	13.9	13.0	9.9	12.0	**10.7**	10.7	9.0	8.9	7.8	4.1	100
	6	11.8	9.0	7.9	9.4	11.0	**9.8**	10.2	8.8	12.1	10.2	100
	7	11.9	5.0	8.2	10.0	8.2	9.9	**10.1**	13.1	11.9	11.6	100
	8	8.5	6.3	7.4	8.1	11.3	11.4	10.0	**11.8**	13.0	12.3	100
	9	7.0	4.6	5.4	7.4	7.5	9.7	10.5	13.0	**17.0**	17.9	100
	10	5.4	2.6	4.4	6.7	6.9	8.3	10.4	11.5	15.8	**27.9**	100

Source: CASEN Surveys, 2009 and 1990

In terms of mobility between deciles of the earnings distribution, 14% of the sons that had a father belonging to the 1^{st} decile moved to the 2^{nd} decile. It is possible to see that the highest immobility cases are present at the extremes of the diagonal. In particular, it seems that people in the richest decile maintain their position in the next generation (27.9%). For levels of education, the highest immobility figures are found, again, at the top of the educational distribution, where 60% of the sons that had a father holding post-secondary education also acquired it[37].

Table 2.10: Transition Matrix Education Level Deciles: Father-Sons (%)

Transition Matrix: Level of Education							
		Son					
Level of Education		None	Primary	SecH	SecT	T/ University	Total
Father	None	**29.4**	41.1	19.3	7.6	2.6	100
	Primary	6.7	**39.4**	34.5	12.8	6.6	100
	SecH	3.0	14.9	**44.8**	14.1	23.2	100
	SecT	1.5	12.4	42.3	**15.6**	28.2	100
	T/ University	0.0	3.9	30.8	4.4	**60.4**	100

Source: CASEN Surveys, 2009 and 1990

2.7.2 TS2SLS and OLS Results[38]

Applying TS2SLS and OLS techniques, the results are presented mainly using the option when parent's earnings are predicted using the level of education converted directly as years of schooling (Alt 2_d), as this option brings more congruency in terms of education between the information provided by individuals in 1990 (synthetic parents) and that reported by their children in 2009 as shown in Table 2.4 in the previous section. The intergenerational earnings elasticity takes values of 0.415 when none of the control variables are included and 0.467 when age and age squared of fathers and sons are used (see

[37] Transition Matrices for the Mother-Daughter pairs can be found in Appendix 2A1. (Table 2A1.7 and Table 2A1.8).

[38] Note that 3 normality tests of residuals of the income regression were performed (option 2_d): Test for skewness and kurtosis, Shapiro-Francia test and Shapiro-Wilk test for normality. All of them give as a result that the normality of residuals can be rejected. For the case of education, the same results are obtained. This non-normality does not produce a bias in the estimated coefficients, but it causes an efficiency problem, that is the OLS standard errors are no longer the smallest and also a bias in the standard errors, therefore the significance test will be wrong. For the last problem, robust standar errors will be more appropriate, which has already been considered in the analysis.

column a. and b. in Table 2.11). Both are significant values that could be considered low earnings mobility in relative terms (the average of other countries corresponds to 0.37).

In term of the intergenerational educational dependency values between 0.385 (no control variables) and 0.377 (controlled for age and age squared) are obtained (see column a. and b. in Table 2.12) which is high intergenerational educational mobility compared to other countries (0.62 corresponds to their average)[39].

In terms of comparing the levels of intergenerational earnings and education dependency. It was expected that the standardised beta of education would have been lower, therefore leading to a high educational mobility, but a higher earnings coefficient, so low earning mobility, suggesting that even though children would not depend so much on their parents' education, in terms of earnings, they would because some other factors were also playing a role. However, taking into account the standardised version of educational and income intergenerational mobility, the values are reduced for the earnings case and increased for the educational case (from 0.467 to 0.311 for earnings and from 0.377 to 0.468 for schooling). In addition, comparing the standardised coefficients of earnings and education, the former is lower than the second, which is opposite to what was expected. That would mean that intergenerational education mobility is lower (in standardised terms) than the earnings mobility ($\beta^{i(std)} < \beta^{e(std)}$). So, even though the education achieved by sons depends highly on their fathers' education, when they go to the labour market they are less affected by their father's earnings.

[39] See Appendix 2A2. for the situation of other countries.

However, this finding could be due to some bias on the calculation of father's earnings in the first stage[40]. In particular, this could be due to the fact that it is assumed that there was no distinction in the data about the category of the education establishment where the years of education were acquired. There was no difference allowed between studying in a 'traditional' university (something similar to what could be a member of the UK Russell Group Universities) which has more prestige in terms of finding a job, neither was there a distinction allowed between private and public schools or/and voucher schools. Private schools typically have more prestige and graduate students who obtain better results in academic tests which are compulsory to enter to university and furthermore, generate wide social connections that could be important in terms of finding future jobs. This non-distinction would mean that the estimated father's earnings standard deviation obtained ($SD(Y'^F)$) would be lower than what one would expect to find if some of the distinctions mentioned above were considered ($SD(Y^F)$). Therefore: (*) $SD(Y'^F)) < (SD(Y^F)$.

Taking account of this assumption and considering the standardised version of the intergenerational earnings coefficient, it is possible to calculate both of the potential values of standardised β (or ρ). The first is the one that was calculated with the information that the sample provided and the second is the one that should be calculated if the information is available[41]. Therefore:

$$\rho'^i = \beta^i \frac{SD(Y'^F)}{SD(Y^S)} \quad \text{or} \quad \rho^i = \beta^i \frac{SD(Y^F)}{SD(Y^S)}$$

Looking at the size of the difference among them:

[40] See first stage regressions in Appendix 2A3., Table 2A3.1 and Table 2A3.2.

[41] The standard deviation of son's earnings is not affected as the earnings were not calculated using other variables.

$$\frac{\rho'^{i}}{\rho^{i}} = \frac{\beta^{i}\frac{SD(Y'^{F})}{SD(Y^{S})}}{\beta^{i}\frac{SD(Y^{F})}{SD(Y^{S})}} \quad \text{or} \quad \frac{\rho'^{i}}{\rho^{i}} = \frac{SD(Y'^{F})}{SD(Y^{F})}$$

Using the assumption in (*): $\frac{SD(Y'^{F})}{SD(Y^{F})} < 1$. Therefore: $\frac{\rho'^{i}}{\rho^{i}} < 1$

So $\rho'^{i} < \rho^{i}$. Hence, the earnings standardised coefficient obtained is lower than the one expected to be obtained. On the other hand, for the standardised coefficient of intergenerational education dependency, this problem is not present as fathers' years of education are not predicted using another data set.

In addition, it is important to mention that the R^2 in the first stage is not very high (around 0.35). This could indicate that the explanatory variables are not highly correlated with the variable to be instrumented (father's earnings), creating inconsistency in the TS2SLS (Ermisch and Nicoletti, 2006). However, it is not possible to use other "instruments" for father's earnings in the first stage using 1990 data, only the ones given by the sons in 2009, which allows the connection of both data sets.

The case becomes interesting when mother's earnings and the mother's schooling are entered as control variables in the earnings and education regressions respectively. In this case, the standardised version intergenerational earnings dependency coefficient becomes larger than (but similar to) the standardised educational mobility coefficient (0.286 in column d. in Table 2.11 versus 0.229 in column e. in Table 2.12). This would imply a lower educational dependency (son's education would not depend mostly on father's education) but son's earnings depends a bit more on his father's earnings (as was expected). In addition, it would give an indication that there could be another mechanism that interferes in the process of mobility through education. For example, it could be some kind of labour market discrimination or issues related to the educational system are existent in Chile. It could also be that an elite social class is being formed, composed of people from private, prestigious and expensive schools who also develop networks in order to establish connections that allow them to obtain better jobs and better salaries than people holding relatively similar qualifications in terms of years of schooling but not the social connections[42]. This issue would be analysed in more details in future chapters of this research.

It is also important to mention that the mother's education seems to have a greater effect on the education of her son than the mother's earnings seems to have on the son's earnings (see column d. in Table 2.11 and column e. in Table 2.12 respectively). In terms of education and considering the standardised version, the mother's education has even more impact than the father's education on the son's education, which would support the idea that mother's education is a crucial factor.

Including years of schooling in the intergenerational earnings mobility regression (see column e. in Table 2.11), it is possible to measure how much of the intergenerational earnings coefficient/std. coefficient is reduced due to education of the child and also, it is possible to see how big the schooling effect is in order to promote the equalisation of opportunities. It was found that son's education takes away a large part of the father's earnings effect (it reduces it by half).

[42] Mothers' earnings would have a moderate correlation with Father's earnings (0.4) but the correlation is higher among them when years of schooling are considered (0.65).

Considering other options for estimating fathers' earnings[43], for the first option (when the parents' earnings are calculated using occupation and level of education instead of asignating a determined number of years of schooling to the different levels of education) the effect of father's earnings on the son's earnings is significant, obtaining values of between 0.254 (no control variables) and 0.340 (when controlling for age and age squared of son and father). That could be considered high intergenerational earnings mobility. It is not possible to compare the results with the education intergenerational dependency when using this alternative, as it implies obtaining more than one coefficient that contains information about the level of dependency between parents and children in terms of education. In the case of the alternative 2.r (when the parents' earnings are predicted using the years of schooling calculated through a regression), lower values than in the alternative 2.d were obtained.

In addition, when the regressions consider mother-daughter pairs the results for the standardised earnings elasticity is half of that obtained in the father-son relationship. However, in terms of the education coefficient, they are similar, which implies that the mother's education has a greater impact on her daughter's education compared to the impact of mother's earnings on her daughter's earnings[44].

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[43] Details can be found in the Appendix 2A3. (Table 2A3.3 and Table 2A3.4).

[44] More details of Mother-Daughter regressions can be found in the Appendix 2A3. (Table 2A3.5).

Table 2.11: TS2SLS Results (Father-Son Earnings[45])

Variable	a:B	a: Bst.	b: B	b: Bst.	c: B	c: Bst.	d: B	d: Bst.	e: B	e: Bst.	f: B	f: Bst.
Ln(Earnings)Father	**0.415*** **	**0.277*** **	**0.467*** **	**0.311*** **	**0.003**	**0.002**	**0.411*** **	**0.286*** **	**0.216*** **	**0.144*** **	**0.205*** **	**0.142*** **
	(0.019)		(0.019)		(0.182)		(0.023)		(0.019)		(0.022)	
age			0.068***	0.568***	0.067***	0.562***	0.042**	0.333**	0.064***	0.531***	0.034**	0.269**
			(0.015)		(0.015)		(0.017)		(0.015)		(0.017)	
age_Sq			-0.001***	-0.487***	-0.001***	-0.475***	-0.001**	-0.322**	-0.001***	-0.399***	-0.000	-0.19
			(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
ageFather			-0.003	-0.021	0.022	0.174	0.013	0.147	-0.020	-0.161	0.006	0.066
			(0.030)		(0.033)		(0.012)		(0.027)		(0.011)	
age_SqFather			0.000	0.089	-0.000	-0.135	-0.000	-0.004	0.000	0.195	0.000	0.017
			(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
employerFather					0.270	0.067						
					(0.249)							
selfemployedFather					0.070	0.0409						
					(0.060)							
navyFather					0.197***	0.0400**						
					(0.065)							
HousekeeperFather					0.259	0.0129						
					(0.199)							
WithoutPayt.Father					(dropped)	(dropped)						
					.							
SchoolingFather					0.054***	0.314***						
					(0.017)							
Ln(Earnings)_Mother							0.140***	0.110***			0.067***	0.0526***
							(0.017)				(0.015)	
Schooling									0.089***	0.414***	0.099***	0.432***
									(0.002)		(0.003)	
_cons	8.117***	0.035**	5.979***	0.038***	10.040***	0.034***	4.817***	0.051***	8.398***	0.018***	7.062***	0.004***
	(0.206)		(0.817)		(1.697)		(0.547)		(0.768)		(0.499)	
N. of observations	6,983		6,983		6,983		6,397		6,983		6,397	
R2	0.074		0.094		0.110		0.092		0.235		0.231	
note: *** p<0.01, ** p<0.05, * p<0.1												

Source: CASEN Surveys, 2009 and 1990

[45] Standard Errors are in brackets.

Table 2.12: OLS Results (Father-Son's Education)[46]

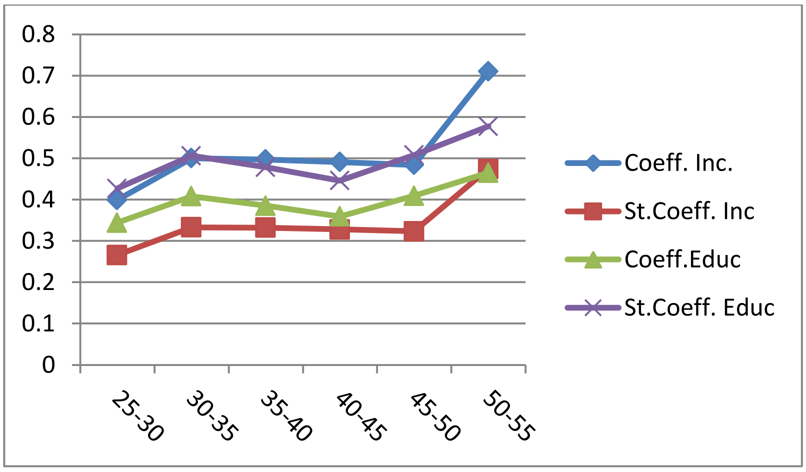
Variable	a: B	a: Bst.	b: B	b: Bst.	c: B	c: Bst.	d: B	d: Bst.	e: B	e: Bst.
Schooling_Father	**0.385*** **	**0.479*** **	**0.377*** **	**0.468*** **	**0.373*** **	**0.463*** **	**0.327*** **	**0.406*** **	**0.186*** **	**0.229*** **
	(0.009)		(0.009)		(0.009)		(0.040)		(0.011)	
age			0.052	0.0937	0.069	0.124	0.069	0.124	0.040	0.072
			(0.080)		(0.070)		(0.070)		(0.053)	
age_Sq			-0.002	-0.207	-0.002*	-0.236*	-0.002*	-0.236*	-0.001**	-0.196**
			(0.001)		(0.001)		(0.001)		(0.001)	
age_Father			0.336***	0.573***	0.302***	0.515***	0.263**	0.448**	0.236***	0.636***
			(0.110)		(0.108)		(0.112)		(0.032)	
age_Sq_Father			-0.003***	-0.526***	-0.002**	-0.466**	-0.002**	-0.390**	-0.002***	-0.607***
			(0.001)		(0.001)		(0.001)		(0.000)	
employer_Father					0.707***	0.0376***	0.018	0.00094		
					(0.213)		(0.617)			
selfemployed_Father					-0.209**	-0.0263**	-0.356**	-0.0449**		
					(0.091)		(0.164)			
navy_Father					1.000***	0.0436***	0.898***	0.0391***		
					(0.189)		(0.219)			
HouseKeeper_Father					0.075	0.00080	0.196	0.00209		
					(0.770)		(0.770)			
WithoutPayt.Father					-0.448	-0.0109	(dropped)	(dropped)		
					(0.381)		.			
Schooling_Mother									0.246***	0.282***
									(0.011)	
Ln(Earnings)_Father							0.511	0.0731		
							(0.434)			
_cons	7.847***	0.0436***	-2.532	-0.04	-1.845	-0.0366	-6.096	-0.0372	0.208	0.0658
	(0.093)		(2.951)		(3.132)		(4.794)		(1.390)	
N.of observations	7,323		7,323		7,124		7,124		7,181	
R2	0.223		0.232		0.238		0.238		0.246	
note: *** p<0.01, ** p<0.05, * p<0.1										

Source: CASEN Survey, 2009

[46] Standard errors are in brackets.

Additionally, results were analysed considering different sons' cohorts (5 years each) separetely. The results are presented in Table 2.13 and Graph 2.1 where controls for father's age and age squared are included[47]. The results suggest that, excluding the oldest cohort (50-55 years old) because of the large standard errors (probably associated with having only a few observations) the situation has been maintained over time quite similarly, except for the youngest cohorts (25-30 years old) where the intergenerational coefficient and its standardised version seem to decline for both earnings and education. Therefore, the situation is slowly improving and the level of dependency among fathers and sons is being reduced over time[48]. However, the possibility that this result is produced by an age effect should be considered, that is, younger people always present lower intergenerational earnings and schooling dependency than older people, and when the individuals in the youngest cohort become part of the older cohorts they will exhibit higher values on earnings and schooling intergenerational dependency.

Graph 2.1: Cohort (Son's age) Results



Source: CASEN Surveys, 2009 and 1990

[47] See details in Appendix 2A3., Table 2A3.6 and Table 2A3.7.

[48] The results, controlling additionally for son's age and age squared and the ones not controlling for any variables, are included in the Appendix 2A3. (Graph 2A3.1 and Graph 2A3.2).

Table 2.13: Age Cohort Results[49]

Earnings Coefficients by Children's age Cohorts: Alt_2_d (only father's age and age squared)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Ln.EarningsFather	**0.399*****	**0.266*****	**0.500*****	**0.333*****	**0.497*****	**0.332*****	**0.491*****	**0.328*****	**0.484*****	**0.323*****	**0.71**	**0.474**
	(0.0438)		(0.0414)		(0.0432)		(0.0526)		(0.1)		(0.52)	
Age_Father	0.0582	0.462	0.00686	0.0545	0.0774	0.615	0.348	2.763	-0.235	-1.864	-10.07	-80
	(0.0545)		(0.0698)		(0.123)		(0.319)		(0.994)		(10.74)	
Age_Sq_Father	-0.00046	-0.43	-9.38E-06	-0.00873	-0.0005	-0.465	-0.00256	-2.383	0.0019	1.768	0.0777	72.41
	(0.000482)		(0.000592)		(0.00101)		(0.00253)		(0.00766)		(0.0811)	
_cons	6.369***	-0.108***	6.809***	0.0515***	4.402	0.0738	-4.39	-0.0729	14.65	0.198	330.7	5.323
	(1.518)		(2.058)		(3.719)		(10.02)		(32.36)		(357.4)	
N	1735		1891		1780		969		271		30	
R-sq	0.065		0.099		0.109		0.089		0.119		0.255	

Education Coefficients by Children's age Cohorts: Alt_2_d (only father's age and age squared)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Y.SchoolingFather	**0.344*****	**0.427*****	**0.408*****	**0.506*****	**0.385*****	**0.478*****	**0.359*****	**0.446*****	**0.409*****	**0.508*****	**0.465***	**0.577***
	(0.0155)		(0.0158)		(0.0176)		(0.0256)		(0.0414)		(0.188)	
age_Father	0.318	0.541	0.702*	1.196*	0.653	1.112	2.225	3.792	0.177	0.302	-20.95	-35.7
	(0.215)		(0.303)		(0.47)		(1.17)		(4.852)		(54.9)	
Age_Sq_Father	-0.00256	-0.511	-0.00585*	-1.170*	-0.00502	-1.003	-0.0174	-3.469	-0.00153	-0.306	0.162	32.4
	(0.0019)		(0.00257)		(0.00384)		(0.00919)		(0.0375)		(0.414)	
_cons	-1.157	0.168	-13.09	0.0664	-13.32	-0.0235	-63.54	-0.295	1.678	-0.22	682.5	2.172
	(6.055)		(8.863)		(14.33)		(37.26)		(157.1)		(1818.7)	
N	1817		1973		1863		1033		290		30	
R-sq	0.204		0.244		0.221		0.185		0.221		0.271	

Source: CASEN Surveys, 2009 and 1990

[49]Standard errors are in brackets.

2.7.3 Quantile Regression Results

The quantile regression (QR) results are significant, with increasingly larger earnings standardised betas obtained over the quantiles (lower quantiles present lower standardised betas and so higher mobility, and higher quantiles present higher standardised betas or lower earnings mobility). This can be appreciated also in the respective graph representation (Graph 2.2). On the other hand, for the education quantile regression, the lower quantiles present a higher standardised beta which means lower educational mobility and higher quantiles present a lower standardised beta which means higher mobility (opposite to the earnings case) which is also presented in graphical terms (Graph 2.3). The results for the median are also very similar to the ones obtained by applying OLS (mean).

Therefore the overall situation is that the intergenerational earnings standardised coefficients are higher for higher quantiles and lower for the lower quantiles. That corresponds to higher intergenerational earnings mobility at the bottom of the children's earnings distribution and lower intergenerational earnings mobility at the top of the children's distribution. This is probably consistent with the idea that at the bottom of the earnings distribution, social policies that aim to raise opportunities for people have been working in the country, but that social background continues to be very imortant in obtaining a highly paid job. The opposite occurs for the case of the intergenerational transmission of schooling, which could be happening because less educated people do not value schooling as much. Therefore, if individuals achieve lower levels of education, it may be due to their parents not having forced or supported them sufficiently in order to continue studying, likely because these parents did not study themselves. On the other hand, highly educated individuals probably achieve high educational levels due to the larger number of opportunities given to them compared to their parents when they themselves were younger.

Comparing the betas (standardised) only at the 90th percentile, the earnings beta is larger than the educational one (0.451 versus 0.414). The details can be found in Table 2.14 and in Graph 2.2 and 2.3, where the intergenerational earnings/education standardised coefficient is plotted over quantiles and contrasted to the OLS estimation (dashed line).

In the QR, when the mother's earnings/education are included in the earnings/education regression as control variables[50], the 2nd highest earnings quantiles are higher than the 2nd highest education quantiles.

[50] QR controlling for mother's earnings and son's schooling can be found in the Appendix 2A3. (Table 2A3.8 and Table 2A3.9).

Table 2.14: QR Results (Father-Son Earnings & Education)[51]

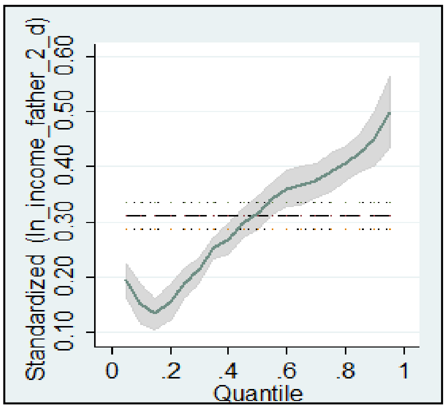
Earnings: Father-Son										
Variable	**q(10)**		**q(25)**		**q(50)**		**q(75)**		**q(90)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Ln(Earnings)_Father	**0.227*** **	**0.152*** **	**0.286*** **	**0.191*** **	**0.476*** **	**0.317*** **	**0.585*** **	**0.391*** **	**0.675*** **	**0.451*** **
	(0.035)		(0.019)		(0.025)		(0.033)		(0.040)	
age	0.042*	0.348*	0.032***	0.267***	0.078***	0.649***	0.081***	0.674***	0.105***	0.874***
	(0.022)		(0.010)		(0.020)		(0.020)		(0.034)	
age_Sq	-0.001*	-0.314*	-0.000***	-0.222***	-0.001***	-0.591***	-0.001***	-0.557***	-0.001***	-0.743***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
age_Father	0.045	0.354	0.045**	0.360**	0.008	0.060	-0.038	-0.298	-0.046	-0.364
	(0.039)		(0.020)		(0.033)		(0.047)		(0.067)	
age_Sq_Father	-0.000	-0.324	-0.000**	-0.326**	0.000	0.0179	0.000	0.373	0.001	0.468
	(0.000)		(0.000)		(0.000)		(0.000)		(0.001)	
_cons	7.277***	-0.925***	6.965***	-0.605***	5.359***	-0.0568***	5.783***	0.619***	4.915**	1.236**
	(1.172)		(0.585)		(0.895)		(1.213)		(1.993)	
N. of observations	6,983									
R2	0.094									

Education: Father-Son										
Variable	**q(10)**		**q(25)**		**q(50)**		**q(75)**		**q(90)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Y. Schooling_Father	**0.426*** **	**0.530*** **	**0.479*** **	**0.595*** **	**0.335*** **	**0.416*** **	**0.373*** **	**0.464*** **	**0.333*** **	**0.414*** **
	(0.016)		(0.017)		(0.006)		(0.026)		(0.004)	
age	0.203	0.362	-0.093	-0.167	-0.300***	-0.536***	0.051	0.090	-0.000	-0.000
	(0.148)		(0.107)		(0.074)		(0.067)		(0.068)	
age_Sq	-0.004**	-0.558**	0.000	0.014	0.003***	0.414***	-0.001	-0.099	0.000	0.000
	(0.002)		(0.002)		(0.001)		(0.001)		(0.001)	
age_Father	0.058	0.099	0.143	0.243	0.375***	0.640***	0.321***	0.547***	-0.000	0.000
	(0.152)		(0.195)		(0.099)		(0.055)		(0.241)	
age_Sq_Father	-0.001	-0.106	-0.001	-0.243	-0.003***	-0.577***	-0.003***	-0.502***	0.000	-0.000
	(0.001)		(0.002)		(0.001)		(0.000)		(0.002)	
_cons	0.674	-1.021	4.399	-0.448	2.783	0.0722	-1.273	0.5486	12.000	1.134
	(4.231)		(5.878)		(3.208)		(1.943)		(7.903)	
N. of observations	7,323									
R2	0.232									
note: *** p<0.01, ** p<0.05, * p<0.1										

Source: CASEN Surveys, 2009 and 1990

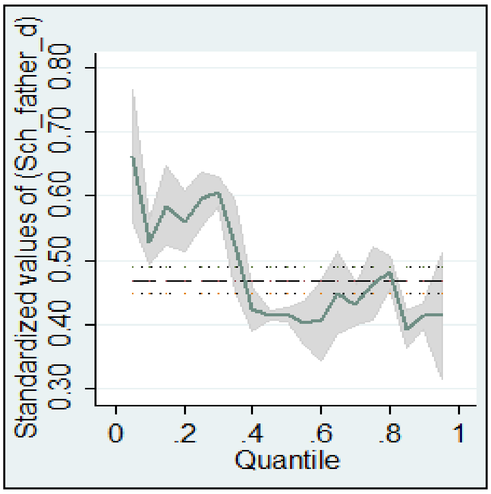
[51]Standard errors are in brackets.

Graphs 2.2: Intergenerational Earnings Standarised Coefficient by Quantile[52]



Source: CASEN Surveys, 2009 and 1990

Graphs 2.3: Intergenerational Education Standarised Coefficient Mobility by Quantile



Source: CASEN Surveys, 2009 and 1990

In addition, the representation of a kind of Engel curve shows that some kind of heteroskedasticity could be present, as they are not parallel, justifying the application of QR. Heteroskedasticity test (Breusch-Pagan/Cook-Weisberg) was also performed, obtaining as results the rejection of the hypothesis of homoscedasticity (constant variance of standard errors) for the income equation. The same conclusion is obtained for education regression. Details can be found

[52] To see more detail, see Appendix 2A3(Graph 2A3.3 to Graph 2A3.15).

in Appendix 2A4. (Graph 2A4.1, Graph 2A4.2, Table 2A4.1, Table 2A4.2 and Table 2A4.3). Furthermore, it is worth noting that tests of equality of the regression coefficients at different conditional quantiles (F-Test) were rejected.

2.7.4 Robustness Results

The results were also tested for robustness. In order to do this the 2009 sample was split in two. Male individuals that are aged between 25 and 35 years old were considered as the sons and the male individuals in the sample who were between 50-60 years old were considered as the respective fathers. The TS2SLS was repeated but instead of considering 2 independent samples, only 1 sample was used and divided into 2 sub-samples acting independent of one of another. The sample of fathers was used to predict their earnings using the same variables as when the 1990 sample was used and then the estimators were used in the second stage to calculate the predicted fathers' earnings and to estimate then the intergenerational earnings elasticity and intergenerational educational coefficient. The results are quite similar to those obtained in the original procedure, but slightly bigger for the earnings case. The same was obtained for the educational mobility, the intergenerational educational coefficient (in the standardised version and in the non-standardised one) are very similar but slightly bigger than when 2 totally independent samples were used.

Table 2.15: Robust Results: Splitting the 2009 Sample into Two[53]

Father-Son: Earnings Alt_2_d			Father-Son: Schooling Alt_2_d		
	2_earnings			2_education	
Variable	B (Coef.)	B^{st}.	**Variable**	B (Coef.)	B^{st}
Ln(Earnings)_F	**0.394*** **	**0.260*** **	**Sch_Father_d**	**0.361*** **	**0.459*** **
	(0.036)			(0.016)	
Age	0.048	0.207	age	0.020	0.019
	(0.095)			(0.372)	
age_Sq	-0.000	-0.0911	age_Sq	-0.000	-0.026
	(0.002)			(0.006)	
age_F	0.160	0.754	age_Father	-0.225	-0.237
	(0.154)			(0.688)	
age_Sq_F	-0.001	-0.753	age_Sq_Father	0.003	0.298
	(0.001)			(0.006)	
_cons	2.192	0.0486	_cons	12.681	0.0574
	(4.323)			(20.463)	
N. of obs.	2,349		N. of obs.	2,455	
R2	0.075		R2	0.208	
note: *** p<0.01, ** p<0.05, * p<0.1					

Source: CASEN Survey, 2009

2.8 How Inequalities are Transmitted

Mobility and inequality are different dimensions of the social distribution of advantages in a society; therefore a society with a certain level of inequality but with a high level of mobility would create less concern than a society with the same level of inequality but with lower mobility (Torche, 2005).

Hence, it is important to analyse the relationship between inequality and social mobility because it gives us an idea of the hope that people might experience in society in terms of improving their socioeconomic condition. However, the inequality and social mobility literatures have in general been advancing in isolation (Andrews and Leigh, 2009).

Corak (2006) suggests that the intergenerational earnings elasticity *(β)* can also be translated to calculate the economic advantage that a high earnings family can expect to have over a low earnings family in the next generation.

[53]Standard errors are in brackets.

Considering the basic equation of parent-children income transmission:

$$\ln(y_{i,t}) = \alpha + \beta \ln(y_{i,t-1}) + \varepsilon_{i,t} \ ,$$

Assuming $\varepsilon_{i,t}$=0

$$\leftrightarrow \ln(y_{i,t}) - \beta \ln(y_{i,t-1}) = \alpha$$

$$\leftrightarrow \ln(y_{i,t}) - \ln({y_{i,t-1}}^{\beta}) = \alpha$$

$$\leftrightarrow \ln\left(\frac{y_{i,t}}{{y_{i,t-1}}^{\beta}}\right) = \alpha$$

$$\leftrightarrow \frac{y_{i,t}}{{y_{i,t-1}}^{\beta}} = e^{\alpha}$$

$$\leftrightarrow y_{i,t} = e^{\alpha}(y_{i,t-1})^{\beta}$$

The ratio of incomes for children for high income families (H) and Low income families (L) are expressed by Corak (2006) as:

$$\frac{y_{H,t}}{y_{L,t}} = \frac{e^{\alpha}(y_{H,t-1})^{\beta}}{e^{\alpha}(y_{L,t-1})^{\beta}} = \left(\frac{y_{H,t-1}}{y_{L,t-1}}\right)^{\beta}$$

Therefore, if Chile has a β of 0.467 and the proportion between the poorest decile to the richest decile is 6.17 times (using predicted parent's earnings in the second stage, 2009) it is possible to replace the equation above and to obtain:

$$\frac{y_{H,t}}{y_{L,t}} = \left(\frac{167{,}711.4}{27{,}173.57}\right)^{0.467} = (6.17)^{0.467} = 2.34$$

Therefore, sons born in families in the 10^{th} decile of earnings distribution can expect to have 2.34 times more economic advantage (more earnings) than children born in families in the 1^{st} decile of the earning distribution due only to their fathers' economic position, which eventually will increase the level of inequality of the country. These figures are even more extreme when the ratio between the richest and the poorest total income (but excluding subsidies and transfers) deciles was found to be 46 times in 2009 (Ministerio de Planificacion, 2010). Hence, the reproduction of inequality would be six times in the next generation. That would be one of the reasons as to why income inequality has not reduced over time.

2.9 Conclusions

This chapter started with the objective of clarifying the Chilean situation in terms of intergenerational mobility, and with the idea that education plays an important role in the process of giving to future generations the opportunities to achieve success independent of their social background. More social mobility implies living in a society where the level of dependency of children's earnings (education) on their parents' earnings' (education) is lower, which means that the level of equality of opportunity is better, which would lead to a society where the resource allocation is more efficient, where skills and abilities are preferred determinants over social connections, or gender or any other kind of social discrimination. Unfortunately, the literature related to the Chilean case and to the developing world in general is scarce.

Many difficulties are associated with the lack of data availability, but this could be due to a kind of dissuading of reality by those that are already better educated, probably at the top of the earnings distribution and in the offices where social policies are proposed. Furthermore, it seems that formal research in

Chile is far from considering the design, analysis and implementation of new strategies in order to increase the level of opportunities of a country that may seem rich and prosperous in the eyes of its neighbours, but that in reality presents high levels of social segregation.

Measures of intergenerational mobility were used to understand the Chilean case and to analyse the level of failure or success that society has bringing new hope to the entire population. It seems that Chile is a country that has low intergenerational earnings elasticity compared to other countries and high intergenerational education mobility (both conclusions consider the non-standarised version of the coefficients), which could be a sign that public policies which increase the level of educational opportunities in the countries have been successful, at least in comparison with other countries. Nevertheless, intergenerational earnings dependency results are relative to developed countries (as they have data to obtain this measure) and intergenerational schooling dependency results are relative to developing countries (which have focused on education, due to earnings lack of data). In addition, when standardised versions are utilised to compare the level of earnings and educational mobility, the former is higher than the latter, which is opposite to what was expected. The use of standardised coefficient was needed to compare earnings and schooling coefficient. On the other hand, children's schooling seems to be very important in terms of reducing the father's earnings effect on their own earnings. However, children's schooling would also depend strongly on their parents' schooling.

The results suggest that, considering sons' age-cohorts, the levels of intergenerational mobility have been maintained over time quite constantly, except for the youngest cohorts. In addition, as mentioned by Torche (2010) it seems that in the context of high inequality, as in the Chilean one, the levels of positive assortative mating could be quite high in terms of education, because economic inequality makes the gap between social classes larger, limiting the interaction among individuals with different educational levels. This topic is analysed in more details in the fourth chapter of this thesis.

Quantile regression estimations seem to suggest that earnings and educational intergenerational mobility behave differently depending on the sons' earnings distribution and the sons' years of schooling distribution respectively. The results found that the first is higher in the lowest quantiles and lower in the highest quantiles. The opposite is found when considering educational mobility. This could imply that social policies that focus on supporting the poorest of society have been working (for example, creating employment for the unskilled), thereby reducing the father-son dependency in terms of income. On the other hand, the educational results could suggest that poorer parents cannot support their children in terms of education and that the social policies in this respect have failed to equilibrate the situation, and they could also suggest that poorer parents do not value education as much, therefore they would not encourage their children to acquire better educational levels than them.

Finally, there is almost a common agreement that the focus of the last governments has been put on increasing the access to levels of schooling in order to promote equality of opportunities among the population, giving children better options for their future. However, the expansion of the Chilean educational system has not been without controversy. Maybe the marginal impact of this policy is reaching a maximum and the focus should change to the family and public provision of social services as proposed by Corak (2006) or improvements to the way in which (or where) education is imparted (which segregates the population) should be made. Therefore in that case, the first step would be to formally prove that the educational system in Chile limits social mobility, which will be analysed in the next chapter. This limitation could be caused by a lack of resources for education, by abundant tight social connections created in primary schools or maybe by a lack of competition among schools that create a poor service provision, in particular in terms of quality.

This chapter has attempted to increase the literature related to the Chilean case intergenerational mobility, opening new challenges for the future, with the aim of promoting social and economic equality of opportunities.

Appendix Intergenerational Mobility

2A1. Descriptive Statistics

Table 2A1.1: Age Mothers 2009 (reported) versus 1990

Age in 2009			
2009 (reported by Daughters) :t		**1990 (potential Mothers) : t+19**	
Avg. Age	58.51	Avg. Age	58.25
Min Age	44	Min Age	44
Max Age	67	Max Age	79
St. Dev.	6.02	St. Dev.	10.25

Source: CASEN Survey, 2009

Table 2A1.2: Daughters' Age

Daughters' age in 2009	
Avg.	34.97
Min	25
Max	56
St.Dev	6.1

Source: CASEN Survey, 2009

Table 2A1.3: % Level of Education (Congruency), Mother-Daughter.

% Level Education			
2009 (reported by Daughters)		1990 (potential Mothers)	
Education	%	Education	%
Nursery	0	Nursery	0
Primary (before 1965) Primary (after 1965)	23.14 33.5	Primary (before 1965) Primary (after 1965)	22.55 14.76
Secondary (before 1965) Secondary (after 1965)	11.17 12.61	Secondary	22.1
Technical Secondary (after 1965) Technical Secondary (before 1965)	3.1 1.79	Technical Secondary	4.61
Professional Technician Professional Institute	0.79 0.51	Professional Technician&Institute	1.7
University	3.37	University	5.4
None	9.9	None	28.88

Source: CASEN Surveys, 2009 and 1990

Table 2A1.4: Years of Education (Congruency),Mother-Daughter.

Number of years of Schooling	Direct	Regression	Estimated	Real
Mean	8.33	10.96	6.8	8.48
Min	0	4.23	0	0
Max	18	16.55	18	19
St. Dev.	3.98	3.19	5.80	4.39

Source: CASEN Surveys, 2009 and 1990

Table 2A1.5: % Occupation (Congruency), Mother-Daughter.

% Occupation			
2009 (reported by Daughters)		1990 (potential Mothers)	
Education	%	Education	%
Employer	2.4	Employer	1.68
Self-Employed	23.52	Self-Employed	20.9
Employee	51.95	Employee	57.8
Navy& Military &Police	0.2	Navy &Military &Police	0.15
HouseKeeping	21.93	HouseKeeping (inside)	3.39
		HouseKeeping (outside)	13.1
		Without payment	0.95
Not Working	58.58	Not Working	65.7

Source: CASEN Surveys, 2009 and 1990

Table 2A1.6 Descriptive Statistics (Mother-Daughters)

Mother_Daughter	1990 Mother	2009 Daughter
Avg. Number of children in the household (St.Dev.)	2.14 (1.44)	1.75 (1.08)
% Rural	24.94%	28.15%
Avg. Number years of Schooling	8.48 (4.4)	11.33 (4.4)
% Married	65.62%	41.39%
Proportion richest and poorest decile of earnings	0.3315	0.1722
Avg. Number people in the household (St.Dev.)	4.72 (1.99)	4.29 (1.72)
% Illiteracy	5.72%	0.98%

Source: CASEN Survey, 2009

Table 2A1.7: Transition Matrix Earnings Mother-Daughter (%)

Transition Matrix: Earnings Deciles (%)												
Earnings Deciles		**Daughter**										
		1	2	3	4	5	6	7	8	9	10	Total
Mother	1	18	12	13	11	9	8	9	8	7	5	100
	2	10	10	11	11	11	12	9	11	8	7	100
	3	13	9	13	15	11	11	10	8	8	3	100
	4	13	9	12	12	9	11	10	9	8	8	100
	5	9	11	7	11	11	11	10	10	11	11	100
	6	7	6	6	8	7	9	10	14	16	17	100
	7	14	11	10	10	8	8	11	8	9	10	100
	8	14	10	11	15	9	9	9	9	9	7	100
	9	9	8	9	8	10	9	12	13	11	13	100
	10	6	6	5	5	6	6	10	13	18	26	100

Source: CASEN Survey, 2009

Table 2A1.8: Transition Matrix Education Mother-Daughter (%)

Transition Matrix: Level of Education							
		Daughter					
Level of Education		None	Primary	SecHum	SecTec	T/University	Total
Mother	None	32	37	22	5.8	4	100
	Primary	14	28	33	13	13	100
	SecHum	2.5	12	42	14	29	100
	SecTec	1.5	8.2	39	14	38	100
	T/University	1.3	2.4	22	5.7	68	100

Source: CASEN Survey, 2009

2A.2 Cross-Country Comparisons

Table 2A2.1: Intergenerational Earnings Elasticity and Standardised Coefficients

Country	Coeff_Inc.	Std.Coeff_Inc.
Australia	0.33	0.22
Brazil	0.82	
Canada	0.23	0.14
Chile	0.47	0.31
China (urban)	0.32	
Colombia	0.70	
Cyprus	0.09	0.05
Czech Republic	0.20	0.13
Denmark	0.14	0.14
Ecuador	1.13	
Finland	0.18	0.15
France	0.46	
Germany	0.23	0.17
Hungary	0.22	0.16
Italy	0.44	
Japan	0.25	
Kyrgyzstan	0.20	0.28
Latvia	0.28	0.22
Malaysia	0.54	
Mexico	0.50	
Nepal	0.32	
New Zealand	0.25	0.19
Norway	0.24	0.14
Pakistan	0.24	
Peru	0.67	
Poland	0.40	
Russia	0.06	0.05
Slovakia	0.25	0.16
South Africa	0.61	
Spain	0.40	0.34
Sweden	0.28	0.14
Taiwan	0.23	
UK	0.50	0.27
USA	0.47	0.29
Average	**0.37**	**0.19**

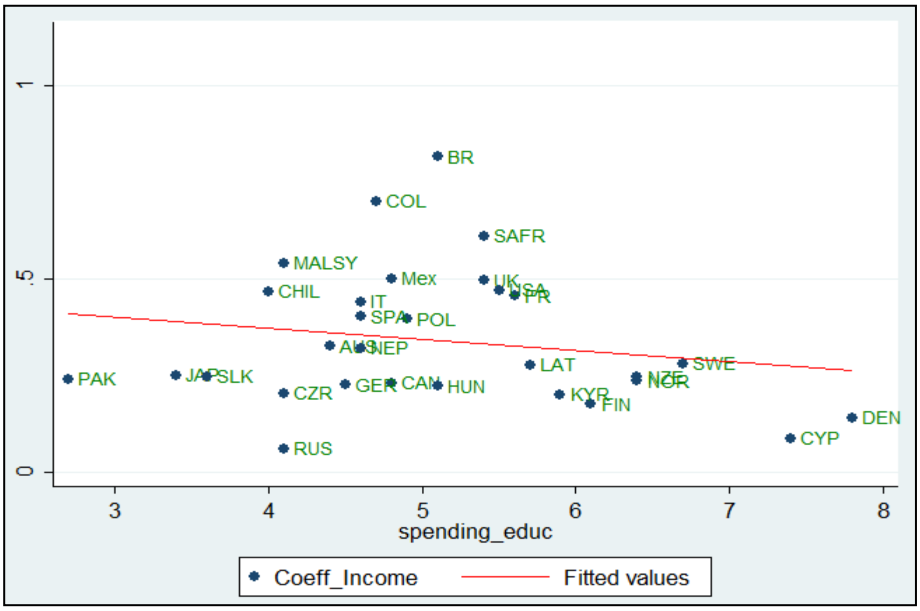
Source: Solon, (2002), Blanden, et al. (2005), Andrews and Leigh (2008), Gong, Leigh and Meng (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

Table 2A2.2: Intergenerational Education Coefficients and Standardised Coefficients.

Country	Coeff_Educ.	Std.Coeff_Educ.
Bangladesh		0.38
Belgium	0.41	0.40
Brazil	0.95	0.59
Chile	0.38	0.47
China (rural)	0.34	0.20
Colombia	0.80	0.59
Czech Republic	0.44	0.37
Denmark	0.49	0.30
East Timor	1.27	0.39
Ecuador	0.72	0.61
Egypt	1.03	0.50
Estonia	0.54	0.40
Ethiopia (rural)	0.75	0.10
Finland	0.48	0.33
Ghana	0.71	0.39
Hungary	0.61	0.48
Italy	0.67	0.54
Indonesia	0.78	0.55
Ireland	0.70	0.46
Kyrgyzstan	0.20	0.28
Malaysia	0.38	0.31
Nepal	0.94	0.35
Netherlands	0.58	0.36
New Zealand	0.40	0.33
Nicaragua	0.82	0.55
N.Ireland	0.59	0.32
Norway	0.40	0.35
Pakistan	1.00	0.46
Panama	0.73	0.61
Peru	0.88	0.66
Philippines	0.41	0.40
Poland	0.48	0.43
Slovakia	0.61	0.37
Slovenia	0.54	0.52
South Africa	0.69	0.44
Sri Lanka	0.61	0.49
Sweden	0.58	0.40
Switzerland	0.49	0.46
UK	0.71	0.31
Ukraine	0.37	0.39
USA	0.46	0.46
Vietnam	0.58	0.40
Average	**0.62**	**0.42**

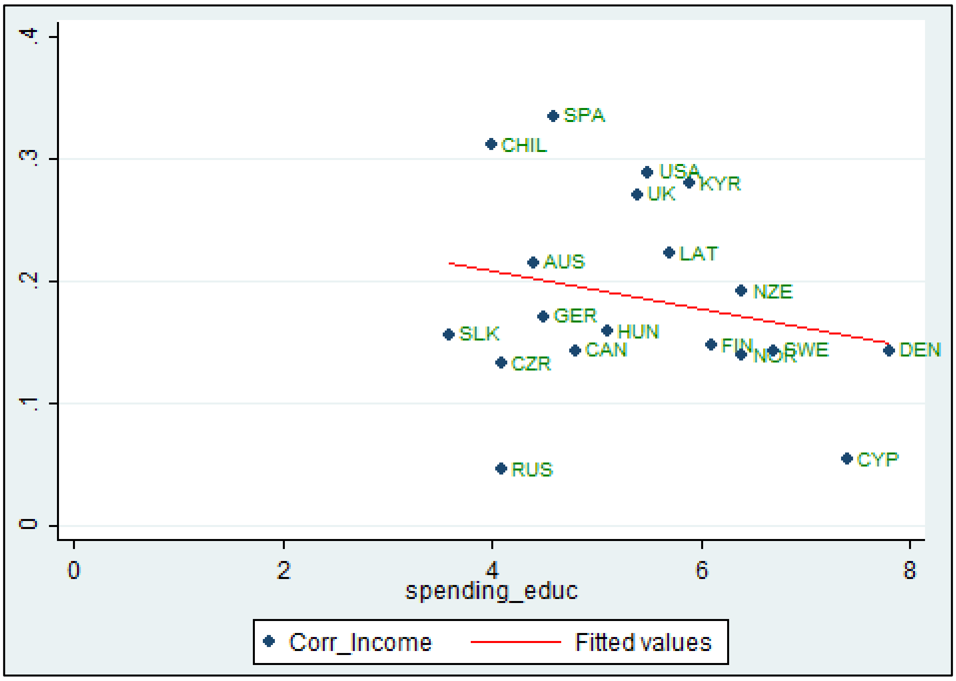
Source: Solon, (2002), Blanden, et. al (2005), Andrews and Leigh (2008), Gong et al. (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

Graph 2A2.1: Intergenerational Earnings Elasticity versus Spending on Education



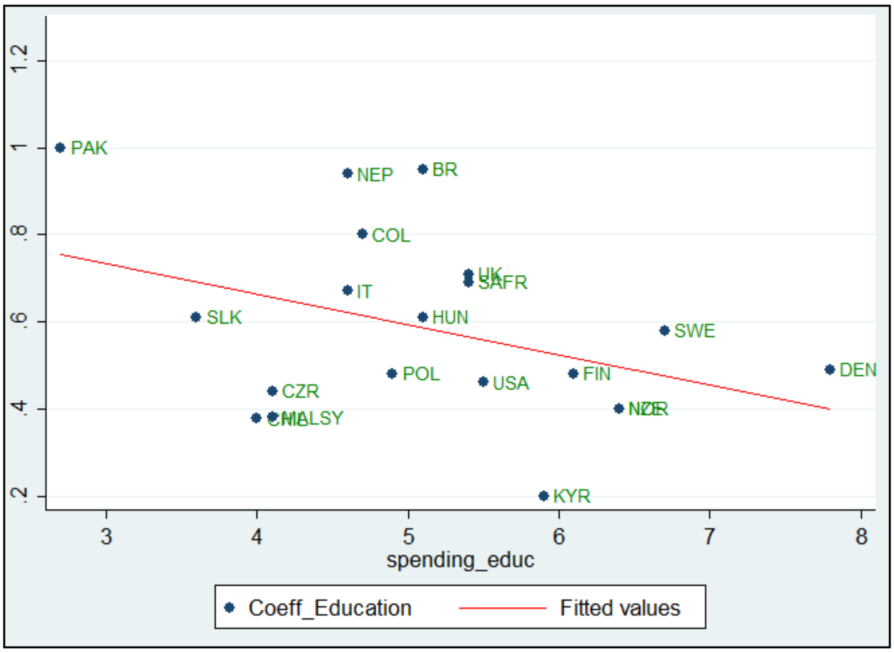
Source: Solon (2002), Blanden, et. al (2005), Andrews and Leigh (2008), Gong et al. (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

Graph 2A2.2: Intergenerational Earnings Correlation versus Spending on Education



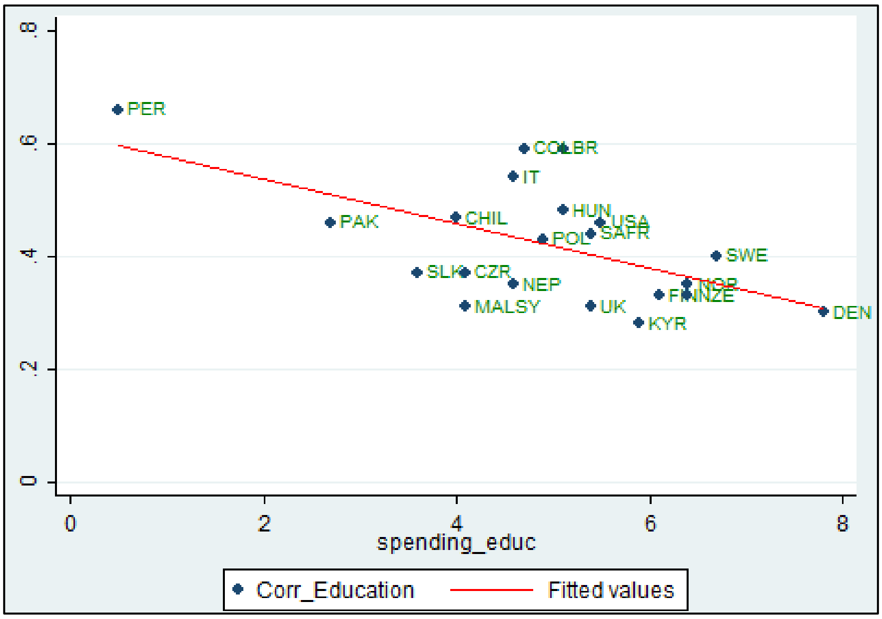
Source: Solon, (2002), Blanden et. al (2005), Andrews and Leigh (2008), Gong et al. (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

Graph 2A2.3: Intergenerational Education Coefficient versus Spending on Education



Source: Solon (2002), Blanden, et al. (2005), Andrews and Leigh (2008), Gong et al. (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

Graph 2A2.4: Intergenerational Education Correlations versus Spending on Education



Source: Solon (2002), Blandenet. al (2005), Andrews and Leigh (2008), Gong et al. (2010), Li (2011), Azevedo and Bouillon (2009), OECD (2012) and World Bank (2012)

2A.3 First Stage Regressions and Alternative Results

Table 2A3.1: First Stage Earnings Regressions using Levels of Education[54]

1st Stage Earnings Regression: Level of Education (1990)		
Variables	Fathers	Mothers
	Earnings_LevelEducation	
	Coef. (Robust S.Errors)	
primary	-0.590***	-0.460***
	(0.014)	(0.011)
primary_65	-1.199***	-0.977***
	(0.028)	(0.022)
secondary_hum	-0.742***	-0.587***
	(0.028)	(0.021)
secondary_tec	-0.751***	-0.622***
	(0.033)	(0.024)
institute	-0.465***	-0.353***
	(0.048)	(0.032)
none_educ	-1.421***	-1.157***
	(0.027)	(0.021)
employer	1.357***	1.439***
	(0.040)	(0.034)
self-employed	0.294***	0.225***
	(0.014)	(0.012)
navy_police	0.202***	0.286***
	(0.032)	(0.030)
HouseKeeping	-0.273**	-0.468***
	(0.122)	(0.017)
withoutpayment	-0.891***	-0.985***
	(0.051)	(0.031)
age	0.074***	0.056***
	(0.004)	(0.002)
age_sq	-0.001***	-0.001***
	(0.000)	(0.000)
_cons	10.331***	10.387***
	(0.095)	(0.043)
N. of obs.	19,013	34,671
R2	0.354	0.344
note: *** p<0.01, ** p<0.05, * p<0.1		

Source: CASEN Surveys, 2009 and 1990

[54]Standard errors are in brackets.

Table 2A3.2: First Stage Earnings Regressions using Levels of Schooling[55]

1st Stage Earnings Regression: Levels of Schooling (1990)		
Variables	Fathers	Mothers
	Earnings_Schooling	
	Coef. (Robust S.Errors)	
employer	1.350***	1.414***
	(0.039)	(0.034)
self-employed	0.289***	0.223***
	(0.013)	(0.011)
navy_police	0.199***	0.285***
	(0.028)	(0.028)
housekeeping	-0.236*	-0.454***
	(0.142)	(0.017)
withoutPayment	-0.877***	-0.970***
	(0.048)	(0.029)
age	0.077***	0.057***
	(0.004)	(0.002)
age_sq	-0.001***	-0.001***
	(0.000)	(0.000)
Schooling	0.090***	0.078***
	(0.001)	(0.001)
_cons	8.324***	8.767***
	(0.081)	(0.034)
R2	0.355	0.356
N. of obs.	19,840	36,120

Source: CASEN Surveys, 2009 and 1990

[55]Standard errors are in brackets.

Table 2A3.3: Second Stage Results Alternative 1 (Education as Level of Education)[56]

Father-Son: Earnings Alt_1						
Variable	B	Bst.	B	Bst.	B	Bst.
Ln(Earnings)_F	**0.254*** **	**0.160*** **	**0.340*** **	**0.214*** **	**-0.001**	**-0.001**
	(0.019)		(0.022)		(0.183)	
age			0.072***	0.597***	0.066***	0.546***
			(0.016)		(0.015)	
age_Sq			-0.001***	-0.517***	-0.001***	-0.463***
			(0.000)		(0.000)	
age_F			0.024	0.194	0.014	0.114
			(0.032)		(0.032)	
age_Sq_F			-0.000	-0.121	-0.000	-0.093
			(0.000)		(0.000)	
primary _F					-0.913***	-0.581***
					(0.056)	
primary _65_F					-0.898***	-0.508***
					(0.153)	
secondary_hum _F					-0.591***	-0.339***
					(0.081)	
secondary_tec _F					-0.500***	-0.157***
					(0.084)	
institute_F					-0.135	-0.023
					(0.117)	
withoutdegree_F					-1.080***	-0.480***
					(0.198)	
employer_F					0.249	0.062
					(0.251)	
selfemployed_F					0.074	0.043
					(0.060)	
navy _F					0.163**	0.033**
					(0.068)	
HKeeping _F					0.269	0.013
					(0.218)	
WithoutPayment_F					(dropped)	(dropped)
					.	
_cons	9.854***	0.035***	6.476***	0.038***	11.660***	0.036***
	(0.211)		(0.861)		(1.965)	
R2	0.025		0.045		0.130	
note: *** p<0.01, ** p<0.05, * p<0.1						

Source: CASEN Surveys, 2009 and 1990

[56] Standard errors are in brackets.

Table 2A3.4: Second Stage Results Alternative 2_r (Education as Estimated Years of Schooling)[57]

Father-Son: Earnings Alt_2_r						
Variable	B	Bst.	B	Bst.	B	Bst.
Ln(Earnings)_F	**0.327*** **	**0.195*** **	**0.398*** **	**0.237*** **	**0.021**	**0.0123**
	(0.020)		(0.021)		(0.186)	
age			0.071***	0.594***	0.071***	0.595***
			(0.016)		(0.016)	
age_Sq			-0.001***	-0.513***	-0.001***	-0.507***
			(0.000)		(0.000)	
age_F			0.014	0.113	0.035	0.279
			(0.030)		(0.033)	
age_Sq_F			-0.000	-0.049	-0.000	-0.234
			(0.000)		(0.000)	
Employer_F					0.280	0.221
					(0.252)	
Selfemployed_F					0.055	0.0695
					(0.061)	
Navy_F					0.301***	0.0325
					(0.064)	
HKeeping_F					0.299	0.0611
					(0.211)	
WithoutPayment_F					(dropped)	(dropped)
					.	
Y.Schooling_F					0.047***	0***
					(0.018)	
_cons	9.013***	0.0351***	6.123***	0.0383***	9.306***	0.0353***
	(0.227)		(0.843)		(1.705)	
N. of observations	6,983		6,983		6,983	
R2	0.037		0.056		0.067	

Father-Son: Earnings Alt_2_r						
Variable	B	Bst.	B	Bst.	B	Bst.
Y.Schooling_F	**0.360*** **	**0.368*** **	**0.349*** **	**0.357*** **	**0.286*** **	**0.292*** **
	(0.012)		(0.013)		(0.041)	
age			0.083	0.148	0.096	0.171
			(0.086)		(0.075)	
age_Sq			-0.002*	-0.259*	-0.002**	-0.281**
			(0.001)		(0.001)	
age_F			0.449***	0.765***	0.356***	0.606***
			(0.113)		(0.121)	
age_Sq_F			-0.004***	-0.712***	-0.003***	-0.538***
			(0.001)		(0.001)	
Employer_F					0.080	0.004
					(0.608)	
Selfemployed_F					-0.456***	-0.0576***
					(0.164)	
Navy_F					1.587***	0.0692***
					(0.220)	
HKeeping_F					0.445	0.005
					(0.749)	
WithoutPayment_F					(dropped)	(dropped)
					.	
Ln(Earnings)_F					0.628	0.0802
					(0.431)	
_cons	7.073***	0.0436***	-7.168**	0.0401**	-11.339**	0.0376**
	(0.145)		(2.939)		(5.083)	
N. of observations	7,323		7,323		7,124	
R2	0.131		0.142		0.152	
note: *** p<0.01, ** p<0.05, * p<0.1						

Source: CASEN Surveys, 2009 and 1990

[57]Standard errors are in brackets.

Table 2A3.5: Second Stage Results Alternative 2_d (Education as Years of Schooling): Mother-Daughter[58]

Mother-Daugther: Earnings Alt_2_d			Mother-Daugther : Education Alt_2_d		
Variable	B	Bst.	Variable	B	Bst.
Ln(Earnings)_M	**0.249*** **	**0.197*** **	**Sch_mother_d**	**0.367*** **	**0.420*** **
	(0.016)			(0.009)	
age	0.022	0.1740	age	0.047	0.086
	(0.017)			(0.065)	
age_Sq	-0.000	-0.201	age_Sq	-0.002**	-0.250**
	(0.000)			(0.001)	
age_M	0.107***	0.807***	age_mother	0.128	0.223
	(0.032)			(0.120)	
age_Sq_M	-0.001***	-0.734***	age_Sq_mother	-0.001	-0.120
	(0.000)			(0.001)	
_cons	6.122***	0.0153***	_cons	3.750	0.0401
	(0.900)			(3.196)	
N.of obs.	7,397		N.of obs.	8,193	
R2	0.043		R2	0.211	
note: *** p<0.01, ** p<0.05, * p<0.1					

Source: CASEN Surveys, 2009 and 1990

[58]Standard errors are in brackets.

Table 2A3.6: Age Cohort Results (Controlling for Father and Son's Age)[59]

Earnings Coefficients by Children's age Cohorts: Alt_2_d (son and father age and age2)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Ln(Earnings)_F	**0.400*** **	**0.267*** **	**0.502*** **	**0.335*** **	**0.498*** **	**0.332*** **	**0.490*** **	**0.327*** **	**0.473*** **	**0.316*** **	**0.277**	**0.185**
	(0.0481)		(0.0392)		(0.0417)		(0.0556)		(0.119)		(0.442)	
age	-0.303	-2.521	0.548	4.568	-0.795	-6.629	0.845	7.038	-2.231	-18.59	25.32*	211.0*
	(0.563)		(0.669)		(0.77)		(1.339)		(2.671)		(11.46)	
age_Sq	0.00596	3.595	-0.00806	-4.864	0.0105	6.359	-0.00974	-5.873	0.0231	13.94	-0.241*	-145.5*
	(0.01)		(0.0101)		(0.0102)		(0.0155)		(0.028)		(0.109)	
age_F	0.0451	0.358	-0.00206	-0.0164	0.0811	0.644	0.342	2.717	-0.196	-1.557	-21.23*	-168.7*
	(0.0525)		(0.0733)		(0.113)		(0.305)		(0.904)		(8.618)	
age_Sq_F	-0.00036	-0.333	5.96E-05	0.0555	-0.00053	-0.496	-0.00252	-2.348	0.00162	1.508	0.163*	151.8*
	(0.000462)		(0.000618)		(0.000917)		(0.00243)		(0.00698)		(0.0652)	
_cons	10.54	0.855	-2.229	-0.338	19.27	0.69	-22.47	-1.471	67.21	6.824	36.62	-100.8
	(7.968)		(11.29)		(14.05)		(30.16)		(75.19)		(377.6)	
N	1735		1891		1780		969		271		30	
R-sq	0.069		0.1		0.11		0.09		0.123		0.441	

Education Coefficients by Children's age Cohorts: Alt_2_d (son and father age and age2)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Y.Schooling_F	**0.343*** **	**0.427*** **	**0.408*** **	**0.507*** **	**0.384*** **	**0.477*** **	**0.358*** **	**0.445*** **	**0.388*** **	**0.482*** **	**0.49**	**0.609**
	(0.0175)		(0.0203)		(0.0158)		(0.024)		(0.0472)		(0.251)	
age	-0.627	-1.122	-0.733	-1.311	0.123	0.22	2.778	4.967	-10.31	-18.43	13.64	24.38
	(2.069)		(2.411)		(3.723)		(5.836)		(11.52)		(70.84)	
age_Sq	0.0105	1.364	0.0118	1.527	-0.00295	-0.382	-0.034	-4.396	0.103	13.3	-0.126	-16.29
	(0.0369)		(0.0365)		(0.0491)		(0.0678)		(0.121)		(0.674)	
age_F	0.332	0.566	0.682*	1.163*	0.678	1.156	2.229	3.799	1.099	1.874	-26.76	-45.59
	(0.229)		(0.295)		(0.514)		(1.175)		(4.522)		(51.37)	
age_Sq_F	-0.00267	-0.534	-0.00571*	-1.141*	-0.00517	-1.033	-0.0173	-3.458	-0.00836	-1.671	0.206	41.09
	(0.00204)		(0.00249)		(0.0042)		(0.0092)		(0.0348)		(0.39)	
_cons	7.69	0.355	-1.131	0.227	-14.74	0.0177	-120.7	-0.976	228.4	7.402	507.5	-11.65
	(29.68)		(40.66)		(69.65)		(130.9)		(318.9)		(1751.8)	
N	1817		1973		1863		1033		290		30	
R-sq	0.205		0.244		0.222		0.188		0.249		0.284	

Source: CASEN Surveys, 2009 and 1990

[59] Standard errors are in brackets.

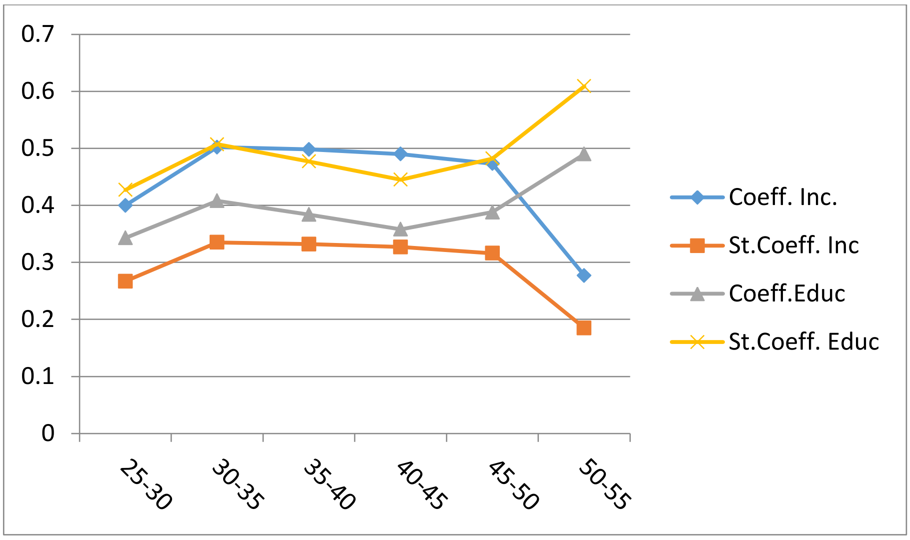
Table 2A3.7: Age Cohort Results (None Control Variables)[60]

Earnings Coefficients by Children's age Cohorts: Alt_2_d (none control variables)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
lnY_Father	0.387***	0.258***	0.487***	0.325***	0.475***	0.317***	0.480***	0.320***	0.481***	0.321***	0.78	0.521
	(0.0457)		(0.0352)		(0.035)		(0.0513)		(0.102)		(0.415)	
_cons	8.300***	-0.132***	7.325***	0.0480***	7.521***	0.134***	7.514***	0.194***	7.469***	0.156***	4.222	0.249
	(0.508)		(0.391)		(0.382)		(0.562)		(1.095)		(4.4)	
N	1735		1891		1780		969		271		30	
R-sq	0.062		0.098		0.102		0.083		0.118		0.123	
Education Coefficients by Children's age Cohorts: Alt_2_d (only father age and age2)												
Variable	**C1 (25-30)**		**C2 (30-35)**		**C3 (35-40)**		**C4 (40-45)**		**C5 (45-50)**		**C6 (50-55)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Y.Schooling_F	0.339***	0.421***	0.410***	0.509***	0.384***	0.477***	0.359***	0.446***	0.409***	0.508***	0.485**	0.602**
	(0.0174)		(0.0147)		(0.0151)		(0.0272)		(0.0514)		(0.164)	
_cons	8.571***	0.144***	7.782***	0.0836***	7.801***	0.026***	7.606***	-0.091***	6.710***	-0.232***	6.919***	0.0121***
	(0.183)		(0.145)		(0.143)		(0.225)		(0.415)		(1.209)	
N	1817		1973		1863		1033		290		30	
R-sq	0.201		0.242		0.218		0.182		0.221		0.24	

Source: CASEN Surveys, 2009 and 1990

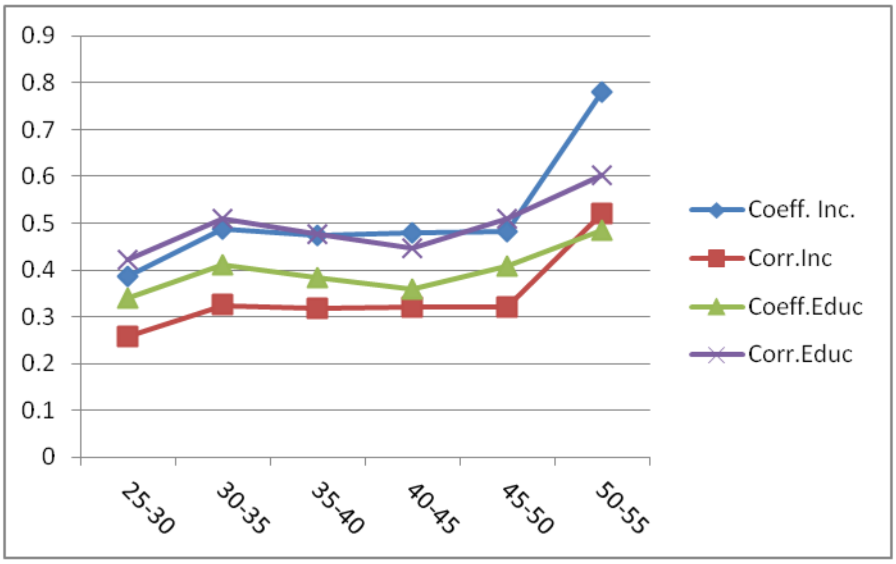
[60]Standard errors are in brackets.

Graphs 2A3.1: Age Cohort Results (Controlling for Father and Son's Age)



Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.2: Age Cohort Results (None Control Variables)



Source: CASEN Surveys, 2009 and 1990

Table 2A3.8: QR Results (Father-Son Earnings & Education): Controlling by Age and Mothers' Earnings (Education)[61]

Earnings: Father-Son										
Variable	**q(10)**		**q(25)**		**q(50)**		**q(75)**		**q(90)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Ln(Earnings)_F	**0.189*****	**0.126*****	**0.223*****	**0.149*****	**0.375*****	**0.250*****	**0.486*****	**0.324*****	**0.576*****	**0.385*****
	(0.026)		(0.027)		(0.027)		(0.039)		(0.043)	
Ln(Earnings)_M	**0.040***	**0.0546***	**0.035*****	**0.0478*****	**0.063*****	**0.0854*****	**0.085*****	**0.116*****	**0.120*****	**0.163*****
	(0.023)		(0.013)		(0.022)		(0.019)		(0.026)	
age	-0.000	-0.000665	-0.000**	-0.000551**	-0.001**	-0.00103**	-0.001***	-0.00131***	-0.001***	-0.00200***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
age_Sq	0.024	0.0322	0.042*	0.0574*	0.023	0.0307	-0.014	-0.019	-0.048	-0.065
	(0.034)		(0.023)		(0.036)		(0.044)		(0.056)	
age_F	-0.000	-0.000228	-0.000	-0.000438	-0.000	-0.000155	0.000	0.000247	0.001	0.000728
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Age_Sq_F	0.092***	0.0782***	0.121***	0.104***	0.184***	0.157***	0.179***	0.153***	0.210***	0.179***
	(0.015)		(0.019)		(0.020)		(0.023)		(0.029)	
_cons	7.401***	-3.098***	6.487***	-3.419***	4.476***	-3.009***	4.355***	-1.559***	3.672**	-0.695***
	(0.914)		(0.680)		(1.001)		(1.216)		(1.598)	
N. of obs.	6,591									
R2	0.114									

Education: Father-Son										
Variable	**q(10)**		**q(25)**		**q(50)**		**q(75)**		**q(90)**	
	B	Bst.	B	Bst.	B	Bst.	B	Bst.	B	Bst.
Y.Schooling_F	**0.293*****	**0.364*****	**0.320*****	**0.398*****	**0.228*****	**0.283*****	**0.259*****	**0.322*****	**0.242*****	**0.301*****
	(0.021)		(0.019)		(0.012)		(0.022)		(0.023)	
Y.Schooling_M	**0.207**	**0.369**	**0.034**	**0.062**	**0.071**	**0.128**	**0.082**	**0.147**	**0.242****	**0.432****
	(0.145)		(0.110)		(0.063)		(0.073)		(0.109)	
age	-0.004*	-0.530*	-0.001	-0.172	-0.002**	-0.255**	-0.001	-0.160	-0.004**	-0.464**
	(0.002)		(0.002)		(0.001)		(0.001)		(0.002)	
age_Sq	0.113	0.193	-0.057	-0.097	0.118	0.202	0.352***	0.600***	0.574**	0.978**
	(0.171)		(0.117)		(0.148)		(0.062)		(0.251)	
age_F	-0.001	-0.192	0.001	0.115	-0.001	-0.122	-0.003***	-0.542***	-0.005**	-0.925**
	(0.001)		(0.001)		(0.001)		(0.001)		(0.002)	
age_Sq_F	0.280***	0.334***	0.253***	0.302***	0.178***	0.212***	0.164***	0.195***	0.133***	0.159***
	(0.020)		(0.023)		(0.012)		(0.024)		(0.024)	
_cons	-2.505	-0.971	6.477*	0.433*	3.013	0.108	-3.251**	-0.562***	-9.800	-1.158
	(5.282)		(3.638)		(3.901)		(1.537)		(7.310)	
N. of obs.	7,035									
R2	0.264									

Source: CASEN Surveys, 2009 and 1990

[61]Standard errors are in brackets.

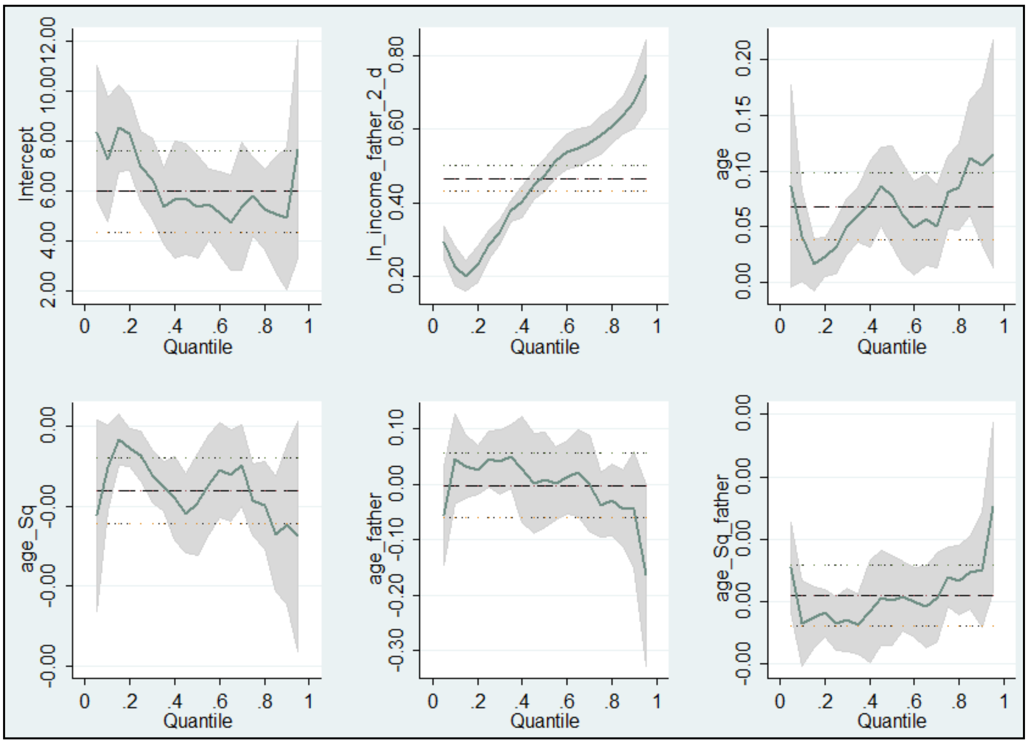
Table 2A3.9: QR Results (Father-Son Earnings): Controlling by Age and Son' Schooling[62]

Earnings: Father-Son										
Variable	**q(10)**		**q(25)**		**q(50)**		**q(75)**		**q(90)**	
Ln(Earnings)_F	0.082***	0.0549***	0.152***	0.101***	0.212***	0.141***	0.291***	0.194***	0.363***	0.242***
	(0.026)		(0.021)		(0.021)		(0.024)		(0.040)	
age	0.036**	0.303**	0.043***	0.357***	0.061***	0.510***	0.070***	0.583***	0.102***	0.854***
	(0.016)		(0.015)		(0.016)		(0.014)		(0.032)	
age_Sq	-0.000*	-0.242	-0.000**	-0.262*	-0.001***	-0.392**	-0.001***	-0.429***	-0.001**	-0.685*
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
age_F	0.019	0.147	0.042	0.335	-0.003	-0.0229	-0.049	-0.388	-0.061	-0.483
	(0.031)		(0.032)		(0.029)		(0.035)		(0.063)	
age_Sq_F	-0.000	-0.138	-0.000	-0.305	0.000	0.0596	0.000	0.431	0.001	0.531
	(0.000)		(0.000)		(0.000)		(0.000)		(0.001)	
Schooling	0.079***	0.370***	0.074***	0.343***	0.087***	0.404***	0.091***	0.425***	0.088***	0.411***
	(0.005)		(0.003)		(0.003)		(0.003)		(0.004)	
_cons	8.901***	-0.917***	7.513***	-0.544***	7.980***	-0.0491***	8.546***	0.516***	7.937***	1.099***
	(0.772)		(0.900)		(0.884)		(1.009)		(1.960)	
N. of observations	6,983									
R2	0.235									
note: *** p<0.01, ** p<0.05, * p<0.1										

Source: CASEN Surveys, 2009 and 1990

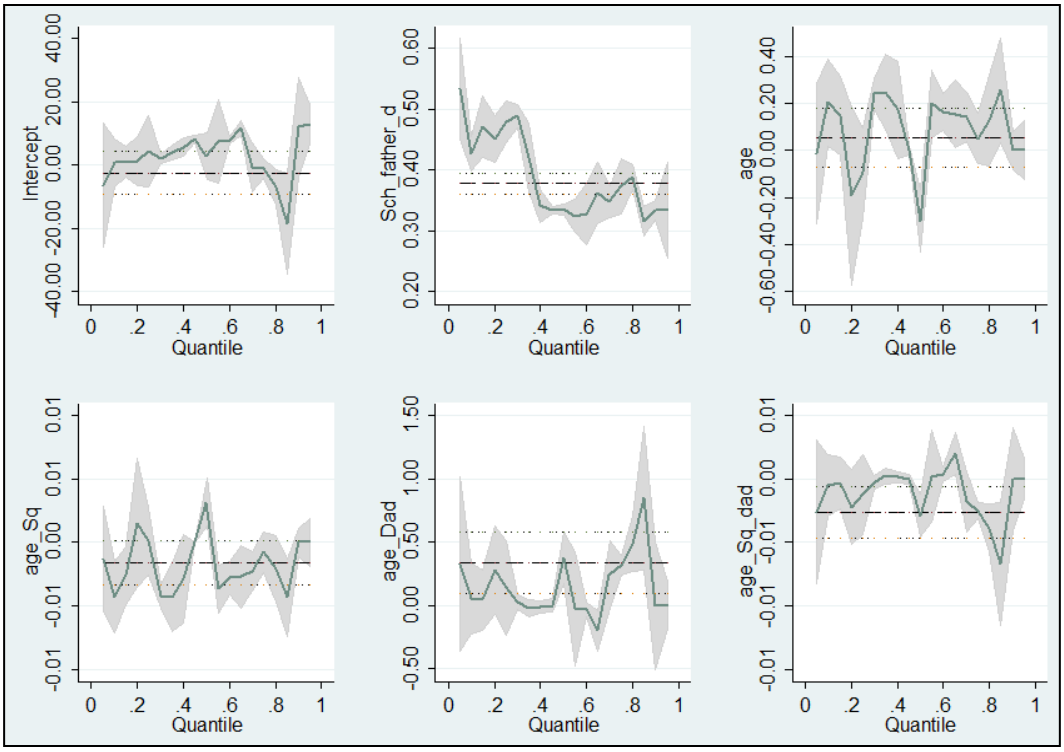
[62]Standard errors are in brackets.

Graphs 2A3.3: Intergenerational Earnings Elasticity and control variables by Quantile



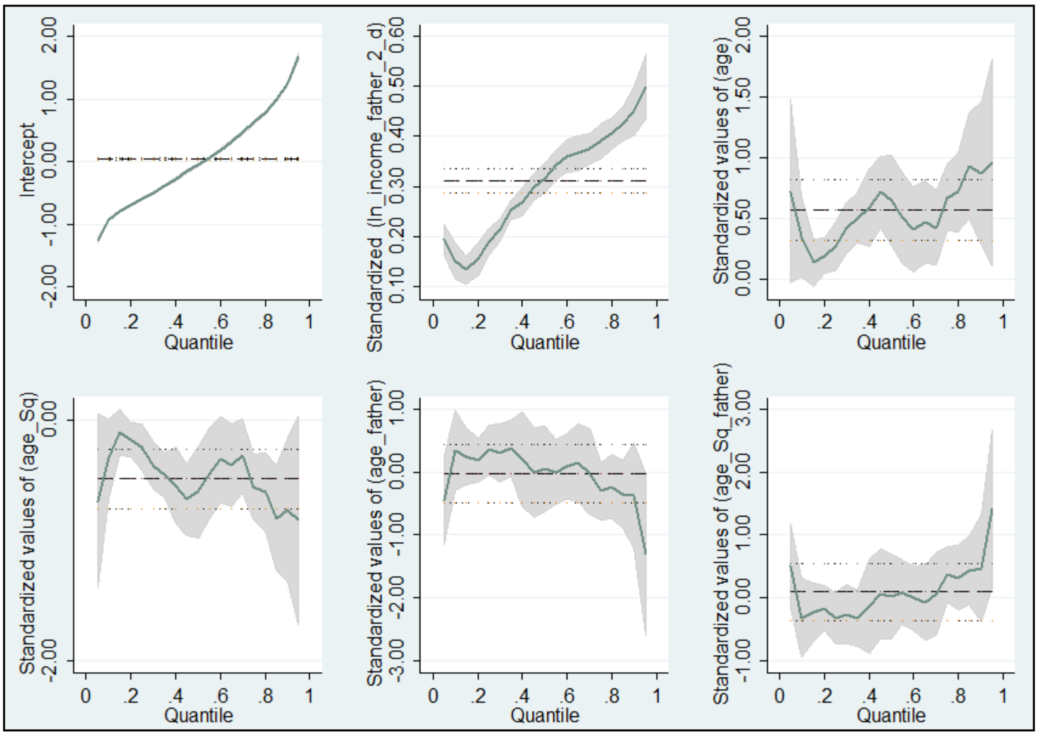
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.4: Intergenerational Education Coefficient and control variables by Quantile



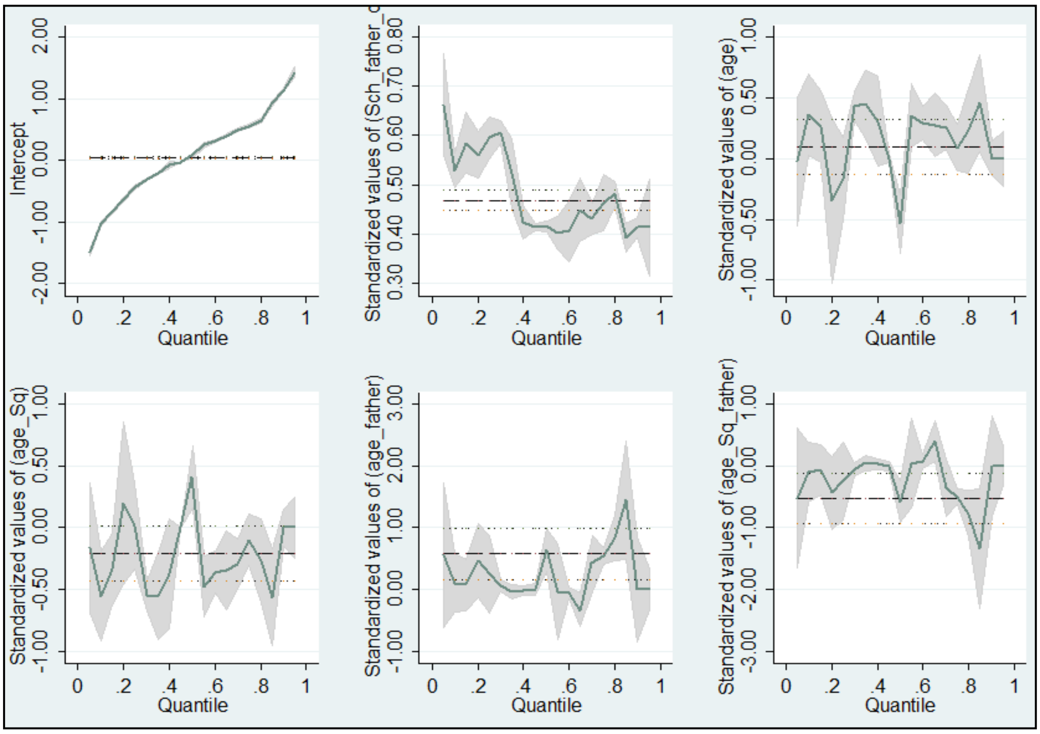
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.5: Intergenerational Earnings Std. Coefficient and control variables by Quantiles



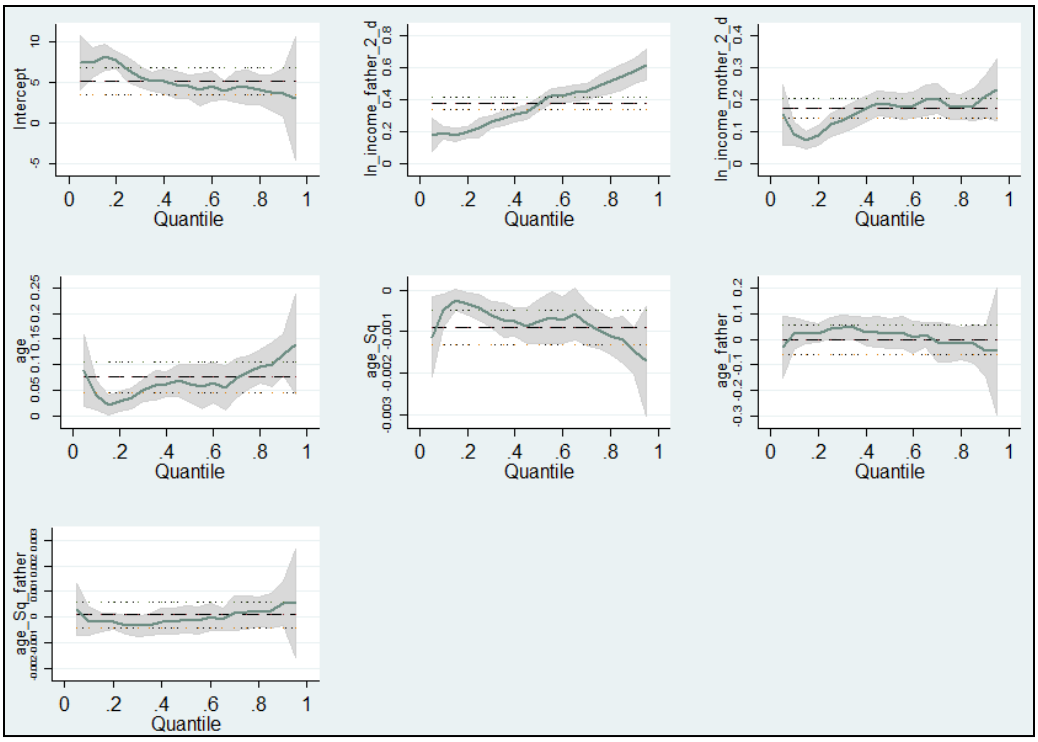
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.6: Intergenerational Education Std. Coefficient and control variables by Quantile



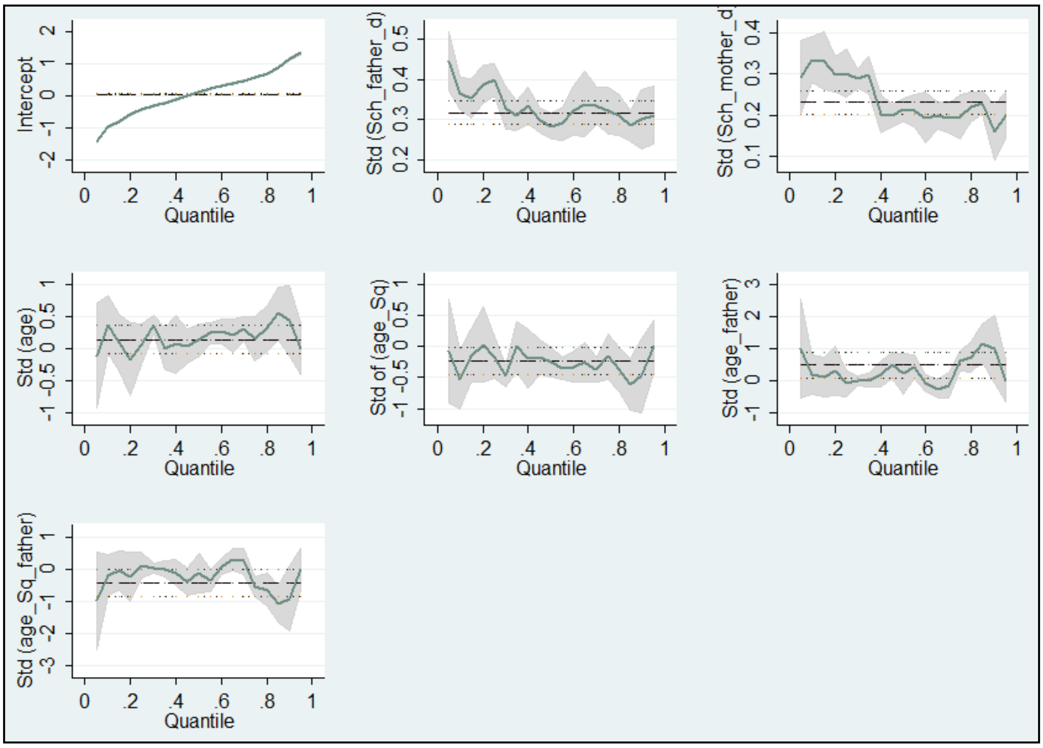
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.7: Intergenerational Earnings Elasticity and control variables by Quantile (Controlling by Mothers' Earnings)



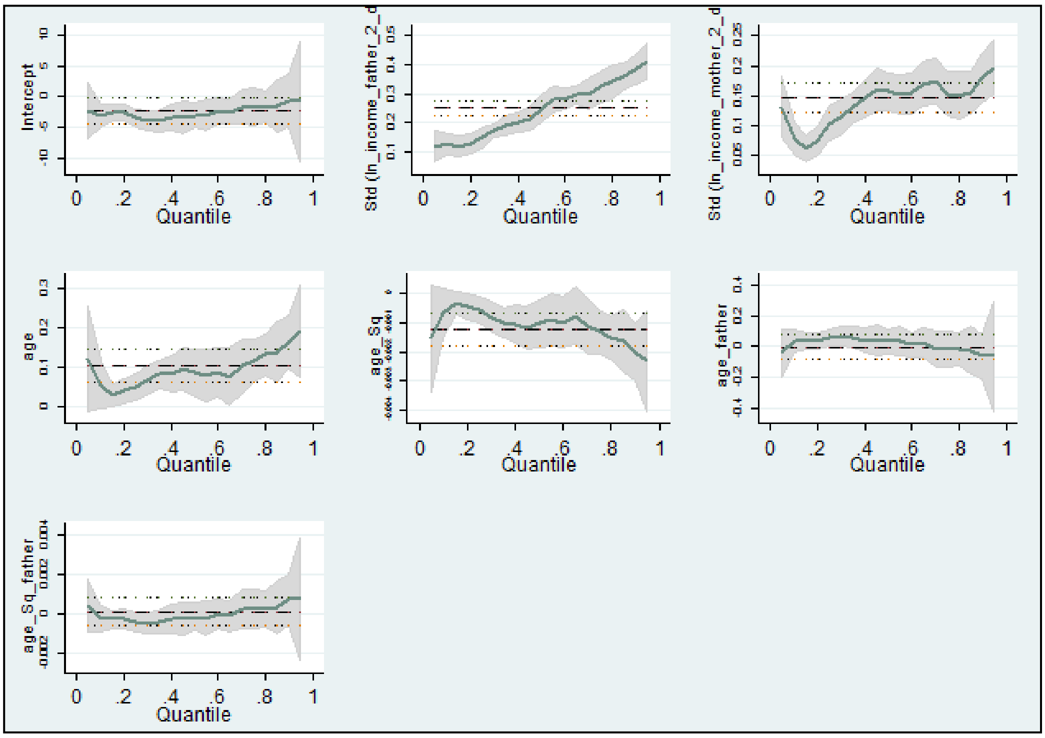
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.8: Intergenerational Education Coefficient and all other variables by Quantile (Controlling by Mothers' Education)



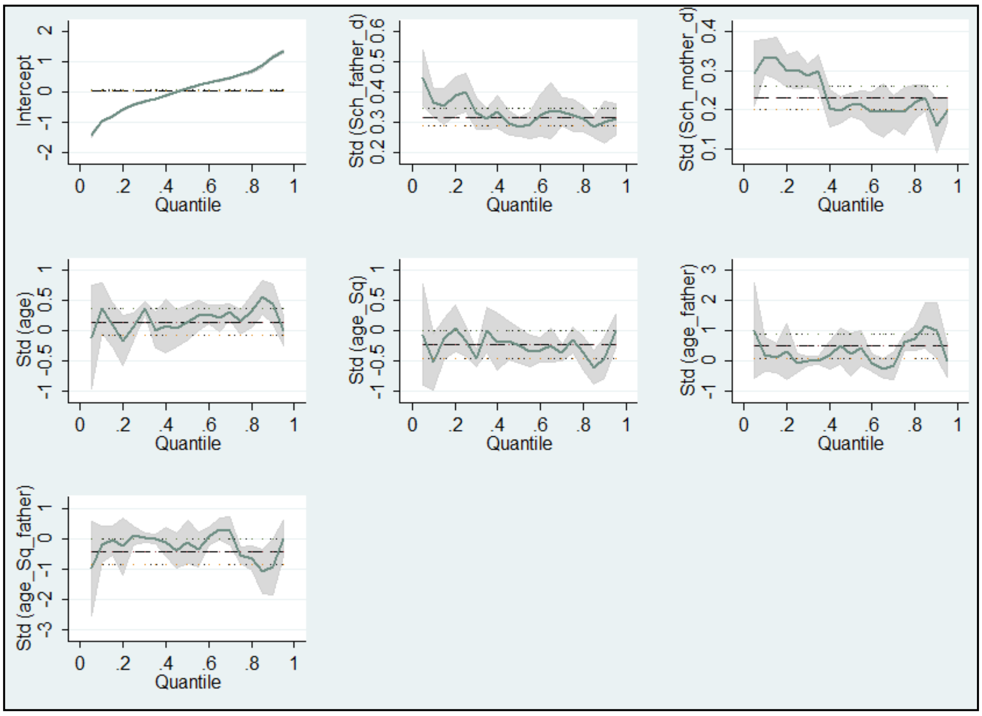
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.9: Intergenerational Earnings Std. Coefficient and control variables by Quantile (Controlling by Mothers' Earnings)



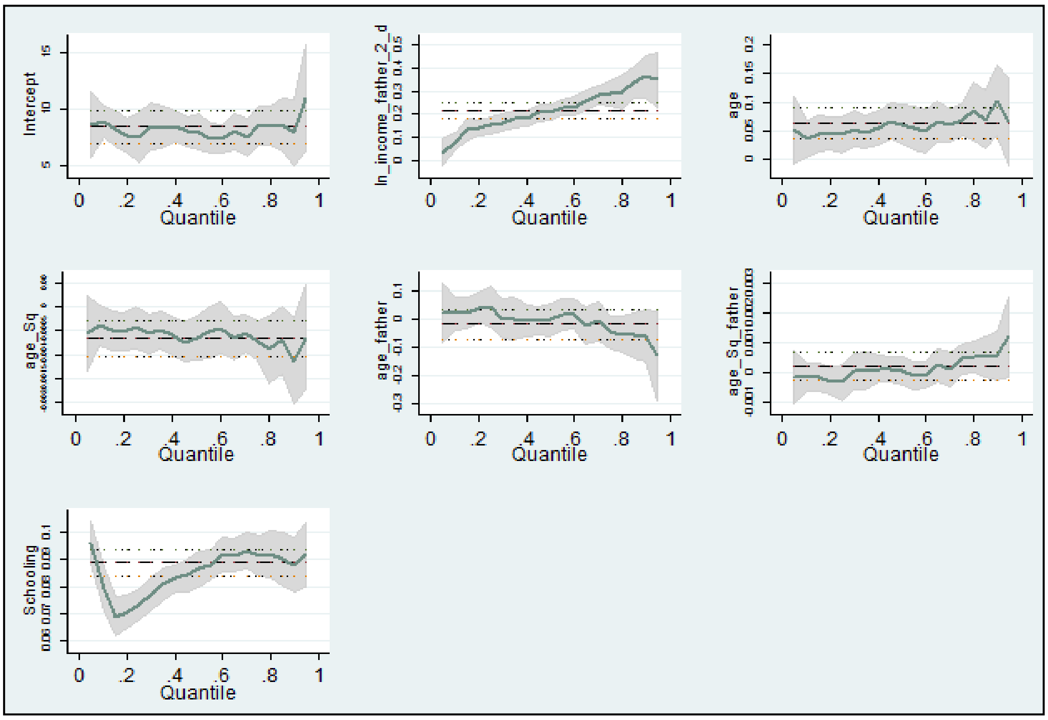
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.10: Intergenerational Education Std. Coefficient and all other variables by Quantile (Controlling by Mothers' Education)



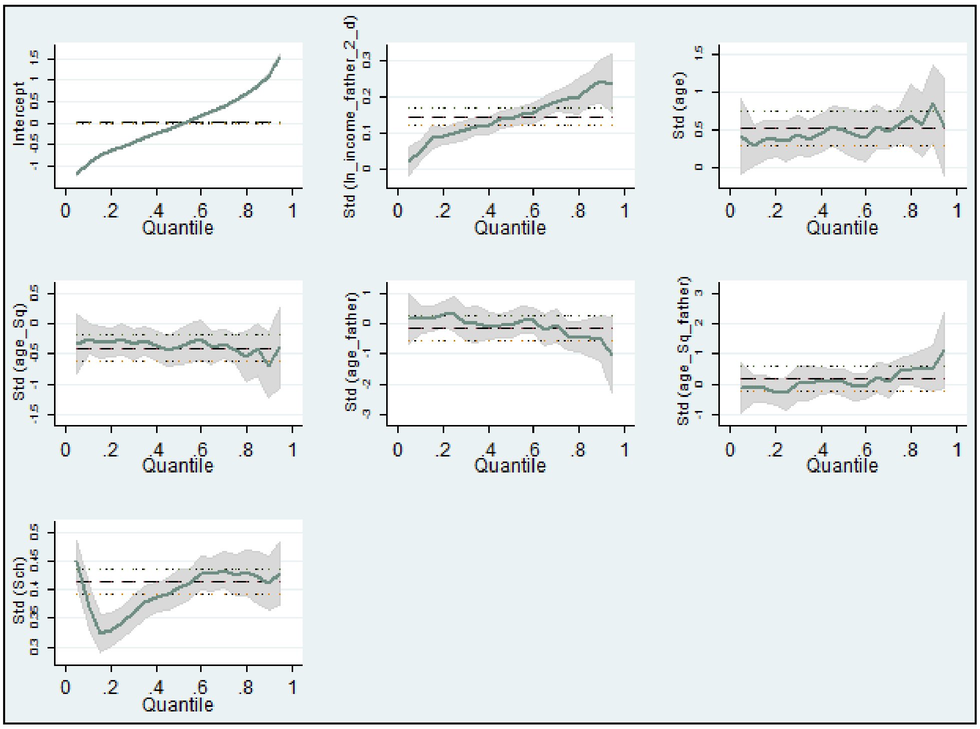
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.11: Intergenerational Earnings Coefficient and all other variables by Quantiles (controlling by son' schooling)



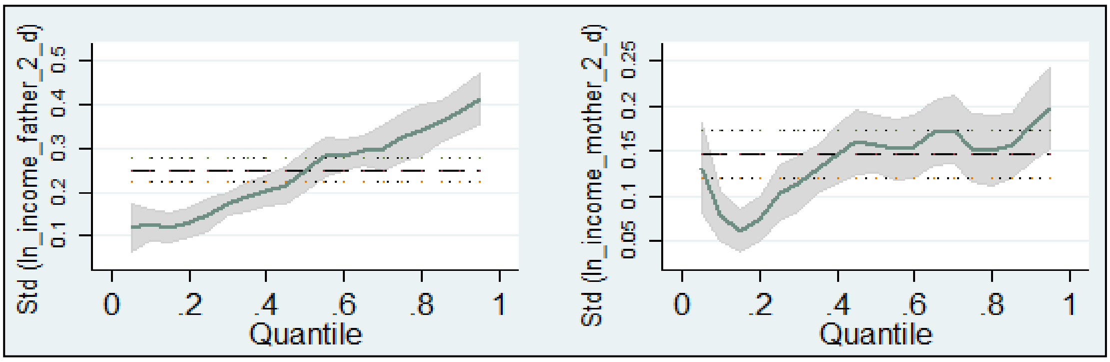
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.12: Intergenerational Earnings Std. Coefficient and control variables by Quantiles (controlling by son' schooling)



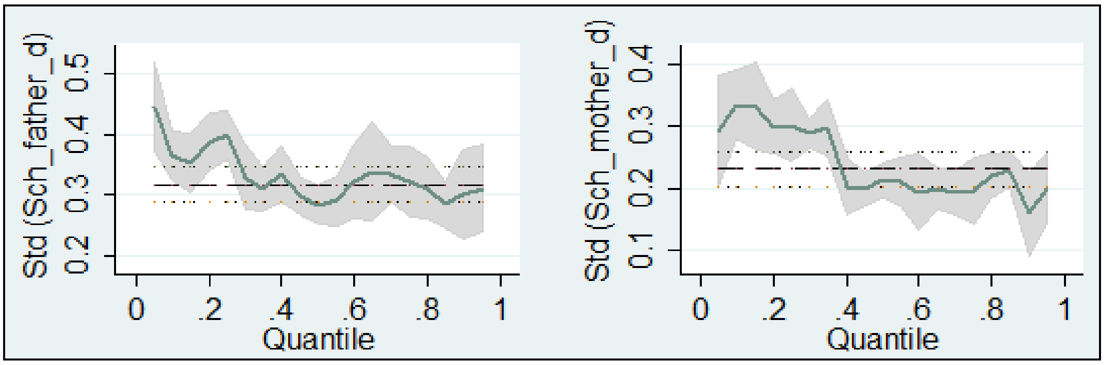
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.13: Intergenerational Earnings Std. Coefficient by Quantile (controlling by Mothers' Earnings)



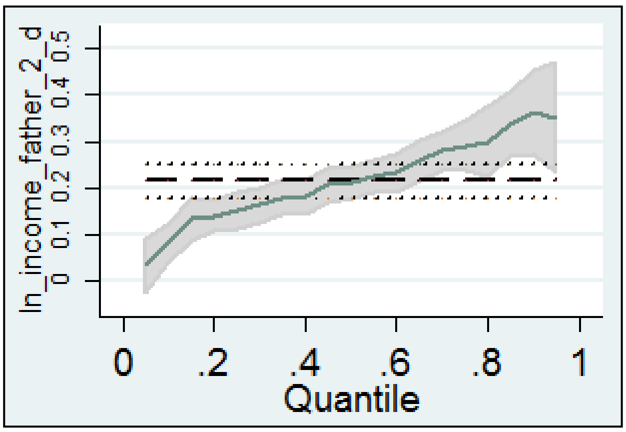
Source: CASEN Surveys, 2009 and 1990

Graphs 2A3.14: Intergenerational Education Mobility Std. Coefficient by Quantile (Controlling by Mothers' Education)



Source: CASEN Surveys, 2009 and 1990

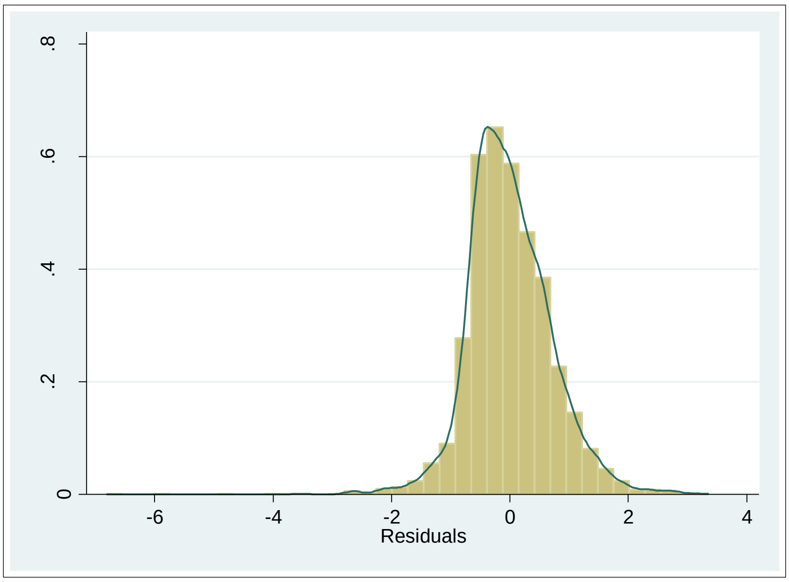
Graphs 2A3.15: Intergenerational Earnings Coefficient by Quantile (controlling by son' schooling)



Source: CASEN Surveys, 2009 and 1990

2A4 Tests

Graph 2A4.1 Earnings Residuals Distribution



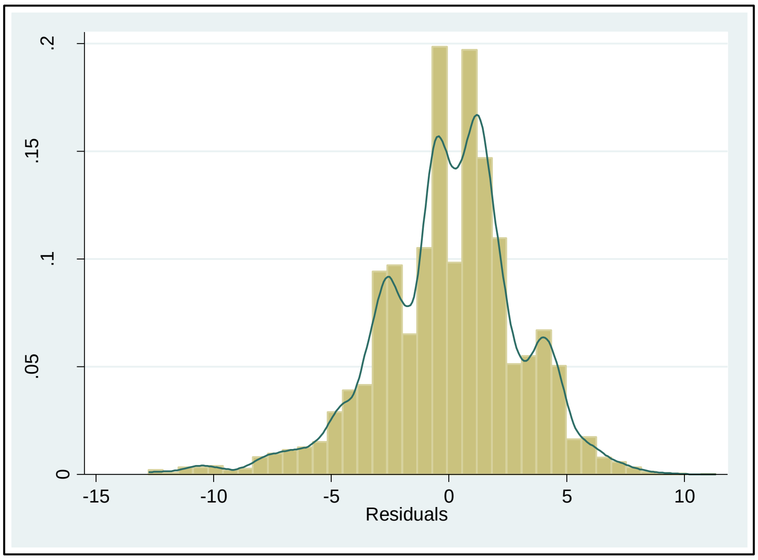
Source: CASEN Surveys, 2009 and 1990

Table 2A4.1: Skewness/Kurtosis Tests for Normality (Earnings)

Earnings: Test for Normality (Residuals)					
Skewness/Kurtosis tests for Normality					
				------- joint ------	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adjchi2(2)	Prob>chi2
Ln(Earnings)_ resid	7.00E+03	0.1523	0	.	0
Shapiro-Francia W' test for normal data					
Variable	Obs	W'	V'	z	Prob>z
Ln(Earnings)_ resid	6983	0.96691	35.877	2.476	0.00664
Shapiro-Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
Ln(Earnings)_resid	6983	0.9674	118.726	12.66	0

Source: CASEN Surveys, 2009 and 1990

Graph 2A4.2 Earnings Residuals Distribution



Source: CASEN Surveys, 2009 and 1990

Table 2A4.2: Skewness/Kurtosis Tests for Normality (Education)

Education: Test for Normality (Residuals)					
Skewness/Kurtosis tests for Normality					
				------- joint ------	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adjchi2(2)	Prob>chi2
Schooling_F_resid	7.30E+03	0	0	.	0
Shapiro-Francia W' test for normal data					
Variable	Obs	W'	V'	z	Prob>z
Schooling_F_resid	7323	0.98083	20.543	2.206	0.01368
Shapiro-Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
Schooling_F_resid	7323	0.98085	72.713	11.376	0

Source: CASEN Surveys, 2009 and 1990

Table 2A4.3: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

Heteroskedasticity: Earnings
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: Ln(Earnings)_F age age_Sq age_F age_Sq_F
chi2(5) = 204.80 Prob > chi2 = 0.0000
Heteroskedasticity: Education
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: Schooling_F age age_Sq age_F age_Sq_F
chi2(5) = 131.50 Prob > chi2 = 0.0000

Source: CASEN Surveys, 2009 and 1990

3 Does the Increase in Educational Provision and Competition between Schools Increase the Quality of the Service? The Role of the 1980s Educational Reform in Chile

3.1 Summary

- Recent reforms of educational systems have focused on privatisation (increasing school choice) and decentralisation. The idea is that higher competition among schools would improve the quality of service (Friedman, 1962) and that local authorities have better information related to the needs of families in their areas.
- However, competition could be associated with social segregation as it could cause sorting among students, concentrating the poorest pupils in to public schools which could also be a concern in terms of negative peer effects.
- Chile has implemented a voucher and privatisation system nationwide for more than 30 years which seems to be in crisis considering that it has been continuously underperforming in international educational tests. It is also considered very socially segregated. The arguments against voucher systems have always been more ideological than supported by empirical evidence.
- Therefore, the analysis of whether or not competition among schools has increased the quality of schools and if it could be having an effect on the levels of social segregation experienced in the country seems to be relevant.
- The data utilisedis the SIMCE (System of Measurement of Quality of Education) for the year 2005 and 2009. It corresponds to academic tests taken every year in every urban school of the country including information related to school location and characteristics.

- The results suggest that increasing competition from public schools increases the student academic performance of schools located in the area and that the performance decreases when the number of voucher schools increases. Therefore, voucher schools have not positively contributed to educational quality of public schools in Chile, raising doubts as to whether or not a privatised market of education really achieves its objectives.

3.2 Introduction

A major goal of social policy in many countries is to design and implement an educational system that promotes opportunities for all students, with the presumption that education will provide them with the necessary tools to have a good future in terms of earnings and quality of life. In this way, inequality should be reduced and a healthy flux in society should provide hope and incentives for new generations. In this respect, some educational policies have focused on increasing public spending on education or increasing teacher quality, among other things, but the effectiveness of these policies has not been agreed. Zanzig (1997) shows that Scholastic Aptitude Test scores (SAT) from 1967 to 1992 have declined by more than 50 points in the USA even though the spending on education has almost doubled; therefore teachers' quality, class size and other factors financed with that funding could be irrelevant with respect to improving students' performance. Nonetheless, the performance of students seems to improve when teachers' salaries are better and when the time students stay in class increases.

Actually, if education is an important determinant in the future earnings of people and it is accepted that the quality of education is important, it would be beneficial not only to the individual, but also to the whole economy of a country. There are many channels through which education can influence earnings, but there is no conclusive evidence that school quality affects them (Heckman *et al.* 1995). In particular, there is no evidence about the relationship between test scores, understood as a measure of education quality, and labour achievement (Hanushek, 1986). However, it has been traditional in the literature to use academic tests to measure quality provided by schools and it is considered that good quality education in primary and secondary education are important in order to access further levels of education which would determine future earnings.

If education is accepted as the main player in terms of explaining the levels of social mobility, the quality of education has become the main concern. In particular, understanding that if poorer children receive education of high standards they will be able to compete better with richer children in the labour market. In this context, Restuccia and Urrutia (2002) suggest that differences in the quality of early education are considered amongst the most important components of earnings persistence across generations. The traditional approach for increasing quality of education was increasing resources available to schools. However, this seems to be disappointing in terms of increasing incentives of students and schools to improve, even though schools are able to provide higher added value (MacLeod and Urquiola, 2009).

On the other hand, others, beginning with Friedman (1962), have promoted a new approach for making educational systems more efficient, namely by increasing the quality of the service provided through decentralisation and privatisation of the educational market. With this approach in mind, the most recent educational reforms in many countries have been more market-oriented than previous ones, promoting competition between schools and being more reactive in terms of covering the needs and preferences of parents (public schools offer a standardised and homogeneous service for everyone without distinction). Mostly, these reforms have been focused on facilitating the opening of private institutions that would be able to provide education. However, in practice, the idea of increasing the quality of the service provision through increasing competition does not seem to be working as intended. In particular, the Chilean experience has always been controversial, considering for example, the bad results in international academic tests such as PISA, where Chile has been scoring well below average compared to other OECD countries[63] (McEwan *et al.,* 2008). Similarly, the New Zealand experience seems to indicate that competition through privatisation (as in Chile) has failed in terms of increasing achievement and therefore opportunities for low income children (Fiske and Ladd, 2001). Often, schools compete using marketing techniques or other ways to influence the consumer choices, but without a real change in the service provided. Clever marketing might attract families with more talented children and that in turn would increase the school's achievement, but it would not do so by investing more resources in education itself but by taking resources away to spend them on advertising their schools (Lubiensk, 2005). In addition, a lack of information available to parents can weaken the competition between schools, which can be even worse when the parents are poor or less educated. The potential competition could also create more inequality among schools and children instead of increasing the standard of education, concentrating poorer or less supported children into fewer schools, reducing the overall quality of the service. It has been therefore claimed that the educational system is one of the main institutions of social reproduction (Breen, 2001).

[63] Results of international tests such us PISA and TIMMS can be found in Appendix 3A1, in Table 3A1.1 and 3A1.2 respectively.

In general, the empirical evidence comes from studies that have looked at competition effects but only measure the differences in outcomes between voucher and public schools, assuming that they compete for students (for example, McConnell, *et al.* (2004), Mizala and Romaguera (1998)). Other studies have focused on explaining the levels of socioeconomic segregation in society that market-oriented and competitive systems achieve (Nores and Narodowski, 2002). Few researchers consider the concept of competition as the percentage of students enrolled in public versus voucher schools and even fewer consider geospatial competition between schools[64] i.e. to measure the role of location in the quality of education provided.

The main concern of research related to competition effects on student performance, considering a privatised market of education (which should encourage an increase in the service provision) is the lack of data, especially because voucher programmes have been, in most cases, implemented on a small scale or were too recent to be evaluated. Therefore, most of the research has been done in places where the magnitude of the competition effect is very small relative to the general impact on the whole educational system of a country (McEwan and Carnoy, 2000). For example, there were several voucher schools operating in the US where there were privately funded schemes in Cleveland (Scholarship and tutoring program), Indianapolis (Educational choice charitable trust program) and San Antonio (Children's educational opportunity foundation scholarship program). These programmes were small and are not expected to grow much more. There were also two public schooling voucher schemes, in Florida and Milwaukee (Wisconsin, USA) where the results were mixed, but had high parental satisfaction (Belfield, 2001).

[64] This could be due to a lack of geo-referential data for the schools' locations.

Chile is a good source of empirical evidence, as a simultaneous voucher and privatisation system has been implemented nationwide for more than 30 years in the country. The country decentralised education in 1980 under a non-democratic government, initiating a voucher system of provision of education which includes religious and non-religious organisations. This was supposed to produce an increase in competition and therefore, an increase in educational quality in the municipalities that had a larger proportion of private institutions (Ladd and Fiske, 2003). Therefore, it is of interest to analyse how expanding the educational market through voucher schools will increase the quality of the whole educational system, the quality of public schools or only the quality of voucher schools. The possibility of sorting in the educational system has also been considered, since children may not be selected by their abilities but more worryingly, will be selected solely based upon their parents' background and education. This could be very harmful to the opportunities for new generations, concentrating "richer" children in voucher schools and leaving more vulnerable children in public schools. The network created in isolation from other socioeconomic groups could reproduce social segregation in societies even more, and education or, more strictly speaking, the educational system could limit social interaction and set aside any hope for less fortunate children. For Chile, in terms of the effects of privatisation on an increase in competition and an increase in the quality of the service, most of the studies have been focused on describing the effect on children's academic performance due to their attendance at public or voucher schools.

This research is motivated by the desire to contribute with evidence to the study of the effect of competition and market-oriented educational provisions on the level of social segregation and the low levels of social mobility in Chile. It is important to keep in mind that the Chilean educational system seems to be in crisis, which is reflected by a permanent underperforming in international educational tests (Medrano and Contreras, 2009) and to consider that the arguments against voucher systems have always been more ideological than actually supported by empirical evidence (Arenas, 2004). Therefore, the aim of this research is to measure the impact of the geospatial level of competition between Chilean schools on the level of academic performance that they achieve. That is, to analyse if a higher number of schools decrease or increase academic performance of schools in the area. It will be assumed that performance can be a sign of the quality of education that schools provide[65] and that the skills that children enrolled in that school develop will be a determinant in accessing higher levels of education and probably accessing better jobs and better salaries in the future. The effect of sorting is also analysed, considering that voucher schools could be attracting the best students in the area leaving public schools with those that suffer from poverty or who have less educated parents. In addition, non-linearities in the effect of competition are considered, as maybe competition could reverse its effect when it reaches a certain level.

3.3 School Competition Effects around the World and in Chile

Previous results regarding the effect on school performance due to competition seem to be diverse, but it is quite clear that there are differences between different studies, which could be related to the fact that the effect of competition was analysed in different contexts, but also because some of them were aimed at analysing the effect of voucher schools on public school performance and others, to the effect of a general competition in the educational market in terms of student's performance. Hoxby (1994) uses data from American school choice programmes and finds that student achievement improves when they attend voucher schools and that public schools respond

[65]Controlling for prior school performance.

positively to competition. This is confirmed by Arum (1996), pointing out that in the US the proportion of private subsidised schools has an important positive influence on the performance of public schools, as theory predicts. However, the improvement does not seem to be related to an increase of efficiency through competition, but because of an increase in the resources provided to public schools.

In terms of the decision-making process between voucher and public schools, Contreras and Macias (2002) point out that most of the research in the USA has been focused on explaining competition based on the Tiebut mechanism. This is not relevant for the Chilean case, as in the US, families choose the education district based upon the place they choose to live[66], concluding that for Chile the implementation of a voucher system has been positive in terms of education quality (considering the Herfindalh Index as a measure for school competition)[67]. On the other hand, Hsieh and Urquiola (2003) find that in Chile, school choice does not seem to improve student performance and point out the importance of separating between the effects of school productivity (increasing the productivity in public schools, as private schools are more efficient) and school sorting. They also suggest that if school choice induces greater segregation, it is not possible to measure to what extent public schools have improved due to greater competition. It is suggested then, that the voucher system in Chile produces cream-skimming and that the average

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[66] In Chile, housing mobility is not very high, 8% in contrast to the USA which has 14%, and in Chile most of those families are high income families (Elacqua, 2009c).

[67] Herfindalh Index corresponds to a measure of a firms's market concentration (for this case, school's market concetration) in relation to other firms (other schools) within the same industry (in the same municipality). The index is calculated as the sum of the squared values of all firms' shares of a given market (all schools share per municipality). Therefore, an increases in this index indicates a decrease in competition within a municipality.

performance of public schools probably decreases even though it is possible that there has been a slight increase in efficiency, as this kind of school loses their best students. This does not mean that voucher systems do not produce any benefits, but maybe schools are spending the money on things that some parents value more (such as the aesthetic appearance) but not on what actually affects productivity which overall could cause the improved efficiency from privatisation reforms of the Chilean education system, but that those benefits are cancelled out with the increase of inequality (Patrinos and Sakellariou, 2008).

In addition, it seems that the results for the Chilean case are also varied (competition would have positive and negative effects on academic performance) depending on the academic test used, the year of the test considered and the control variables included. Furthermore, some of the reasons for these inconclusive results are that the voucher system which was initially implemented in the early 1980s was not a proper voucher system, as initially the budgets of public schools were not immediately affected by the reform and the decentralisation of public schools was completed in the late 1980s. On top of that, test scores were not public until the mid-90s as a democratic government was not elected until 1999 and the value of the voucher consistently declined during the 1980s and only started increasing in the early 1990s. That could be a reason why the results that considered the latest years find a positive effect of competition.

Additionally, if other countries are considered, the results are also not conclusive. In the British context (where competition is promoted by publishing school rankings, but not through a big scale privatisation), Gibbons, *et al.* (2006) analysed the effect of increasing school choice and increasing school competition separately for the case of London’s primary schools. The former is related to residential location and depends on the number of schools available to a family; the latter is related to school location and depends on the number of schools available to students attending a certain school because at the family level, these effects are different, finding evidence to suggest that geospatial competition affects performance positively but only for faith schools. Slightly different results are found by Bradley and Taylor (2002) who analyse the effect of the quantity and the quality of schools per area in England, finding that an increase in competition actually increases performance of schools in the area. This is also found by Böhlmark and Lindahl (2008), for the case of Sweden, where the effect of voucher school reform in 1992 is considered, concluding that the effect of a bigger share of voucher schools per municipality on student performance is positive, but small and only found in the short run (for an increase in student performance in a determined year in primary school, but not to increase performance of students in secondary school or university tests entrance). A summary of these previous results are presented in Table 3.1 below:

Table 3.1: Summary School Competition Effect on Performance

Authors	Country	Measure of Competition	Effect of Competition on School Quality
Böhlmark and Lindahl (2008)	Sweden	Share of Voucher Schools	+ , but small and only in the short term
Ladd and Fiske (2003)	New Zealand	Perception of Competition by Head Teacher & Increase of Enrolment in Voucher Schools per Municipality	-
Gibbons, *et al.* (2008)	London, UK	Average Number of Schools Accessible to Pupils in each School	+, but Very Limited
Bradley and Taylor (2002)	England, UK	Quantity and Quality of Schools by Area	+
Hoxby (1994)	US	Enrolment of Voucher Schools by Area	+ for Public Schools
Hsieh and Urquiola (2003)	Chile	Enrolment of Voucher Schools by Area	Non Effect for Public Schools
Contreras and Macias (2002)	Chile	Herfindalh Index	+

3.4 Does the Right to Choose Correspond to the Individual's Ability to Choose?

From the theoretical point of view, the increase in welfare implementing a voucher system, will be given by an apparent satisfaction of parents that decide to move their children from a public to a voucher school. However, the increase in welfare for those that can move can be cancelled out by the decrease in welfare for those that cannot but who want to (Carnoy, 1998), especially when many families move from one area or city to another whilst trying to find jobs and cheaper places to live, and educational choice would not be an important priority. In addition, using economic theory it is possible to suppose that competition will influence the allocation of resources positively and consumers would play an active role in choosing their favourite supplier. Therefore, free provision does not seem to be equal to free consumption as families have to incur some private costs such as transportation, and it is precisely these additional costs which make poorer families use education services less than richer families. In this context, transportation costs play an important role in the impact of a voucher system, as when they are very high, the poorest will be limited to attend only the schools in their neighbourhood. Hence, the ability of parents to transport their children to the school of their choice cannot be taken as certain (Levin, 1991).

In terms of segregation related to school choice, Becker (1995) points out that poorer families, in particular, need better education to overcome their lack of family support and they are normally destined to accept the schools in their neighbourhood as they cannot afford to move house or the travelling costs. In addition, consumers face the limitation factor of costs associated with changing from one supplier to another. Switching costs seem to play a role when parents decide to change or not to change their children from one school to another, so even though better quality schools might be available, families would not change their children from their current schools as there is some resistance of parents for changing children from school to school[68] caused, for example by the stress that the change implies by itself, and they will have the problem of comparing different suppliers of the educational service. However, for the case of Chile, the proportion of children that change school is not insignificant (16.73%), and around 19% of students attending public schools move to another school when they pass from primary to secondary education (considering only schools that offer both primary and secondary education). It seems that even though the switching cost can be quite high, there is a breaking point which decreases the probability of staying at the old school (Chumancero, *et al*., 2011), see Table 3.2.

Table 3.2: Number of Students that stay or switch schools (period 2000-2004) in the Metropolitan Area[69]

Stay	Total	%	Public	%	Voucher	%	Private	%
No	2,921	16.73	364	19.15	1,841	20.10	716	11.20
Yes	14,534	83.27	1,537	80.85	7,318	79.90	5,679	88.80
Total	17,455	100	1,901	100	9,159	100	6,395	100

Source: Chumancero *et al.* (2011) using SIMCE data set.

Chumancero, *et al*., (2011) consider this evidence, and point out that students that move from one school to another obtain around 5.74 points less in academic test scores, than the ones that stay, suggesting that those that move

[68] Part of the quality of the educational system is affected by the children's comfort at the school, if parents use their choices correctly in order to move their children, it would imply some sunk costs in the process of adaptation implicit when changing schools such as to meet new people, to adapt to new rules, changes in the colours of uniform, etc. (Glennerster, 1991).

[69] Table 3.2, only considers students in the 4th grade in 2000 who were attending a school that imparts primary and secondary level education, so in 2004 (8th grade, the last one in terms of primary education) they could move to another school or stay in the same school.

around are moving to worse schools, and probably the movement was not related to the parents attempting to find a better future, but it was more likely related to expulsion from schools in order to try to maintain certain standards (however this cannot be considered as certain, because maybe the students presented problems before the transfer). Nevertheless, the schools that improve their SIMCE results seem to have higher numbers of students leaving and those with a worse SIMCE performance attract most of the students that are moving. Therefore, school mobility may not be helping social cohesion (Zamora, 2011).

Despite the costs involved in moving to a school outside the neighbourhood, in order to move from one school to another, the Chilean reality seems to indicate that there is a certain level of mobility between place of residence and the chosen school. According to Chumancero *et al.* (2009) only 17.6% of the students attend their nearest schools (24.4% of the students that attend public schools go to their nearest school, 15.5% of the children in the voucher schools go to their nearest school and 8.9% of the students of private chools go to their nearest)[70], using the information from about 34 municipalities in the Metropolitan Region[71].

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[70] Using data from CASEN it is possible to identify the school that children are attending, and the student's address. Using the name of the school it is possible to find the school in the geographic location data set for schools. However, this research does not attempt to do that, because there are many names for each school which are similar, but not exactly the same and matching them correctly would not be easy. The author of the paper mentioned does try to do so, but only for the Metropolitan Region.

[71] Considering only schools of the same type: 36.3% of public school students choose the closest public school, 24.3% of the voucher school students go to the nearest school. So, choosing the closest school could be important, but not essential (Chumancero*, et al.*, 2009).

In addition, Table 3.3 shows the average distance and the average academic performance (quality), where the average distance that students travel to their school is around 3 kilometres. Even though this information corresponds to students in the Metropolitan area (Greater Santiago), it will be relevant in future sections to establish an arbitrary geographical area to measure competition.

Table 3.3: Distance (Km) and Quality (SIMCE performance) by type of School Administration (Average) in the Metropolitan Area.

Variable	**Total**	**Public**	**Voucher**	**Private**
Distance of school chosen	**2.9**	**2.57**	**2.78**	**4.22**
Quality of school chosen	256	240	257	295
Distance of nearest school	0.52	0.46	0.55	0.53
Quality of nearest school	248	240	246	272
Distance of nearest public school	0.9	0.67	0.93	1.34
Quality of nearest public school	232	229	231	246
Distance of nearest voucher school	0.78	0.71	0.73	1.15
Quality of nearest voucher school	254	250	253	266
Distance of nearest private school	1.92	2.08	2.07	0.95
Quality of nearest private school	286	285	287	287
Number of schools (2 Km radius)	20.8	21.1	21.3	18.2
Quality of schools (2 Km radius)	255	252	253	270
Number of public schools (2 Km radius)	4.4	5.2	4.4	2.2
Quality of public schools (2 Km radius)	241	239	240	254
Number of voucher schools (2 Km radius)	13.6	14	15.3	6.3
Quality of voucher schools (2 Km radius)	252	250	252	263
Number of private schools (2 Km radius)	2.8	1.9	1.6	9.8
Quality of private schools (2 Km radius)	286	285	286	287
Share of students that attend their:				
nearest school	17.6	24.4	15.5	8.9
nearest school of the same type	26.9	36.3	24.3	13.8

*Source:*Chumancero, *et al.* (2009)

3.5 Data

The data sets to be used in this chapter are part of the SIMCE (System of Measurement of Quality of Education) – an academic test that exists from the year 1990 until now. These data sets correspond to academic tests in mathematics, reading/writing (in Spanish), natural sciences and history (in recent years, English and physical education have also been included), which are taken every year in every urban school of the country independent of the school's type of funding (alternating fourth grade and eighth grade in primary schools and second grade for secondary schools) by the Ministry of Education (Chilean government). For this research, private schools are not taken into account, as they were never part of the voucher reform and tuition is fully paid by families, with almost no control from the government.

The purpose of these tests is to act as a tool for increasing the quality and equity of education in Chile, collecting information about the academic performance of students and the quality of the service provided by schools, including information about the school's location and parents' and teachers' information.

Table 3.4 shows the levels of education that were evaluated each year using the SIMCE academic performance test ("x"). So, for example, in the year 1998 only 4th year primary education students took the test, in 2003 only students in their second year of secondary education were evaluated, in 2007 4th and 8th years of primary school took the test, etc. The colour of the cells corresponds to the chronological compatibility of the test for the same pupils. That is, 2 cells will have the same colour if the same students are found in another school grade in the following years. For example, students in 4th grade in primary school in 1999 were in their 8th grade of primary school in 2003 and in their second grade of secondary school in 2005, that is why the cell is red for these cases. Therefore, two pairs of years would be potentially suitable to be considered if two cells have the same colour and they are signed with an X: 4th Primary 2005 and 8th Primary 2009, 8th Primary 2004 and 2nd Secondary 2006, 4th Primary 2007 and 8th Primary 2011 or 4th Primary 2006 and 2nd Secondary 2012. Each year, the sample corresponds to approximately 4,450 schools and 350,000 students distributed in to 15 regions and 330 municipalities (this is in fact, a population sample as all urban schools have been considered).

Table 3.4: Level of Schooling Evaluated Using the SIMCE Test by Year

Year	Level of Education		
	4th Primary	8th Primary	2nd Secondary
1998			x
1999	x		
2000		x	
2001			x
2002	x		
2003			x
2004		**x**	
2005	**x**		
2006	**x**		**x**
2007	**x**	x	
2008	x		x
2009	x	**x**	
2010	x		x
2011	x	**x**	
2012	x		**x**

The information is collected for the school but also for the students. However, there is no personal identification code that allows the students to be followed over time, only the schools can be followed. In order to select the years to be used for this research, the aim was to choose 2 years where the same children were evaluated, allowing to control for previous attainment of students. The year 2002, for example, is not suitable, as if 4th year primary school students in 2002 were evaluated in primary school and four years later, when they are in their 8^{th} of primary school, the test was taken in the 2^{nd} year of secondary education in that year. However, the year 2005 and the year 2009 are compatible as in 2005 the test was taken in the 4^{th} year of primary school and four years later the test was taken in the 8^{th} year of primary school. The years 2004 and 2006 would also be suitable, as in the year 2004 students were evaluated in their 8^{th} year of primary education, and two years later, in 2006, the students would be in their 2^{nd} year of secondary education. Nevertheless, this combination will be avoided as there is a lot of mobility between students to different schools when they finish primary education, so it is unlikely that the students in 2004 that were in their 8^{th} year of primary school will remain at the same school to receive secondary education. Another suitable combination would be the years 2006 and 2011 or the years 2007 and 2012, but the information was not available when this research commenced and they are both 5 years apart which could not be appropriated in terms of controlling for previous educational attainment. Therefore, the years to be used are 2005 and 2009, because in this way the students evaluated in a specific year attending a specific grade are also evaluated in a further grade in the future.

In practical terms, the performance of schools is calculated as the school's average score in mathematics and Spanish for each year. Additional information about schools, which is not found in the SIMCE data set, has been added using the schools' identification number. In addition, in order to include characteristics of the municipalities and schools involved, other data sets have been included. The connection between the school's information data set and municipalities' information has been done using the location of each school (name of the municipality in which they are located) and the respective municipalities' name in the local governments data set. In terms of the geographic coordinates data (schools' address), the information is found in metres by UTM (Universal Transverse Mercator), which is a projection that uses 2-dimensional Cartesian coordinates to represent the surface of the Earth.

Table 3.5 below shows the variables that have been taken from the main data set to be used (SIMCE) and from the other data sets. The information related to municipalities corresponds to illiteracy and poverty levels, assuming that they would affect the performance of students in an area (even though students do not necessarily live in the same municipality as where schools are located). In addition, the spending by municipalities on public education is expected to control for different levels of resources available to schools. Other municipality information is also used, for example, the average schooling of the population or the human development index, which includes information about education, health and income of every area.

There is one particular piece of information that has not been presented in Table 3.5, the number of Catholic churches and chapels by municipality. This information will help to solve some endogeneity problems in the estimation that will be explained in subsequent sections. The reason for not presenting the information as an additional data set utilised is that it was manually created - it does not exist by itself. It was created using information disclosed on-line by Catholic archbishops on their respective web sites. The majority of the information was found as: Name of the parish (or main church, which is serviced by at least one priest), the number of chapels (secondary churches depending on the parish) and their addresses. The number of churches (and chapels) was counted manually and connected to a municipality’s name (using the address information). Hence, it is possible to link this to the previous data sets. However, it was not possible to acquire information for all the municipalities involved, mostly because there was no information related to church location or the records were not available to the general public or researchers. Therefore, there are only 212 out of 345 municipalities that have information regarding the number of Catholic churches.

Table 3.5: Data Sets, Variables and Years Included

Data Sets	Variables, Year
SIMCE 2009, Ministry of Education http://www.simce.cl/	Average Academic Test Performance (SIMCE) by School, 2009 Average Income of Parents by School, 2009 Educational Level of Father by School, 2009 Educational Level of Mother by School, 2009 Average Income of Households by School, 2009 Type of School (Voucher or Public), 2009
Schools Directory, Ministry of Education http://www.mineduc.cl/	Number of Students by School, 2009
Enrolment, Ministry of Education http://www.mineduc.cl/	Number of Teachers by School, 2009 Number of Teachers' Working Hours by School Gender of Students by School, 2009
Vulnerability Index, Ministry of Education http://www.mineduc.cl/	Vulnerability Index of Schools, 2009 Students Socioeconomic Groups, 2009
Voucher Registration, Ministry of Education http://www.mineduc.cl/	Type of Voucher School (Fee or Free), 2009 Fee, 2009
Vulnerable Children, Ministry of Education http://www.mineduc.cl/	Number of Vulnerable Children by School, 2009
SIMCE 2005, Ministry of Education http://www.mineduc.cl/	Average Academic Test Performance (SIMCE) by School, 2005
School Geographic Location, Ministry of Education, Chilean Government http://www.mineduc.cl/	(X,Y) Coordinates by School, 2009
CASEN 2006, Ministry of Development and Planning http://www.ministeriodesarrollosocial.gob.cl	Poverty Level by Municipality, 2006
Municipality Indicators, Ministry of Housing and Urbanism http://www.observatoriourbano.cl/indurb/seleccion.asp	Perception Close to Public Transportation by Municipality, 2010 Perception of Traffic Jam Level by Municipality, 2010 Books per capita by Municipality, 2001 Illiteracy Level by Municipality, 2006 Water Coverage by Municipality, 2006 Electricity Coverage by Municipality, 2006 Average Schooling Population by Municipality, 2006
Municipality Information, SINIM: Municipality Information National System http://www.sinim.gov.cl/	Education Spending Per Capita by Municipality, 2006
Human Development Index by Municipality, UNDP & Ministry of Development http://www.desarrollohumano.cl/	Human Development Index by Municipality, 2003
Census 2002, National Estadistics Institute http://www.ine.cl/	Number of Indigenous People by Municipality, 2002 Number of Catholic People by Municipality, 2002 Population Density by Municipality, 2002 Population Total and 5 to 14 years old by Municipality, 2002

In terms of the sample characteristics, the sample used is characterised by having a similar proportion of public relative to voucher schools performing the test in 2009, where 32.7% are totally free voucher schools and 67.4% are voucher schools charging tuition fees (see Table 3.6). In addition, 238 municipalities of the sample have at least 1 voucher school. The municipalities included in the analysis are 330 (as mentioned before) out of 346 with a total of 4,457 schools.

Table 3.6: % of Each School Type (2009)

School Type	**Number**	**%**
Public	2,450	54.97%
Voucher	2,007	45.03%
Voucher_Free	655	32.64%
Voucher_Fees	1,352	67.36%
Total Schools	**4,457**[72]	**100%**

In addition, Table 3.7 shows some descriptive statistics for the sample used, considering school characteristics, students' performance and municipality features[73]. For example, in some schools less than 15% of pupils are vulnerable, but in other schools 100% of their students are considered vulnerable. There is a large difference between levels of their HDI (human development index) between municipalities; this index combines the estimation of life expectancy at birth of individuals, their health and income. Moreover, there is also a large difference in the level of poverty found in each municipality, showing potential residential segregation among Chilean households. Differences are also found related to the education of parents in every school, some schools probably receive the benefits of receiving children where all the parents have finished

[72] The number of schools is later reduced to around 3,000 when considering the control variables included.

[73] More information (classified by voucher or public schools) is found in Appendix 3A2. (Table 3A2.1 and Table 3A2.2).

tertiary education and others are probably affected by the disadvantage of parents with very low levels of education. In addition, there is a large difference in terms of the percentage of Catholic individuals living in each municipality, from between 23% to 96% professing faith.

Table 3.7: Descriptive Statistics[74]

Variable	Obs	Mean	Std. Dev.	Min	Max
Number Churches by Municipality	3,529	7.08	6.06	1.00	28.00
Spending Education per capita (Thousands of Chilean Pesos) by School	4,415	74.21	37.93	9.39	297.84
Density (5 to 14 years old) by Municipality Population by Km^2	4,457	3,340	6,075	0	29,654
Fee by School (Chilean pesos)	4,457	5,178	11,742	0	76,402
average Income Parents by School (Chilean Pesos)	4,355	283,954	189,536	50,000	1,631,429
% Mother Tertiary Education by School	4,355	4.04	7.69	0	100
% Father Tertiary Education by School	4,355	4.95	9.17	0	100
Total Population by Municipality	4,457	121,110	115,789	507	492,915
Population (5 to 14 years old) by Municipality	4,473	21,749	21,777	8	102,760
% Indigenous by Municipality	4,457	5.49	9.43	0.18	78
% Vulnerable Students by School	4,415	75.69	15.28	14.57	100
% Catholics by Municipality	4,457	70.71	9.53	23.04	96
Average Schooling Population by Municipality (years)	4,016	8.34	1.46	5.57	14
% Infant Mortality by Municipality	4,058	9.06	9.03	0.00	77
HDI 2003 by Municipality	4,400	0.71	0.05	0.51	1
% Poverty by Municipality	4,455	14.79	6.69	0.60	51
Weekly Working Hours Teachers per Students	4,457	1.73	0.70	0.31	7
Score_Language8_2009 by School	4,457	243.80	23.71	154	329
Score_Math8_2009 by School	4,457	248.95	25.64	180	340
Score_Language8_2005 by School	4,386	249.59	25.28	150	329
Score_Math8_2005 by School	4,382	240.84	27.01	150	326
avgSIMCE_2009 by School	4,457	246.37	23.82	175	334
avgSIMCE_2005 by School	4,380	245.23	25.64	150	325
Total Teachers per 20 Student by School 2009	4,457	0.07	0.01	0.07	0.09
Size School 2009 (number of Students) by School	4,457	491.75	426.78	20	5,107
% Illiteracy by Municipality	4,058	4.19	2.92	0.30	14.09
% Positive Perception Public Transportation by Municipality	3125	85.10	7.54	43.20	99.00

[74] Descriptive statistics for the restricted sample size used under the Instrumental Variable methodology can be found in Appendix 3A2. (Table 3A2.3). The sample is reduced because information about the number of churches is available for only 212 municipalities.

3.6 Methodology

3.6.1 The Model

The impact of competition between schools on school quality will be analysed considering the approach followed by Gibbons *et al.* (2008) which is based on the following model:

$$y_{st} = \alpha y_{st-1} + \theta CI_{st} + \sigma X_{st} + \varepsilon_{st}$$

Where y_{st} corresponds to the average academic performance (understood as the quality of education, even though it is certain that other issues can be considered[75]) of children in school *s* at year *t* (2009). y_{st-1} is theaverage performance of the same children in an earlier year (2005) in the school *s*to controlfor a school's previous performance, in a way that allows the estimation of the change in school performance, instead of focusing on current performance by itself. This is of particular importance because it will allow the measurement of the added value effect of competition. CI_{st} corresponds to the competition index of the school *s* at year *t*, that is, the number of schools that are in a straight line distance of less than 3 km[76] from the school analysed[77]. X_{st} is the vector of student, school and neighbourhood characteristics and ε_{st} is the error term.

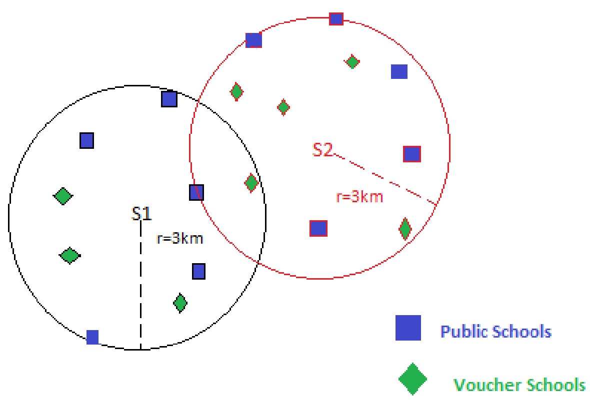
[75] Quality consist of much more than just a standardised academic test, it could also be measured by class size, expenditures, student performance, by measures of teachers' skills (Hanushek, 1986) or by the success of children in their future labour market, even though academic tests are found to have a weak correlation with labour market outcomes (Card and Krueger, 1996).

[76] The distance was selected using the average distance that students travel from their residence to their school presented by Chumancero*, et al*. (2009).

[77] The schools that are used are the voucher and public ones around a determined school, using as location two dimensional Cartesian coordinates.

For example, Graph 3.1 shows two schools (*S1* and *S2*) and a number of public and voucher schools around them, within a radius of 3 km. In the case of *S1*, there are 5 public schools and 4 voucher schools around it. On the other hand, *S2* has 6 public schools and 5 voucher schools around it. Therefore, the competition index from public schools having an effect on the performance of school *S1* is equal to 5 and the competition index from public schools on the performance of *S2* is equal to 6 (the same procedure is used for calculating competition indexes from voucher schools on school *S1* and *S2*). This approach of fixing the radius of 3 km differs from Gibbons *et al.* (2008) as they define travel zones that encompass all the postcodes in the same Local Education Authority as the school *s* and that are inside the circle drawn around the school *s* at the median of the distribution of the distance between school and houses for that school's students. This is not possible for this research as the data do not include students' house location, and travel zones are not possible to define. This creates the limitation of not incorporating either the geography or the density of every municipality into the competition measure. Although the density issue has been solved by controlling for this variable), some cities have a concentration of schools in their city centre, leaving their hills for residential location. Therefore, it may look as though such cities have a high competition index, when in reality this is due to the particular geographic characteristics of each area.

Graph 3.1: Competition Index Calculation



In the case of competition indices, they were calculated using the location coordinates by school mentioned before. In order to measure the distance between school locations three additional programmes were used: ArcGis 10 (in particular, the ArcMap application), Geospatial Modelling Environment (GME) and R+ which allows calculation of the distance between geographic points.

ArcGis allows one to use Excel data (the data given by the Chilean government are in an Excel format) and export it as a shapefile (or shp). This transformation is necessary as the ArcGis version utilised does not allow the calculation of distance between points by itself (in previous versions that was possible using some ArcGis extensions). However, GME is able to read ArcGis files (shp) and to calculate the distance between points using as an extension of the statistics programme R+. The calculation of distances are again exported to csv (Comma Separated Value) format which is easily imported to Stata, allowing the connection of the geographic coordinates information with the other data sets via the unique identification number for schools.

In practical terms, the competition index is applied only to primary schools in urban areas and it is separated initially in to two competition indexes: A public competition index (which represents the number of public schools around school *s*) and a voucher competition index (which represents the number of voucher schools around school *s*). Using only primary education would help because children often move between schools when they progress to secondary education (many primary schools do not allow for the possibility of continuing onto the secondary level at the same institution).

Considering also the fact that voucher schools impose a tuition fee, the competition index for voucher schools is also divided into two, a voucher competition index that represents the number of voucher schools around school *s* that charge some tuition fee and a voucher competition index that represents the number of voucher schools around school *s* that are totally free.

The modifications above are to be incorporated into the model as follows:

a) Separating between public and voucher schools:

$$y_{st} = \alpha y_{st-1} + \theta_P CI\_Public_{st} + \theta_V CI\_Voucher_{st} + \sigma X_{st} + \varepsilon_{st}$$

b) Separating between public, voucher schools with tuition fee and free voucher schools:

$$y_{st} = \alpha y_{st-1} + \theta_p CI\_Public_{st} + \theta_{V\_TF} CI\_Voucher\_TuitionFee_{st} + \theta_{V\_F} CI\_Voucher\_Free_{st} + \sigma X_{st} + \varepsilon_{st}$$

In addition, the competition index is re-calculated considering the quality (average test performance) of public schools that are located at less than 3 km from school *s* and the quality of education of voucher schools that are located at less than 3 km from school *s,* as suggested by Bradley, *et al.* (1999).

On the other hand, competition indices could undesirably capture the effect of urban density and school size effects (Gibbons, *et al.*, 2008), therefore, the competition indices described above have also been calculated, dividing them by the number of people living in the municipality where the school *s* is located. Also, the theoretical idea of increasing public school performance due to an increase in competition from the private sector (increase in the number of voucher schools around public schools) has been considered, but also the possibility of important levels of sorting (better students going to voucher schools and worse students staying in public schools) which would influence a decline in quality levels of public schools when they face voucher school competition[78].

Moreover, considering that Chile is a country that spans a vast longitude where people face different realities and there are large regional differences in terms of inequality of opportunities of access to education and health (Contreras, *et al.,* 2009) the results are estimated using 4 out of the 15 different regions, the Metropolitan Region (the most highly populated region located in the centre of the country), the Atacama Region (located in the north of Chile, covered mostly by the driest desert in the world, The Atacama's Desert (Wierzchos, *et al.,* 2006), Valparaiso Region (the third most populous region, located in the centre of the country and where the one of the busiest ports resides) and the Bio-Bio Region (the second most populated, located in the south of Chile).

The effect on a public school's academic performance due to the number of public schools around it and the same for voucher schools will be evaluated, to try to analyse if competition from voucher schools affects the performance of public schools. In particular, the equations include interaction variables including competition indices and a dummy variable that indicates the type of schools analysed. This allows the analysis of the effect from public schools on voucher school performance or the effect from voucher schools on public schools, for example:

[78] Spillover effects have also been considered using the spatial econometric matrix available in Stata. However, due to a lack of memory, it was impossible to perform. Note, however, that municipality characteristics were not particularly significant, therefore neighbouring municipalities are unlikely to have more effect, except perhaps for schools located on the borders.

i) CIndexPublic_VoucherDummy= CIndexPublic*VoucherDummy, therefore if the VoucherDummy is equal to 1 (the school analysed is a voucher school), the interaction term will capture the difference between the effect of public schools on voucher schools compared to the effect of public schools on other public schools. On the other hand, if the VoucherDummy is equal to 0 (the school analysed is public), the coefficient on the CompetitionIndex_Public by itself will capture the effect of public schools in the area on public school performance in the area.

ii) CIndexVoucher_VoucherDummy=CIndexVoucher*VoucherDummy, therefore if VoucherDummy is equal to 1 (the school analysed is a voucher school), the interaction term will capture the difference between the effect of voucher schools on public schools compared to the effect of voucher schools on other voucher schools. On the other hand, if the VoucherDummy is equal to 0 (the school analysed is public), then the coefficient on the CompetitionIndex_Voucher by itself will capture the effect of voucher schools in the area on public school performance in the area.

Finally, the robustness of the results will be tested, using different distances to calculate the competitive index, i.e. 2 kilometres and 4 kilometres as a lower and higher band of the original 3 kilometres.

3.6.2 Estimation Bias and Instrumental Variables

To compare schools it is necessary to control for children's characteristics, school characteristics and their background, in order to be able to compare them at the same condition and effectively analyse if the quality of education is really affected by the competition that schools face and not because the students and schools face different environments. Nevertheless, competition could be an endogenous variable, as more schools could be established in a particular area because, for example, better performing students could be located there (reverse causality), so the competition index would be correlated with the error term and OLS (Ordinary Least Squares) estimation will be biased and inconsistent, as there will be a violation of one of the assumptions which are relevant for this methodology. In addition, due to the fact that voucher schools will be more likely built in areas where low quality public schools are located (acting as a substitute for the latter), the comparison of the academic performance of students attending public schools with the performance of students attending voucher schools is not easy when areas differ in the proportion of voucher schools found. A simple comparison will confuse the effect of an increasing demand for voucher schools due to their potential higher efficiency with the possibility that voucher schools are going to be in higher demand when public schools are of low quality. In other words, the number of voucher schools could be endogenous to the quality of public schools and that would create a downward biased OLS estimation of the effect on school performance in academic tests (Hoxby, 1994). The solution is to use the instrumental variable approach described below:

Considering the linear model: $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ \ldots \ + \beta_k x_k + \mu$, where x_j is endogenous if $Cov(x_j, u) \neq 0$.

For the Chilean case, the endogenous variable is the voucher school competition index. The public school competition index is considered as exogenous because the local government does not have a clear policy that makes them decide to build new schools, and also the possibility of closing public schools seems to be very unlikely.

If one assumes that there is an additional variable, z (the instrument) which satisfies two assumptions:

a) z is uncorrelated with u : $Cov(z,u) = 0$
b) z is correlated with x_j : $Cov(z,x_j) \neq 0$

Then, z should simply have no effect on y after controlling for all x_k - in other words, z should not be correlated with an unobserved factor that affects y - and, z must be related (positively or negatively) to the endogenous variable x_j.

It is important to keep in mind that condition a) cannot be tested and it is only possible to appeal to economic theory. On the other hand, condition b) can be tested by regressing x_j on z, if the coefficient on z is significantly different from zero, then the assumption holds.

In addition, IV estimation is always considered as being biased in small samples. However, using a large enough sample considerably reduces their bias, so that IV estimation is consistent, even though in large samples, IV methods can still have problems if the instruments are weak (Wooldridge, 2002).

Finding good instruments is not easy, they should be correlated with the number of voucher schools found in a determined area, but they should not have an impact on the performance of students. One of the variables that achieves these requirements is the percentage of Catholics in each municipality, considering that an important percentage of voucher schools are officially Catholic and many others are at least nemed according to Catholic saints or otherwise that could potentially attract Catholic families. Catholic voucher schools would be favoured by sharing buildings and having more available teachers (nuns and priests[79]). However, the proportion of Catholics could be misleading in the sense that many people claim to be Catholic (according to the 2002 census, more than 70% of the Chilean population purport to be Catholic), but they are not fully practicing their faith, and in many cases they do not pay too much attention to the religion of the school as Chilean society is quite homogenous in this respect, so this would not make too much of a difference in terms of values or ethical preferences.

Therefore, a second option was to select as an instrument the number of Catholic churches by municipality, where a larger number of them implies a larger number of Catholic households that are more likely to care strictly for Catholic education and would like to attend a school with such a system. Therefore, a high number of Catholic churches likely indicates that the area would be populated by families that are more concerned about practicing Catholic values and traditions and also with families that might care more about religious education, than areas with a lower number of Catholic people that are not very interested in practicing their faith (areas with less Catholic churches around), and about sending their children to Catholic schools. Some voucher schools are officially Catholic (registered with the Catholic Church), but others may choose a name of a Catholic saint as the name of their school (even though the school is not registered as officially Catholic), and in this way they attract students with parents that primarily are concerned about Catholic education.

[79]The fact that churches will create more space of study for children in the area, potentially increasing their academic performance, does not really impact the instrument used, as the number of churches by municipality is considered rather than by a neighbourhood area where schools are located. So, all the schools in the same municipality will have the same number of churches as an instrument.

Therefore, it is expected that a higher number of Catholic churches by municipality will increase the number of voucher schools in that particular area. In addition, Catholic schools are believed to be exogenous, that is, no churches are built or closed over time, therefore they do not follow a tendency associated with a higher development or a larger amount of amenities in a particular area.

3.6.3 Quantile Regression, Split Sample and the Impact of Socioeconomic Background

Quantile Regression techniques are also used to analyse the results. In particular, different competition effects are expected to be found depending of the levels of performance that schools achieve, so for example, a higher effect on competition on higher performance schools is expected to be found, asparents in this kind of school would care more about the school's academic achievements and would also have more information about it. On the other hand, performance in academically lower-achieving schools should not be as affected by competition from other schools. The details of quantile regression estimation have already been presented in the previous chapter, but implementing it in terms of the impact of school competition on school performance the school *s* will be in the τ^{th} quantile of academic performance if school *s* has an academic performance larger than the proportion τ of all the schools and lower performance than the quantity $1-\tau$ (Koenker and Hallock, 2001). So basically, applying the quantile regression methods to the estimation of competition effects on school performance:

$$Q_{Competition}\left(\tau \middle| F_{School\_Performance2009}\right) = \beta_0(\tau) + \beta_\tau Y_{school\_Performance2009}$$

Additionally, the sample is split according to the socioeconomic condition of schools. For this, the original sample is divided into five, corresponding to the five categories (A, B, C, D and E) of the average socioeconomic status of families that attend each school given by the Ministry of Education and using the conglomerate technique[80]. They are classified in this way considering the average education and monthly income of each household which has children attending each school, and the average vulnerability index of their students (this is given by the Ministery of Education and considers the probability that pupils drop school considering chracteristics related to education and income of their parents, socio-cultural background, and neighbourhood where they live, among others).

In order to consider the socioeconomic level of the school (A, B, C, D and E), the creation of five new samples would be required. Each sample could have a different impact of competition on the level of performance, so the coefficient that represents the index of competition can take different values depending on the socioeconomic level of the school (although the competition could come from any socioeconomic group of schools).

3.7 Results

3.7.1 Descriptive Results

Competition between schools, understood as the number of schools (public or voucher) in a particular area, seems to vary depending on the type of school analysed. Schools face an average of 2.7 public schools in a 3 km

[80] In this way, a school's characteristics within the same group are similar and different to schools' characteristics of other groups.

radius[81]. On the other hand, schools face, on average, a larger number of voucher schools around them (9.1 schools). However, as presented in Table 3.8, schools face more competition from voucher schools that charge tuition fees (7.3), which follows the logic that totally free voucher schools are normally run by Catholic or charitable institutions, therefore it is unlikely for them to decide to build too many schools in the same area.

Table 3.8: Competition Index by School Type (3 km)

Variable	Obs	Mean	Std. Dev.	Min	Max
CompIndex_Public by School	4,457	2.70	5.02	0	41
CompIndex_Voucher by School	4,457	9.09	12.00	0	66
CompIndexVoucher_free by School	4,457	1.75	2.96	0	25
CompIndexVoucher_fees by School	4,457	7.33	10.36	0	63

The Chilean educational system seems to be suffering an evident segregation of students by social class: the poorest children attend public schools, generating segregation in the educational system, and likely negative peer effects. Table 3.9 shows the distribution of socio-economic groups of schools. These socioeconomic groups are given by the Ministry of Education, considering information related to the average parents' income and schooling and the level of vulnerability[82] of children by school. Group A includes the poorest and the most vulnerable schools, followed by group B which also includes schools that have been classified as being attended (on average) by children from poorer backgrounds but a bit better-off than the first group. Groups C and D include what could represent the schools that attend the middle class.

[81] This figure differs from Table 4.2 as there, only schools in the capital of Chile have been considered.

[82] Corresponding to an index that involves the probability of leaving the school, students' and parents' health characteristics, cultural environment, socioeconomics and psychosocial characteristics, etc. (JUNAEB, 2005).

It is possible to see that public school students are part of the poorest group, having a student composition higher in group A (33.7% of public schools arefrom group A). That is, pupils from the poorest backgrounds are over-represented in public schools. However, free voucher schools also service very poor students (33.9% of this type of schools are from group A). On the other hand, voucher schools that charge a fee to parents seem to attract middle class students (group C and D are the most popular among these schools).

Group E is actually very small because the amount of schools classified as being attended by average "richer" families are very few, as richer students normally go to fully privatised schools. This analysis could be revealing some hints of sorting in the Chilean educational system, where students are clustered in their schools considering their social background. The sorting effect in other educational systems seems to arise due to parental decisions of where to live, or due to the selection process about who will benefit from school vouchers (for example, poorer female students) as mentioned by Burgess *et al.* (2005), but in the Chilean case seems to be related to the selection process that voucher schools implement.

Table 3.9: Distribution of Schools According to Socioeconomic Group

Type of School	Socio-Economic Group											
	A		B		C		D		E		Total	
Public	820	33.7%	1,258	51.7%	331	13.6%	24	1.0%	0	0.0%	2,433	100%
Voucher_Fee	4	0.3%	144	10.5%	627	45.8%	565	41.3%	29	2.1%	1,369	100%
Voucher_Free	222	33.9%	246	37.6%	167	25.5%	19	2.9%	1	0.2%	655	100%
Total	1,046	23.5%	1,648	37.0%	1,125	25.2%	608	13.6%	30	0.7%	4,457	100%

The concentration of poorer children in public schools seems to affect their performance, Table 3.10 shows the average student performance by school in the SIMCE academic test, where it is shown that public schools have a lower academic performance than voucher schools and privileged children (the ones that normally attend voucher schools that charge tuition fees) have better results. This could effectively be because voucher schools are more efficient at producing better results than public schools, or because children that attend voucher schools have better abilities, or because their parents can help them and support them in their studies, not allowing for an equalising effect of the educational process.

Table 3.10: Average Student Performance by School in SIMCE (2009)

Type of School	Mean	Std. Dev.	Min	Max
Public	238.10	18.45	175	329
Free Voucher	241.18	22.86	184	322
Fee Voucher	263.89	23.59	183	334

Nevertheless, looking at the changes in performance (value-added), the percentage of schools that improved their academic performance from the year 2005 to the year 2009 (that is when the performance of a school in 2005 is compared to the performance of the same school in the year 2009) is higher among free voucher schools (64.0%) and very similar between public schools and fee-based voucher schools (49.2% and 50.4% respectively)[83]. See Table 3.11.

Table 3.11: % Schools Improving their Academic Performance

Variable	N	%
Public	1,187	49.23
Free Voucher	405	63.98
Fee Voucher	673	50.37
Total[84]	2,265	

The following section presents the results obtained using competition indices and their effect on performance.

[83] Any level of improvement has been considered.

[84] The sample is reduced because it corresponds only to the schools that have improved.

3.7.2 Estimation Results

The main interest of this research is to analyse the effect of school competition on the level of performance of schools. Considering the OLS estimation, the results are found in Table 3.13 column a. Results indicate that a higher number of public schools has a positive effect on the academic performance of schools in an area of 3 km radius and that a higher number of voucher schools in the area has a negative effect on the academic performance of surrounding schools: one additional public school in the area improves the neighbour school's academic performance by 1.598 points and the effect of voucher schools in the area decreases the performance of neighbouring schools by 0.763 points. Both effects are small if it is considered that the possible average academic performance varies from 175 to 334 points, but relevant if it is considered that the results control for the previous academic performance results (year 2005) to appreciate the improvement from one period of time to another which on average is equal to 1.27, instead of just measuring the absolute effect on academic performance. Therefore, the effect of competition mentioned above corresponds to an increase/decrease in academic performance, relative to previous performance. These results may be contrary to what was originally expected, but it could be representative of the idea that voucher schools take the best students and in a particular area there could be one or two good schools that are attracting the best students, deteriorating the performance of all the other schools in the area (the prestigious school would improve its performance, but on average the performance across all schools could decrease). Otherwise this result could be produced by a tendency to locate voucher schools where public schools have bad results and a bad reputation[85].

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[85] The endegoneity of voucher school location will be tackled in the following sections.

Voucher schools effectively seem to be more efficient, obtaining better results than public ones as presented in column a. of Table 3.13. In particular, voucher school pupils achieve around 13 points higher on average than public school pupils, which could be a reason for why their coverage has increased over time and a consequence of the way that voucher schools allocate their resources, or because, as was mentioned above, the bad quality of public schools which leads families to send their children to voucher schools, leaving the best students in these kinds of institutions, or because, in fact, voucher schools enrol students with different characteristics (for example, more able pupils), therefore voucher students would also benefit from better peers (McEwan, 2004). The idea that more able children attend the same schools will be of particular concern; because more able students are those that likely receive greater support from their parents, because their parents are probably also more able and better educated (see Topor *et al.* 2010). This would increase the inequality of educational opportunities of children and it could increase the effect of parental background on a child's educational attainment, which could play a very important role in the intergenerational reproduction of inequality. In the case of Chile, even though there has been a large educational expansion and social policies have focused on decreasing inequality, the effect of parental background on the educational attainment of children has been constant over time (Torche, 2005), therefore pupils with similar background and ability in the same classroom, sharing a large proportion of their life, could create friendship and social connections that could reinforce previous inequalities in society.

To facilitate the understanding of the results, Table 3.12 tabulates a dictionary of the variables utilised in future tables:

Table 3.12: Dictionary of Variables

Variable	Definition	Level
CompIndex_Public	Competition Index from Public Schools	School
CompIndex_Voucher	Competition Index from Voucher Schools	School
PerceptionTranport_CompIndexVoucher (interaction). Perception of Transportation system asks individuals how they perceive the public transport (with higher values indicating a more positive perception)	Interaction Variable between people's perception of transportation system coverage in the municipality they live and the competition Index from voucher schools	Municipality
PerceptionTranport_CompIndexPublic (interaction) Perception of Transportation system asks individuals how they perceive the public transport (with higher values indicating a more positive perception)	Interaction Variable between people's perception of transportation system coverage in the municipality they live and the competition Index from public schools	Municipality
avgTest_2005	Average Performance (Mathematics and Spanish) in the academic test SIMCE in 2005	School
ContractHoursClass_PerStudent	Number of Weekly Working Hours per Student	School
voucher_School	Dummy Variable: 1 if Voucher School and 0 if Public School	School
voucher_ContractHourCPS (interaction)	Interaction variable between the dummy variable of voucher school and the number of weekly hours per student	School
ComIndexPublic_VoucherSchool (interaction)	Interaction variable between the competition index from public schools and the dummy variable of voucher school	School
ComIndexVoucher_VoucherSchool (interaction)	Interaction variable between the competition index from voucher schools and the dummy variable of voucher school	School
%_Father_UniversityDegree	Percentage of Fathers that have completed a university degree	School
%_Mother_UniversityDegree	Percentage of Mothers that have completed a university degree	School
avgIncome_Parents	Average Income of Parents	School
girls	Dummy Variable: 1 if Schools is only for girls and 0 otherwise	School
boys	Dummy Variable: 1 if Schools is only for boys and 0 otherwise	School
fee	Fee charged by the school to parents	School
Density_5_14	Population density of individuals between 5 and 14 years old	Municipality
% Poverty (defining 'poor' as a household's monthly income per capita below the poverty line; established by the Chilean government, which is around £70)	Percentage of poor individuals	Municipality
%_Indigenous	Percentage of indigonous individuals	Municipality
BooksperCapita_2001	Number of books per capita 2001	Municipality
%_Illiteracy_2006	Percentage of illiterate individuals in 2006	Municipality
AvgSchoolingPop	Average Schooling of Population	Municipality
Munispe_EducPC	Municipality spending on Education per capita	Municipality

Table 3.13: Effect of Competition on Performance, OLS and IV Results

School Performance	a: OLS (Quantity)	b: OLS Interaction	c: IV	d: IV Interaction	e: OLS (Restricted Sample)
	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public	**1.598****	**1.450****	**3.092****	3.024*	**1.684*****
School Level	(0.625)	(0.610)	(1.449)	(1.556)	(0.627)
CompIndex_Voucher	**-0.763****	**-0.761****	**-1.646***	**-1.649***	**-0.804****
School Level	(0.377)	(0.376)	(0.916)	(0.951)	(0.378)
PerceptionTranport_CompIndexVoucher (interaction)	0.008*	0.008*	-0.032*	-0.033*	0.008*
School Level	(0.004)	(0.004)	(0.017)	(0.018)	(0.004)
PerceptionTranport_CompIndexPublic (interaction)	-0.018**	-0.018**	0.014	0.015	-0.019***
School Level	(0.007)	(0.007)	(0.010)	(0.010)	(0.007)
SchoolPerformance_2005	0.559***	0.559***	0.574***	0.574***	0.564***
School Level	(0.017)	(0.017)	(0.021)	(0.021)	(0.019)
ContractHoursClass_PerStudent	0.460	0.309	-0.089	-0.158	0.108
School Level	(0.712)	(0.731)	(0.811)	(0.756)	(0.744)
voucher_School	13.903***	13.077***	13.578***	13.298***	13.354***
School Level	(2.014)	(2.269)	(2.329)	(2.713)	(2.174)
voucher_ContractHourCPS (interaction)	-5.455***	-5.236***	-5.284***	-5.167***	-5.095***
School Level	(1.119)	(1.141)	(1.308)	(1.199)	(1.209)
ComIndexPublic_VoucherSchool (interaction)		**0.284***		**0.328**	
School Level		(0.149)		(0.260)	
ComIndexVoucher_VoucherSchool (interaction)		**-0.039**		**-0.086**	
School Level		(0.045)		(0.171)	
%_Father_UniversityDegree	0.228**	0.227**	0.198**	0.197**	0.220**
School Level	(0.089)	(0.089)	(0.095)	(0.099)	(0.096)
%_Mother_UniversityDegree	0.240**	0.244**	0.251**	0.251**	0.238**
School Level	(0.100)	(0.100)	(0.103)	(0.105)	(0.111)
avgIncome_Parents	0.451	0.481	0.460	0.506	0.601
School Level	(0.517)	(0.515)	(0.602)	(0.604)	(0.587)
boys	9.320***	9.452***	9.340***	9.428***	9.129***
School Level	(2.328)	(2.306)	(2.431)	(2.459)	(2.373)
girls	9.604***	9.829***	9.685***	9.844***	9.294***
School Level	(1.287)	(1.289)	(1.621)	(1.609)	(1.424)
fee	0.043	0.040	0.016	0.015	0.016
School Level	(0.068)	(0.068)	(0.076)	(0.077)	(0.078)
Density_5_14 years old	-1.158	-1.687	15.484	14.339	0.453
Municipality Level	(6.071)	(5.944)	(17.269)	(17.447)	(6.839)
% Poverty	-0.013	-0.004	-0.043	-0.032	-0.007
Municipality Level	(0.072)	(0.073)	(0.091)	(0.096)	(0.072)
%_Indigenous	-0.040	-0.039	-0.128	-0.129	-0.152
Municipality Level	(0.060)	(0.060)	(0.257)	(0.269)	(0.158)
BooksperCapita_2001	0.222**	0.223**	0.326	0.319	0.203*
Municipality Level	(0.096)	(0.094)	(0.532)	(0.509)	(0.109)
%_Illiteracy_2006	0.869***	0.860***	0.780	0.787*	0.982***
Municipality Level	(0.253)	(0.251)	(0.505)	(0.454)	(0.339)
AvgSchoolingPopopulation	-0.022	-0.017	0.057	0.063	0.038
Municipality Level	(0.243)	(0.242)	(0.352)	(0.347)	(0.288)
MunicipalitySpending_EducPCapita	-6.894	-8.382	-24.531	-23.784	-0.347
Municipality Level	(19.103)	(18.841)	(34.915)	(35.838)	(23.729)
_cons	99.609***	100.120***	100.478***	100.422***	97.584***
	(4.532)	(4.573)	(6.250)	(6.405)	(4.645)
Number of observations	2,909	2,909	2,578	2,578	2,578
R2	0.659	0.659	0.651	0.651	0.651
note: *** p<0.01, ** p<0.05, * p<0.1					

Transportation costs could also play an important role in the impact of a voucher system, as when they are very high, the poorest will be limited into attending only the schools in their neighbourhood. Hence, the ability of parents to transport their children to the school of their choice cannot be taken as certain (Levin, 1991). In this respect, it is possible to analyse the effect of the coverage of the transportation system (since a competing school is only a realistic competitor if it is accessible), the expectation is that a wider coverage of a transportation system will increase the entitlement of choosing between one school or another (because it will make the movement from the area of residence to school easier[86]). However, contrary to what might be expected, a higher perception by individuals of how close they are to public transport from their house decreases the positive effect of the competition from public schools (by -0.018 points)[87] and reduces the negative effect of the competition from voucher schools (by 0.008 points), thus, when the transportation system is wider in terms of coverage, the competition effects of public schools and voucher schools tend to zero (see column a. in Table 3.13 for more details). One of the reasons could be a decrease in the quality of the service due to the expansion of public services (for example, the Metropolitan Region public transportation service has experienced a massive modernisation and expansion in their coverage, since the 'TranSantiago' plan started being implemented in 2005, when massive chaos was faced by commuters and the new system was largely rejected by popular opinion)[88]. Unfortunately, information related to the quality of transportation system per municipality is not currently available.

[86] Better public transportation will increase the ability of people to choose schools because of better mobility, but it would not impact the number of schools in a determined area.

[87]Calculating the respective partial derivatives.

[88] The effect of perception of being close to public transportation has not been included in the specification in column a. in Table 3.13, because it is assumed that by itself it does not affect schools' academic performance, but it affects as an interaction with the number of schools located in the area.

Briefly considering the coefficients on the other explanatory variables in the estimated equation in column a. in Table 3.13, parents' education (especially mother's education) plays an important role in the performance of children that is,schools that perform better also have "higher quality" parents. Nevertheless, parents' income surprisingly seems to have no significant effect. Moreover, the results also suggest that, as in many other countries, single sex schools perform better relative to mixed gender schools (around 9 points increase in performance). Most of the municipality level variables (population density, poverty level, proportion of indigenous population, spending on education, etc.) reveal statistically insignificant effects; however the number of books per capita in each municipality and the percentage of illiterate individuals in each municipality are exceptions, which are probably affected by neighbourhood socioeconomic status. In this sense, areas of better socio-economic standing are likely to have more informed parents, who are also parents that are likely to know that if a school does not satisfy their expectations, they can take their children out and move them to a better one. Therefore, schools in areas where parents are more informed will feel the parental pressure to compete for students, increasing the quality of education they provide accordingly. Different specifications to the preferred ones presented on column a. in Table 3.13 are found in Appendix 3A3. (Table 3A3.1), obtaining very similar results (the preferred specifications were chosen considering that they include the larger number of control variables associated with schools and municipalities' characteristics).

Due to the presence of heteroscedasticity[89] (that is errors do not have constant variance, meaning that the t-values for the estimated coefficients

[89] Using Breusch-Pagan / Cook-Weisberg test (Ho: Constant variance), heteroscedasticity was detected.

cannot be trusted because the estimates of the standard errors are biased), all the results were calculated using robust standard errors which do not assume homoscedasticity. Additionally, the standard errors have been clustered by municipality in the estimation in order to control for the possibility that individual errors are correlated at municipality level[90]. The usual assumption is that the error terms are *iid.* (independently and identically distributed), but this is violated in many cases, as observations within group *i* could be correlated, which make the standard errors wrong in the OLS estimation, but will not invoke a bias in the estimation. Therefore, clustered errors are assumed, which assumes zero correlation across groups, but allows for within-group correlation of the error terms.

The separate effects that the number of public and voucher schools have on the academic performance of public and voucher schools has also been considered by including interaction terms between the competition index and the type of school being considered (see column b. in Table 3.13). The results found that a higher number of public schools increases the performance of voucher schools (1.450 + 0.284=1.734 added value) in the area more than it increases the public school performance in the area (1.450 added value); but this, as mentioned before, could be due to the allocation of voucher schools in areas with a large number of bad quality public schools. On the other hand, the effect of a higher number of voucher schools on public schools is indistinguishable from the effect of voucher schools on other voucher schools. Therefore, voucher schools would be damaging to surrounding schools independent of their type.

[90] Fixed effects by municipality (holding constant the average effects of each city) were also tested, but no significant effect was found.By including fixed effects (group dummies), the intention was to control for the average differences across cities in any observable or unobservable predictors.

The negative effect of competition from voucher schools could be produced by i) the location of voucher schools in areas where public schools are of a very poor quality (omitted variables problem), ii) a higher number of voucher schools located in areas that for some reason perform better (reverse causality problems) or iii) sorting (i.e. voucher school taking the 'best' students from public schools provoking this negative effect). Effects i) and ii) would create a potential endogeneity concern. Therefore, in order to potentially distinguish the effects above from the real effect of sorting, an IV estimation is necessary. If this estimation still shows a negative effect, it would mean that even though i) and ii) have been ruled out, an increase in the number of voucher schools is detrimental for the surrounding schools due to sorting. This is apparently happening as IV results show a negative and significant effect of the number of voucher schools on public school performance[91], suggesting that the results obtained could be due to sorting, as voucher school location will be exogenous, depending only on the number of Catholic churches in the area (a variable which has been stated as affecting the number of voucher schools in the area positively, but not having an effect on the performance of schools in academic tests). In this respect, for the IV estimation, the first stage of the estimation (Appendix 3A3., Table 3A3.2) shows that the number of Catholic churches is a good instrument for the number of voucher schools, showing a positive and significant relationship between both variables and using the rule of thumb of having a joint significance (F-test) in the first stage above 10, it is possible to suggest that it would be a good instrument[92]. The instrumental variable estimation includes bootstrap standard errors. Because of the use of interaction variables that includes the endogenous variable (voucher competition index), the

[91] Although, it is likely that the effect of sorting is better reflected by the Quality Competition Index, than the number of schools competition index, as the quality of neighbourhood schools will be mostly affected.

[92] $F(19,148)=36.21$, $Prob>F=0.000$

first stage regression was estimated manually which without using bootstrapping in the second stage (300 iterations) would not consider that the voucher competition index is actually a predicted value and the standard errors would be wrong (Wooldridge, 2002).

Using IV estimation(see column c. in Table 3.13, for the same specification of column a., but using IV estimation), the results show a higher positive impact on academic performance from public school competition than when using the OLS estimation (the effect size is also doubled). Furthermore, a bigger decrease on academic performance when the voucher competition index increases is observed in comparison to the OLS results. This support the idea that the negative effect from an increase in the number of voucher schools in a particular area is due to sorting as opposed to endogenous voucher school location explaining the negative OLS effect, that is,they are attracting the most able students, which is worrying in terms of reproducing educational opportunities for future generations, as explained previously.

In addition, in column d. in Table 3.13, using IV estimation, the differential effect of the number of public and voucher schools on the performance of voucher and public schools is considered, finding that even though the effect from public schools is still positive and from voucher schools is still negative, the effect of either on public schools does not seem to differ from the effect on voucher schools. Therefore, the IV results in this respect are similar in size to the OLS results, but the difference in the impact between school type (interaction variable for public/voucher school effect on public/voucher school performance) is no longer statistically significant due to the higher standard error in this specification.

This is consistent with the idea of sorting in the Chilean educational system, because voucher schools would damage the academic performance of the surrounding areas. This could be particularly worrying, if equity issues are considered, as more disadvantaged students will be sorted into public schools, and their performance in schoolis probably related, at least at early stages, with parental socioeconomic background. Student's ability could play an important role in terms of their academic performance, in this sense, integrating more able with less able students does not seem to harm the former students as showen by Guyon, *et al.* (2012) for the case of Northern Ireland, therefore an educational system that promotes integration rather than segregation by ability would be able to increase equity without reducing efficiency (or vice versa, increasing efficiency without decreasing equity), which is in general the most common concern in terms of social policy. On the other hand, pupils with a low ability could receive benefits from being in a more homogenous environment, because teachers can be obliged to teach them at the speed that suits them (Figlio and Page, 2000). Nevertheless, Gallindo-Rueda and Vignoles (2004) find that more able pupils would benefit from a more homogenous school environment, but low ability pupils would not actually be affected by being with better or similar peers.

The idea that homogeneity could bring benefits to pupils with different levels of ability could be cancelled out by the fact that parents claim that they choose schools by considering academic performance, but in practice they consider other factors. In England, for example, more educated and richer parents tend to claim that they prioritise the academic characteristics of schools and less educated and poorer parents tend to claim that they prioritise school proximity. Nevertheless, "better" parents in practice choose schools with a lower proportion of free school meal students. Therefore, even though parents do not explicitly say they choose schools related to the socioeconomic background of pupils, in reality they do (Burgess *et al.,* 2009). This is what could also be happening in Chile, where a comparison (using the Santiago data set) between claimed and revealed preferences is analysed by Elacqua *et al.* (2006) finding that parents state that they choose schools based on their academic performance among their school possibility set, but in practice they choose schools that are very similar in terms of their socio economic characteristics even though these schools can be very varied in terms of academic quality. Therefore ability sorting would not be the only concern, but the idea of sorting by social class would also become very relevant. In fact, this is in line with the findings of Nunez and Guttierrez (2004), who indicate that social class would be more important than academic performance at university in terms of explaining earnings of individuals.

It is important to mention that the IV estimation results related to the coverage of the transportation system differ in sign from the OLS results (see column c. and d. in Table 3.13). Therefore the results are conclusive as IV estimation will indicate that a higher coverage of transportation system increasesthe positive effect of a higher number of public schools and also increases the negative effect of a higher number of voucher schools in an area.

Finally, the OLS results based on exactly the same sample used for the IV estimation has been considered. For this case, there has been a contraction in the sample size (not all the municipalities have information about the number of Catholic churches located in their area). The results are presented in column e. in Table 3.13 obtaining a higher positive effect from public schools and more of a negative effect from voucher schools than using the original sample and the OLS technique in column a.

3.7.3 Robustness Checks

The results were tested for robustness, considering the level of competition involved in a 2 km and 4 km radius, obtaining positive effects of competition at 2 km from public schools that were even higher than when a 3 km radius was considered. On the other hand, a higher negative impact, on performance, is observed from voucher school competition when a 2 km radius was considered rather than a 3 km one. Using 4 km, the results are similar, but the effect of competition from public schools is lower than when using 2 km and 3 km, and the effect of competition from voucher schools is less negative than when considering other values to calculate the distance between schools (more details can be found in Appendix 3A3., Table 3A3.3 for 2 km and Table 3A3.4 for 4 km).

Additionally, when the voucher competition index is separated into two, considering voucher schools that charge tuition fees and the ones that are totally free, the results are significant only for the positive effect on performance from public schools and negative for the effect of competition from fee-based voucher schools (more details can be found in Appendix 3A3., Table 3A3.5)[93].

Moreover, the possibility that schools react to the average quality of other schools in the area instead of to the number of schools in the area, has also been considered. In particular, the competition index of public schools is calculated as the average performance of public schools in an area of 3 km radius and the competition index of voucher schools is calculated as the average

[93] The difference in results from when the separation between the voucher fee and free schools is considered and when they are not separated is likely because the number of voucher schools (with fee or without) could be correlated to the number of public schools in an area.

performance of voucher schools in an area of 3 km radius. In column a. of Table 3.14 the results are presented, finding that a higher quality of public schools increases the performance of other schools, while the opposite effect is produced by voucher schools with a higher average performance. However, these results are not statically significant[94].

In column b. of Table 3.14 the competition indexes for voucher and public schools were also modified with the idea that the number of schools established in a particular area can be affected by the number of individuals at the right age to attend school living there. Therefore, the competition index from public schools is re-understood as the number of public schools in a 3 km radius divided by the size of the population between 5 to 14 years old in the municipality (i.e. children at the right age toattend primary school) where schools are located (the same for the competition index from voucher schools)[95]. In previous regressions, this issue was considered by controlling for population density of individuals between 5 to 14 years old, not finding statistically significant results in this respect.

[94] A wider range of specifications, but considering the competition indexes calculated as the average quality of schools in the neighbourhood (instead of the quantity) is found in Appendix 3A3., Table 3A3.6.

[95] Different specifications for this estimation have also been considered (see details in Appendix 3A3, Table 3A3.7). In addition, regional samples are considered (Region of Antofagasta or Region II, Metropolitan Region or Region XIII, Region of Valparaiso or Region V and Region of Bio-Bio or Region VIII) to try to analyse if competition is playing a different role when considering the difference between geographic areas in the country. The competition results are not statistically significant for this case. Nevertheless, the regional results indicate that voucher schools are significantly better than public schools only in two of the four regions analysed, i.e. Region VIII and the Metropolitan Region which are the largest in the country in terms of population (see column a., b., c. and d. in Appendix 3A3, Table 3A3.8).

Moreover, the sample has been split into four different samples using different socio-economic groups. It is found that middle-class schools' (those to which children from socio-economics groups B and C attend) performance would be positively affected by competition from public schools. On the other hand, the effect of voucher schools is significantly negative only for the performance of surrounding schools where children from socio-economic group C attend. But even more importantly, amongst the poorest students, competition from public schools has a negative and statistically insignificant effect as presumably, the threat of pupils changing schools when offered alternatives is less credible. The results per socio-economic group are presented in Table 3.15. These results can be interpreted as middle-class parents taking part and more advantage of the educational market. It is likely that if parents are more educated and/or richer, they would be more interested in having information about school ranking based on academic test results, and furthemore they are usually able to buy the newspaper and to have access to this information.

Table 3.14: Average Quality and Population Based Competition Indexes[96]

School Performance	a: OLS (Quality)	b: OLS (Population)
	coef/se	coef/se
CompIndex_Public	**0.203**	**0.291****
School Level	(0.387)	(0.141)
CompIndex_Voucher	**-0.063**	**-0.136**
School Level	(0.334)	(0.088)
PerceptionTranport_CompIndexVoucher (interaction)	0.000	-0.003**
School Level	(0.004)	(0.002)
PerceptionTranport_CompIndexPublic (interaction)	-0.001	0.002
School Level	(0.004)	(0.001)
avgTest_2005	0.565***	0.558***
School Level	(0.024)	(0.017)
ContractHoursClass_PerStudent	-0.368	0.630
School Level	(0.976)	(0.708)
voucher_School	13.988***	14.165***
School Level	(2.499)	(1.986)
voucher_ContractHourCPS (interaction)	-3.796**	-5.491***
School Level	(1.552)	(1.118)
%_Father_UniversityDegree	0.220	0.238***
School Level	(0.140)	(0.089)
%_Mother_UniversityDegree	0.343*	0.240**
School Level	(0.178)	(0.100)
avgIncome_Parents	1.054	0.428
School Level	(0.740)	(0.516)
boys	9.109***	9.410***
School Level	(2.458)	(2.311)
girls	8.379***	9.610***
School Level	(1.665)	(1.295)
fee	-0.146	0.043
School Level	(0.094)	(0.069)
Density_5_14 years old	-4.995	
Municipality Level	(5.173)	
% Poverty	0.044	-0.008
Municipality Level	(0.095)	(0.072)
%_Indigenous	-0.055	-0.035
Municipality Level	(0.089)	(0.064)
MunicipalitySpending_EducPCapita	-25.408	6.530
Municipality Level	(18.490)	(16.758)
BooksperCapita_2001	0.172**	0.179**
Municipality Level	(0.077)	(0.088)
%_Illiteracy_2006	0.895***	0.907***
Municipality Level	(0.271)	(0.250)
AvgSchoolingPopulation	0.404	-0.037
Municipality Level	(0.265)	(0.252)
_cons	67.776***	97.976***
	(13.442)	(4.554)
Number of observations	1,755	2,909
R2	0.659	0.657
note: *** p<0.01, ** p<0.05, * p<0.1		

[96]Standard errors are in brackets.

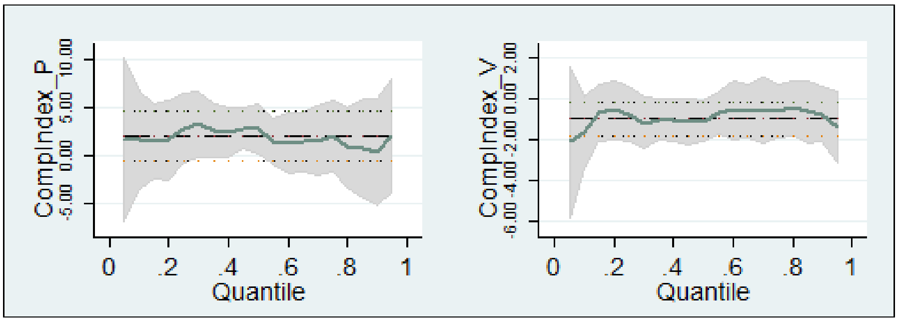
Table 3.15: Socio-Economics Groups Estimation[97]

School Performance	A	B	C	D
	coef/se	**coef/se**	**coef/se**	**coef/se**
CompIndex_Public	**-1.420**	**1.341***	**2.261***	**4.326**
School Level	(3.591)	(0.780)	(1.272)	(3.268)
CompIndex_Voucher	**0.004**	**-0.509**	**-1.406*****	**-0.403**
School Level	(1.389)	(0.479)	(0.525)	(0.744)
PerceptionTranport_CompIndexPublic (interaction)	0.014	-0.016*	-0.024	-0.050
School Level	(0.042)	(0.009)	(0.015)	(0.037)
PerceptionTranport_CompIndexVoucher (interaction)	-0.000	0.005	0.015**	0.004
School Level	(0.016)	(0.006)	(0.006)	(0.009)
avgTest_2005	0.498***	0.404***	0.616***	0.596***
School Level	(0.032)	(0.028)	(0.036)	(0.053)
ContractHoursClass_PerStudent	0.211	1.900**	-0.126	7.185
School Level	(1.259)	(0.834)	(2.669)	(11.246)
voucher_School	6.898	16.824***	8.851*	17.994
School Level	(4.878)	(3.784)	(4.805)	(15.618)
voucher_ContractHourCPS (interaction)	-2.693	-8.872***	-1.548	-13.056
School Level	(2.307)	(2.631)	(3.646)	(11.351)
%_Father_UniversityDegree	-0.006	-0.042	0.116	0.232*
School Level	(0.335)	(0.203)	(0.155)	(0.130)
%_Mother_UniversityDegree	-0.000	-0.497**	0.438**	0.123
School Level	(0.351)	(0.240)	(0.208)	(0.148)
avgIncome_Parents	-3.573**	0.210	-2.175*	0.596
School Level	(1.531)	(1.175)	(1.160)	(0.896)
boys	20.637***	10.056***	0.392	9.876***
School Level	(5.811)	(1.614)	(5.823)	(3.643)
girls	(dropped)	7.663*	6.296***	10.439***
School Level		(3.936)	(1.901)	(1.549)
fee	-1.633	1.323**	-0.002	-0.015
School Level	(4.266)	(0.548)	(0.124)	(0.078)
Density_5_14 years old	-42.440***	4.799	6.394	22.094
Municipality Level	(14.103)	(7.808)	(10.805)	(16.588)
% Poverty	-0.133	-0.072	-0.087	0.130
Municipality Level	(0.177)	(0.097)	(0.151)	(0.169)
%_Indigenous	-0.098	0.170*	-0.194	-0.321
Municipality Level	(0.080)	(0.097)	(0.124)	(0.245)
MunicipalitySpending_EducPCapita	-0.703***	-0.173	0.154	0.232**
Municipality Level	(0.254)	(0.133)	(0.099)	(0.103)
BooksperCapita_2001	0.296	1.059***	1.022**	1.565**
Municipality Level	(0.384)	(0.346)	(0.415)	(0.612)
%_Illiteracy_2006	-0.544	-0.172	-0.097	0.235
Municipality Level	(0.424)	(0.310)	(0.418)	(0.464)
AvgSchoolingPopulation	131.249***	134.702***	96.611***	82.720***
Municipality Level	(8.972)	(7.109)	(10.625)	(20.885)
_cons	406	1,011	923	559
	0.428	0.320	0.396	0.453
Number of observations	406	1,011	923	559
R2	0.430	0.320	0.409	0.453
note: *** p<0.01, ** p<0.05, * p<0.1				

[97]Standard errors are in brackets.

In terms of quantile regression estimations (see Appendix 3A3., Table 3A3.9), the impact of public school competition increases with better school performance until a certain point around the median, but decreases thereafter, with no statistically significant effect amongst the best performing schools. Thus, it seems that competition does not lead to further improvements when a school is already among the best. This could be because better schools are already good, so for them to perform better than they are currently doing is more difficult than for schools that perform slightly worse. Similarly, the impact of public school competition for the worst schools is lowest - probably because the students attending those schools do not have the option of moving to other schools[98], so competition has a weaker effect. See Graph 3.1.

Graph 3.2: Quantile Regression Estimation (Public School on the Left and Voucher School on the right)



[98] Using some small surveys asking schools or parents directly in 1996 (Estudio Nacional de Opinion Publica Nov-Dec 1996), some parents wanted to move their children from public to voucher schools, but there was not enough availability to enrol them. That is whythe demand has grown but not at a higher speed because there are no incentives to create new voucher schools since the owners do not make enough profit from them (Lehmann and Hinzpeter, 1997).

3.7.4 Non-Linearity of the Competition Effects

The possibility that competition does not affect school performance linearly has also been considered. First, competition indexes have been included in their squared form, obtaining the result that as the number of public schools increase in an area their effect on increasing the performance of schools becomes weaker (however, the necessary number of public schools to cause this turning effect is quite high, around 147 public schools for the IV results and around 318 schools for the OLS results, which is out of range for a radius of 3 km[99]). Therefore the competition effect from public and voucher schools has a decreasing rate and there is a threshold where a higher number of public schools at some point produces a negative effect on school performance. On the other hand, a higher number of voucher schools at some point produces a positive effect on school performance. In fact, calculating the respective partial derivative, after around 146 voucher schools (for the IV result) or after 881 voucher schools (for the OLS result) the negative effect of a higher number of voucher schools changes from negative to positive (these results are also not very feasible). These results are presented in Table 3.16. Moreover, spline variables have been included, to analyse in a different way the idea of a non-linearity effect of school competition. Nevertheless, considering the previous results, the spline ranges would be too wide to be considered. Actually, when they are included, the effect from voucher schools is negative and from public schools is positive for all the splines, as it was expected.

[99] For the IV estimation: $\frac{\partial Performance}{\partial CI\_P} = 3.546 - 0.024CI_P = 0 \;\; or \; CI_P = 147.75$ and $\frac{\partial Performance}{\partial CI\_V} = -2.049 + 0.014CI_V = 0 \;\; or \; CI_V = 146.36$

Table 3.16: Non-Linearity (Sq) of Competition Effects[100]

	OLS	IV
School Performance	coef/se	coef/se
CompIndex_Public	**1.913****	**3.546****
School Level	(0.934)	(1.579)
CompIndex_Voucher	**-0.881***	**-2.049****
School Level	(0.468)	(0.924)
CompIndex_Public_sq	**-0.006**	**-0.024****
School Level	(0.006)	(0.012)
CompIndex_Voucher_sq	**0.001**	**0.014****
School Level	(0.002)	(0.007)
PerceptionTranport_CompIndexVoucher (interaction)	-0.021**	-0.037**
School Level	(0.010)	(0.018)
PerceptionTranport_CompIndexPublic (interaction)	0.009	0.016
School Level	(0.005)	(0.010)
avgTest_2005	0.559***	0.567***
School Level	(0.018)	(0.019)
ContractHoursClass_PerStudent	0.480	-0.192
School Level	(0.752)	(0.741)
voucher_School	14.135***	13.319***
School Level	(2.141)	(2.296)
voucher_ContractHourCPS (interaction)	-5.506***	-5.062***
School Level	(1.211)	(1.294)
%_Father_UniversityDegree	0.227**	0.197**
School Level	(0.094)	(0.097)
%_Mother_UniversityDegree	0.242**	0.243**
School Level	(0.095)	(0.105)
avgIncome_Parents	0.452	0.563
School Level	(0.515)	(0.572)
boys	9.240***	9.433***
School Level	(2.373)	(2.672)
girls	9.678***	9.672***
School Level	(1.332)	(1.518)
fee	0.042	0.018
School Level	(0.064)	(0.078)
Density_5_14 years old	-1.044	-1.258
Municipality Level	(7.443)	(16.863)
% Poverty	-0.006	-0.032
Municipality Level	(0.075)	(0.098)
%_Indigenous	-0.040	-0.099
Municipality Level	(0.097)	(0.284)
MunicipalitySpending_EducPCapita	-9.767	-33.260
Municipality Level	(21.555)	(37.052)
BooksperCapita_2001	0.230	0.287
Municipality Level	(0.336)	(0.540)
%_Illiteracy_2006	0.860***	0.793*
Municipality Level	(0.290)	(0.452)
AvgSchoolingPopulation	-0.034	0.092
Municipality Level	(0.291)	(0.324)
_cons	99.912***	103.286***
	(4.739)	(6.218)
Number of observations	2,909	2,578
R2	0.659	0.652
note: *** p<0.01, ** p<0.05, * p<0.1		

[100]Standard errors are in brackets.

3.8 Conclusions

This chapter started with the assumption that education could provide private benefits for children and their families in terms of increasing their incomes, but it would also increase public benefits as poverty would be reduced, the economy would grow, etc. (Card and Krueger, 1996). Having an educational system that promotes opportunities for the whole population should be fundamental in order to achieve better economic, cultural and social outcomes for a nation. With this in mind, privatisation and competition reforms that have been implemented in many countries are playing an important role in educational systems (Dee, 1998). Nevertheless, the negative effects of elitist educational systems have not been prevented effectively. In particular, the idea that educational systems could be associated with socio-economic segregation among pupils and reinforce and reproduce inequalities in society has been mentioned in the so-called equity-efficiency trade off, where more efficiency in terms of getting better results with fewer resources (for example, being more strict in terms of who can achieve higher educational attainment) could seriously damage some pupils in terms of giving them opportunities to achieve a better life, as children from poorer backgrounds will probably be left behind.

As regards the effect of competition on educational performance, very little is known and the results are diverse. From the theoretical point of view, the idea of making schools behave similarly to the private sector follows the logic that this would create the opportunity for schools to compete that would increase incentives for innovation in the way that children are taught, diversifying options and increasing effectiveness. Therefore, the objectives of the voucher system are to increase parental choice, increase motivation and the dedication to learn and increasecompetition bringing lower costs and increasing quality (as opposed to having public schools present a monopolistic market). On the other hand, choice is considered something good in and of itself as an indicator of the freedoms that people can enjoy, but in more practical terms, that is more controversial.

There is no unique voucher system; they differ in terms of their finance, regulation and information (how much information parents have about their alternatives). Therefore, critics of the privatisation idea suggest that educational systems that are privatised generate few benefits and produce segregation and sorting among students, limiting the possibilities for the poorest, mostly because the increase in efficiency is considered to be related with a decrease in equity, creating a trade-off problem (West, 1996).

In terms of empirical evidence, the lack of data limits the possibility for analysis and in many cases, it still seems that the effect of privatisation/competition reforms are not conclusive, mostly because the results of voucher systems in terms of academic outcomes likely depend on how the reforms are structured in terms of funding, targeting (all the people, or only poor, or only women, etc.), admission regulations etc. Chile is an interesting case study, because a nationwide privatisation reform was implemented in the early 1980s. Nevertheless, the results of this research are not necessarily intended to be extended to other countries, understanding every case as unique, especially because voucher reforms are not necessarily unrelated to political and economic circumstances (Belfield, 2001).

This research defines a competition index as the number of schools around each school that are within 3 km, considering public and voucher schools, and aims to analyse the effect of geographic competition between schools on academic performance, assuming that academic tests are good proxies for the quality of education provided by schools. The OLS results suggest that increasing competition from public schools (increasing the number of public schools) increases the student academic performance of schools located in the area (3 km) and that the performance decreases when the number of voucher schools (competition index of voucher schools) increases. In addition, it seems that when the public transportation system provides a wider coverage of its service, the effect of competition from public schools decreases, but the effect from voucher schools increases. Thus, effects tend to zero, as for the case of voucher schools, competition has a negativeimpact and the interaction with transportation has a positive one, and for public schools, the effect of competition is positive, but the interaction with public transportation is negative. These surprising results could be related to the fact that an increase of coverage of public transportation would decrease the quality of the service. These results were tested for robustness, considering the level of competition involved whitin a 2 km and 4 km radius, obtaining similar results.

Considering the competition index as relative to the population (between 5 to 14 years old) of the municipality, the results suggest that the public school competition index coefficient is still positive and significant, but the voucher school competition index coefficient is not. It seems also that voucher schools provide a better quality of education than public schools, obtaining around 13 points higher in the academic test used. However, the reasons behind this result could be related to sorting of better students into voucher schools, leaving more vulnerable children in public schools (although results control for previous school performance).

Due to the possible voucher school competition endogeneity and the possibility of estimation bias in the OLS results, the instrumental variable estimation using the Two Stages Least Squares estimator (2SLS) was also considered, using the number of Catholic churches in each municipality as the instrument for the number of voucher schools in the area. For this case, the results show a higher positive impact on academic performance when the public school competition increases than with the OLS estimation and a bigger decrease in academic performance when the voucher competition index increases in comparison to the OLS results. In addition, the OLS results show that public school competition has a positive impact on the performance of both public and voucher schools, but a significantly larger effect for voucher schools. In this respect, IV results are insignificant, suggesting that the effect of competition is similar regardless of type of school analysed, with the exception of the competition effect from public schools which has a slightly larger impact on other voucher schools than on public schools.

Therefore, the major inference from this research has to be that voucher schools have not positively contributed to educational quality of public schools in Chile, raising doubts as to whether or not a privatised market of education really achieves its objectives. This is especially so considering that the benefits of competition could be enjoyed by implementing school choice without the need for implementing a strongly privatised educational system, as the Chilean one. In fact, public school competition seems to be working, obtaining a positive effect on academic performance in areas with a higher number of public schools. Even though this research did not expect to rule out the idea that competition through privatisation brings benefits, especially to the most disadvantaged of students, the results could be taken as an alert to other nations that want to implement similar educational reforms. The main impact of voucher schools seems to be a sorting one, with better pupils leaving public schools and therefore reducing the average performance of the latter schools. An alert that could help policy makers to prevent failures in their systems and the consequences for the opportunities of children and families.

This does not mean that creating competition between public schools has no positive effect. The results suggest that an increase in the number of public schools in an area is associated with an improved performance in schools in that area. The effect seems to be largest among middle-class families and in middle-ranking schools, the inference being that rich families do not use public schools and more successful schools are not threatened by competition, while poorer pupils in low-performing schools are less likely to move between schools to better performing ones.

In addition, issues related to differences in preferences between parents and a lack of information are relevant for this research as they suggest that parents perhaps do not select the best quality schools for their children, but maybe they care more about the school's infrastructure, or the treatment children receive at that school (for example, a more familiar relationship with teachers) or the type of children attending schools considering their socioeconomic background as mentioned by Gibbons and Telhaj (2005), which would also tend to generate much more stratification in the educational system. This situation seems to be happening in Chile, where the school choice reform seems to have been associated with an exodus of middle-class families from public schools to private schools. That could influence school choice to produce stratification where high ability children attend better (more productive) schools. In any case, it is not possible to neglect the idea that public schools are more effective for more disadvantaged students, but voucher schools are more effective for more advantaged students (Bravo *et al*., 2010).

Finally, further research could be conducted to analyse the impact of profit and non-profit institutions providing education; will profit organisations try to reduce the quality of the service in order to reduce their cost, attracting students by others means? In fact, such non-profit organisations would exist to serve people who are less informed who need someone to trust. However, it could also be that non-profit organisations do not have the incentive to act more efficiently because the earnings have to be reinvested and the quality of the service could also deteriorate as teachers for example do not enjoy benefits such as overtime that employees from other professions might. The increasing research in this area should open up a lot of discussion and will probably show the need for innovative ideas to reduce the social gap in education (Perry and Francis, 2010).

Appendix School Competition

3A1. International Academic Performance

Table 3A1.1:PISA Results

Country	Overall Reading	Mathematics	Science	Country	Overall Reading	Mathematics	Science
OECD average	**493**	**496**	**501**	Spain	481	483	488
Shanghai	556	600	575	Czech Republic	478	493	500
Korea	539	546	538	Slovak Republic	477	497	490
Finland	536	541	554	Croatia	476	460	486
Hong Kong	533	555	549	Israel	474	447	455
Singapur	526	562	542	Luxemburg	472	489	484
Canada	524	527	529	Austria	470	496	494
New Zealand	521	519	532	Lithuania	468	477	491
Japan	520	529	539	Turkey	464	445	454
Australia	515	514	527	Dubai	459	453	466
Netherlands	508	526	522	Russian Federation	459	468	478
Belgium	506	515	507	**Chile**	**449**	**421**	**447**
Norway	503	498	500	Serbia	442	442	443
Estonia	501	512	528	Bulgaria	429	428	439
Switzerland	501	534	517	Uruguay	426	427	427
Poland	500	495	508	Mexico	425	419	416
Iceland	500	507	496	Romania	424	427	428
United States	500	487	502	Thailand	421	419	425
Liechtenstein	499	536	520	Trinidad and Tobago	416	414	410
Sweden	497	494	495	Colombia	413	381	402
Germany	497	513	520	Brazil	412	386	405
Ireland	496	487	508	Montenegro	408	403	401
France	496	497	498	Jordan	405	387	415
Tapei (China)	495	543	520	Tunisia	404	371	401
Denmark	495	503	499	Indonesia	402	371	383
United Kingdom	494	492	514	Argentina	398	388	401
Hungary	494	490	503	Kazakhstan	390	405	400
Portugal	489	487	493	Albania	385	377	391
Macao (China)	487	525	511	Qatar	372	368	379
Italy	486	483	489	Panama	371	360	376
Latvia	484	482	494	Peru	370	365	369
Slovenia	483	501	512	Azerbaijan	362	431	373
Greece	483	466	470	Kyrgyzstan	314	331	330

Source: OECD (2010), PISA 2009 Results: Executive Summary

Table 3A1.2:TIMSS Average Mathematics Scale Scores of 8th Grade Students, by Country (2003)

Country	Average Score
Singapore	605
South Korea	589
Hong Kong	586
Chinese Taipei	585
Japan	570
Belgium-Flemish	537
Netherlands	536
Estonia	531
Hungary	529
Malaysia	508
Latvia	508
Russian Federation	508
Slovak Republic	508
Australia	505
United States	504
Lithuania	502
Sweden	499
Scotland	498
Israel	496
New Zealand	494
Slovenia	493
Italy	484
Armenia	478
Serbia	477
Bulgaria	476
Romania	475
Norway	461
Moldova	460
Cyprus	459
Macedonia	435
Lebanon	433
Jordan	424
Iran	411
Indonesia	411
Tunisia	410
Egypt	406
Bahrain	401
Palestinian National Authority	390
Chile	**387**
Morocco	387
Philippines	378
Botswana	366
Saudi Arabia	332
Ghana	276
South Africa	264
Average	**466**

Source: International Association for the Evaluation of Educational Achievement (2003)

3A2. Descriptive Statistics

Table 3A2.1: Descriptive Statistic Restricted Sample (Voucher Schools)

Variable	Obs	Mean	Std. Dev.	Min	Max
N. Churches	1,643	7.89	5.95	1.00	28.00
Spending Education per capita (Thousands of Chilean Pesos)	1,988	61.57	29.73	9.39	251.97
Density (5 to 14 years old) by Municipality Population by Km2	2,007	4,381	6,354	0.64	29,654
fee	2,007	11,464	15,299	0.00	76,402
average Income Parents	2,007	380,036	229,942	50,000	1,631,429
% Mother University Level	2,007	7.02	9.73	0.00	100.00
% Father University Level	2,007	8.74	11.69	0.00	100.00
Total Population by Municipality	2,007	153,062	127,406	5,138	492,915
Population (5 to 14 years old) by Municipality	2,007	27,690	24,618	806	102,760
% Indigenous by Municipality	2,007	5.92	9.88	0.30	70.02
% Vulnerable Students by School	1,989	67.22	16.07	14.57	100
% Catholics by Municipality	2,007	69.52	8.29	23.04	90.38
Average Schooling Population by Municipality (years)	1,921	8.31	1.41	5.57	13.63
% Infant Mortality	1,935	8.86	8.11	0.00	76.90
IDH 2003	1,974	0.72	0.05	0.51	0.94
% Poverty	2,007	14.04	6.29	2.30	36.10
Weekly Classes Working Hours Total Teachers per Students	2,007	1.43	0.50	0.31	7.28
Score_Language8_2009	2,007	252.86	24.86	158.00	329
Score_Math8_2009	2,007	260.09	27.95	180.00	340
Score_Language8_2005	1,970	258.91	27.45	150.00	329
Score_Math8_2005	1,971	250.25	29.05	150.00	326
avgSIMCE_2009	2,007	256.48	25.66	182.50	334
avgSIMCE_2005	1,969	254.60	27.80	150.00	325
Total Teachers per 20 Student by School 2009	2,007	0.07	0.00	0.07	0.07
Size School 2009 (number of Students	2,007	609.65	501.69	25.00	5,107
% Illiteracy	1,935	3.52	2.58	0.30	14.09
CompIndex_Public	2,007	1.59	3.62	0.00	33
CompIndex_Voucher	2,007	9.65	11.50	0.00	66
CompIndexVoucher_free	2,007	1.64	2.70	0.00	24
CompIndexVoucher_fee	2,007	8.01	10.20	0.00	61
% Positive Perception Public Transportation	1,669	84.98	7.96	43.20	99

Table 3A2.2: Descriptive Statistic Restricted Sample (Public Schools)

Variable	Obs	Mean	Std. Dev.	Min	Max
N. Churches	1,886	6.39	6.07	1.00	28.00
Spending_Education per capita (Thousands of Chilean Pesos)	2,427	84.57	40.68	9.39	297.84
Density (5 to 14 years old) by Municipality Population by Km2	2,450	2,487	5,698	0	29,654
fee	2,450	29.26	491.04	0	15,130
average Income Parents	2,348	201,826	82,522	50,000	911,667
% Mother University Level	2,348	1.48	3.81	0.00	100
% Father University Level	2,348	1.71	4.06	0.00	100
Total Population by Municipality	2,450	94,936	97,860	507	492,915
Population (5 to 14 years old) by Municipality	2,450	17,022	17,756	80	102,760
% Indigenous by Municipality	2,450	5.13	9.04	0.18	78.11
% Vulnerable Students by School	2,426	82.64	10.31	18.39	100
% Catholics by Municipality	2,450	71.69	10.34	23.04	95.62
Average Schooling Population by Municipality (years)	2,095	8.38	1.50	5.57	13.63
% Infant Mortality	2,123	9.25	9.79	0.00	76.90
IDH 2003	2,426	0.70	0.05	0.51	0.94
% Poverty	2,448	15.41	6.95	0.60	50.90
Weakly Classes Working Hours Total Teachers per Students	2,450	1.98	0.75	0.43	5.13
Score_Language8_2009	2,450	236.37	19.85	154	317
Score_Math8_2009	2,450	239.83	19.27	183	340
Score_Language8_2005	2,416	242.00	20.45	166	323
Score_Math8_2005	2,411	233.14	22.46	155	312
avgSIMCE_2009	2,450	238.10	18.45	175	328.50
avgSIMCE_2005	2,411	237.59	20.80	164.50	309.00
Total Teachers per 20 Student by School 2009	2,450	0.08	0.01	0.07	0.09
Size School 2009 (number of Students)	2,450	395.17	323.30	20.00	3,959
% Illiteracy	2,123	4.81	3.07	0.30	14.09
CompIndex_Public	2,450	3.61	5.77	0.00	41
CompIndex_Voucher	2,450	8.63	12.38	0.00	66
CompIndexVoucher_free	2,450	1.85	3.17	0.00	25
CompIndexVoucher_fee	2,450	6.78	10.47	0.00	63
% Positive Perception Public Transportation	1,456	85.23	7.02	43.20	99

Table 3A2.3: Descriptive Statistic Restricted Sample (IV)

Variable	Obs	Mean	Std. Dev.	Min	Max
N. Churches	3,529	7.08	6.06	1.00	28.00
Spending Education per capita (Thousands of Chilean Pesos)	3,510	69.38	36.17	9.39	282.06
Density (5 to 14 years old) by Municipality Population by Km2	3,529	4,174	6,576	0	29,654
fee	3,529	5,995	12,441	0	76,402
average Income Parents	3,463	300,451	190,738	50,000	1,501,333
% Mother University Level	3,463	4.17	7.64	0.00	100
% Father University Level	3,463	5.30	9.39	0.00	100
Total Population by Municipality	3,529	138,071	119,484	2,356	492,915
Population (5 to 14 years old) by Municipality	3,529	24,735	22,718	216	102,760
% Indigenous by Municipality	3,529	3.26	3.95	0.18	60.75
% Vulnerable Students by School	3,499	74.20	14.94	14.57	100.00
% Catholics by Municipality	3,529	70.87	9.85	23.04	95.62
Average Schooling Population by Municipality (years)	3,300	8.24	1.42	5.57	12.60
% Infant Mortality	3,334	9.60	9.53	0.00	76.90
IDH 2003	3,480	0.72	0.05	0.57	0.94
% Poverty	3,528	13.68	5.92	2.30	37.50
Weekly Classes Working Hours Total Teachers per Students	3,529	1.67	0.68	0.43	7.28
Score_Language8_2009	3,529	244.14	23.99	154.00	329
Score_Math8_2009	3,529	250.28	25.68	183.00	340
Score_Language8_2005	3,474	251.11	24.88	164.00	329
Score_Math8_2005	3,472	242.86	26.23	152.00	321
avgSIMCE_2009	3,529	247.21	24.02	175.00	334
avgSIMCE_2005	3,470	246.99	25.10	160.50	325
Total Teachers per 20 Student by School 2009	3,529	0.07	0.01	0.07	0.09
Size School 2009 (number of Students	3,529	525.27	443.22	20.00	5,107.00
% Illiteracy	3,334	3.56	2.36	0.30	13.59
CompIndex_Public	3,529	3.21	5.43	0.00	41
CompIndex_Voucher	3,529	10.67	12.62	0.00	66
CompIndexVoucher_free	3,529	1.78	2.64	0.00	14
CompIndexVoucher_fee	3,529	8.89	11.04	0.00	63
% Positive Perception Public Transportation	2,747	85.21	7.47	43.20	99

3A3. Results

Table 3A3.1: Comp.Index OLS Regressions: Number of Schools (Other Specifications)[101]

School Performance	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**
CompIndex_Public	**2.098*** **	**2.064*** **	**1.762*** **	**1.598** **	**1.762*** **	**1.602** **	**1.450** **
School Level	(0.755)	(0.745)	(0.635)	(0.625)	(0.634)	(0.690)	(0.610)
CompIndex_Voucher	**-0.523**	**-0.917** **	**-0.809** **	**-0.763** **	**-0.809** **	**-0.773* **	**-0.761** **
School Level	(0.370)	(0.409)	(0.381)	(0.377)	(0.391)	(0.451)	(0.376)
%_PerClosetoPublicTranort	0.106						
Municipality Level	(0.084)						
PerceptionTranport_CompIndexVoucher (interaction)	0.004	0.009**	0.008*	0.008*	0.008*	0.008	0.008*
School Level	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
PerceptionTranport_CompIndexPublic (interaction)	-0.023***	-0.022***	-0.020***	-0.018**	-0.020***	-0.019**	-0.018**
School Level	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)
avgTest_2005	0.559***	0.558***	0.558***	0.559***	0.558***	0.564***	0.559***
School Level	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)
ContractHoursClass_PerStudent	0.498	0.475	0.458	0.460	0.458	0.798	0.309
School Level	(0.708)	(0.725)	(0.707)	(0.712)	(0.707)	(0.679)	(0.731)
voucher_School	14.323***	14.399***	14.145***	13.903***	14.144***	14.253***	13.077***
School Level	(2.015)	(2.027)	(2.009)	(2.014)	(1.993)	(1.968)	(2.269)
voucher_ContractHourCPS (interaction)	-5.551***	-5.591***	-5.545***	-5.455***	-5.545***	-5.698***	-5.236***
School Level	(1.122)	(1.137)	(1.129)	(1.119)	(1.130)	(1.103)	(1.141)
ComIndexPublic_VoucherSchool (interaction)							0.284*
School Level							(0.149)
ComIndexVoucher_VoucherSchool (interaction)							-0.039
School Level							(0.045)
%_Father_UniversityDegree	0.228***	0.228**	0.228**	0.228**	0.228***	0.251***	0.227**
School Level	(0.089)	(0.089)	(0.088)	(0.089)	(0.087)	(0.089)	(0.089)
%_Mother_UniversityDegree	0.236**	0.238**	0.236**	0.240**	0.236**	0.292***	0.244**
School Level	(0.099)	(0.099)	(0.100)	(0.100)	(0.100)	(0.099)	(0.100)
avgIncome_Parents	0.450	0.447	0.455	0.451	0.455	-0.086	0.481
School Level	(0.508)	(0.511)	(0.509)	(0.517)	(0.505)	(0.510)	(0.515)
boys	9.144***	9.211***	9.293***	9.320***	9.293***	9.515***	9.452***
School Level	(2.365)	(2.360)	(2.326)	(2.328)	(2.334)	(2.356)	(2.306)
girls	9.551***	9.627***	9.570***	9.604***	9.570***	9.725***	9.829***
School Level	(1.287)	(1.297)	(1.288)	(1.287)	(1.292)	(1.272)	(1.289)
fee	0.044	0.043	0.043	0.043	0.043	0.046	0.040
School Level	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.067)	(0.068)
% Poverty	0.005	-0.006	-0.012	-0.013	-0.012		-0.004
Municipality Level	(0.071)	(0.072)	(0.072)	(0.072)	(0.072)		(0.073)
Density_5_14 years old	0.065	0.453	-0.016	-1.158			-1.687
Municipality Level	(5.321)	(5.437)	(5.417)	(6.071)			(5.944)
%_Indigenous	-0.040	-0.037	-0.038	-0.040	-0.038	-0.005	-0.039
Municipality Level	(0.063)	(0.063)	(0.062)	(0.060)	(0.062)	(0.053)	(0.060)
BookspserCapita_2001	0.200***	0.206***	0.207***	0.222**	0.207***	0.164***	0.223**
Municipality Level	(0.065)	(0.066)	(0.067)	(0.096)	(0.066)	(0.042)	(0.094)
%_Illiteracy_2006	0.826***	0.828***	0.846***	0.869***	0.846***		0.860***
Municipality Level	(0.230)	(0.232)	(0.239)	(0.253)	(0.237)		(0.251)
AvgSchoolingPopulation	0.016	-0.053	-0.034	-0.022	-0.034		-0.017
Municipality Level	(0.249)	(0.235)	(0.239)	(0.243)	(0.240)		(0.242)
CompIndex_P_sq	-0.006	-0.006					
School Level	(0.005)	(0.005)					
CompIndex_V_sq	0.001	0.001					
School Level	(0.001)	(0.001)					
MuniSpdng_EducPCapita				-6.894			-8.382
Municipality Level				(19.103)			(18.841)
HumDevelopIndex_2003						-2.529	
Municipality Level						(12.602)	
_cons	89.532***	99.654***	99.413***	99.609***	99.412***	103.265***	100.120***
	(9.278)	(4.453)	(4.495)	(4.532)	(4.466)	(10.183)	(4.573)
Number of observations	2,927	2,927	2,927	2,909	2,927	2,944	2,909
R2	0.659	0.659	0.659	0.659	0.659	0.656	0.659

[101] Standard errors are in brackets.

Table 3A3.2: First Stage Estimation (IV)[102]

Comp.Index 1st Stage Regressions	
CI_Voucher	**coef/se**
Number of Catholic Churches	**0.256****
Municipality Level	(0.109)
CompIndex_Public	1.012***
School Level	(0.153)
avgTest_2005	0.030***
School Level	(0.010)
ContractHoursClass_PerStudent	-0.546
School Level	(0.513)
voucher_School	0.698
School Level	(1.589)
voucher_ContractHourCPS (interaction)	-0.637
School Level	(0.639)
%_Father_UniversityDegree	-0.070
School Level	(0.062)
%_Mother_UniversityDegree	0.019
School Level	(0.035)
avgIncome_Parents	-0.308
School Level	(0.333)
boys	1.000
School Level	(1.620)
girls	0.977
School Level	(1.261)
fee	-0.002
School Level	(0.029)
Density_5_14 years old	47.062***
Municipality Level	(11.636)
% Poverty	-0.134
Municipality Level	(0.093)
%_Indigenous	-0.000
Municipality Level	(0.094)
MunicipalitySpending_EducPCapita	-77.556***
Municipality Level	(21.491)
BooksperCapita_2001	0.169
Municipality Level	(0.149)
%_Illiteracy_2006	-0.386**
Municipality Level	(0.188)
AvgSchoolingPopulation	0.004
Municipality Level	(0.391)
_cons	6.690*
	(3.818)
Number of observations	3,092
R2	0.586
note: *** p<0.01, ** p<0.05, * p<0.1	

[102]Standard errors are in brackets.

Table 3A3.3: Comp.Index Regressions: Robustness (2 Km)[103]

School Performance	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public	**2.468****	**2.955****	**2.933****	**2.705****	**2.931****	**2.716****	**2.623****
School Level	(0.962)	(1.314)	(1.211)	(1.216)	(1.203)	(1.256)	(1.179)
CompIndex_Voucher	**-0.130*****	**-1.424****	**-1.334****	**-1.290****	**-1.300***	**-1.276***	**-1.349****
School Level	(0.046)	(0.672)	(0.647)	(0.646)	(0.664)	(0.750)	(0.632)
%_PerceptionClosetoPublicTransport	0.133*						
Municipality Level	(0.074)						
PerceptionTranport_CompIndexVoucher (interaction)		0.014*	0.014*	0.013*	0.014*	0.013	0.014*
School Level		(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.007)
PerceptionTranport_CompIndexPublic (interaction)	-0.029**	-0.034**	-0.034**	-0.031**	-0.034**	-0.032**	-0.032**
School Level	(0.011)	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)
avgTest_2005	0.560***	0.558***	0.558***	0.559***	0.559***	0.565***	0.558***
School Level	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)
ContractHoursClass_PerStudent	0.480	0.387	0.452	0.451	0.464	0.829	0.232
School Level	(0.694)	(0.729)	(0.712)	(0.717)	(0.713)	(0.688)	(0.738)
voucher_School	14.067***	14.198***	14.154***	13.893***	14.105***	14.206***	12.466***
School Level	(2.068)	(2.109)	(2.076)	(2.079)	(2.061)	(2.039)	(2.335)
voucher_ContractHourCPS (interaction)	-5.506***	-5.540***	-5.540***	-5.443***	-5.549***	-5.705***	-5.089***
School Level	(1.119)	(1.146)	(1.136)	(1.126)	(1.136)	(1.111)	(1.147)
ComIndexPublic_VoucherSchool (interaction)							0.689**
School Level							(0.279)
ComIndexVoucher_VoucherSchool (interaction)							-0.022
School Level							(0.077)
%_Father_UniversityDegree	0.225**	0.222**	0.222**	0.222**	0.225***	0.250***	0.224**
School Level	(0.088)	(0.087)	(0.087)	(0.088)	(0.086)	(0.087)	(0.088)
%_Mother_UniversityDegree	0.236**	0.240**	0.237**	0.241**	0.239**	0.299***	0.245**
School Level	(0.098)	(0.098)	(0.099)	(0.099)	(0.099)	(0.098)	(0.099)
avgIncome_Parents	0.450	0.454	0.464	0.461	0.452	-0.117	0.502
School Level	(0.507)	(0.512)	(0.510)	(0.518)	(0.505)	(0.504)	(0.516)
boys	9.284***	9.426***	9.357***	9.381***	9.370***	9.599***	9.604***
School Level	(2.322)	(2.334)	(2.313)	(2.316)	(2.318)	(2.343)	(2.304)
girls	9.713***	9.889***	9.773***	9.808***	9.819***	10.059***	10.079***
School Level	(1.284)	(1.288)	(1.288)	(1.286)	(1.291)	(1.271)	(1.273)
fee	0.046	0.045	0.045	0.044	0.045	0.049	0.042
School Level	(0.068)	(0.068)	(0.068)	(0.068)	(0.067)	(0.066)	(0.067)
% Poverty	0.002	-0.003	-0.011	-0.011	-0.011		0.003
Municipality Level	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)		(0.071)
Density_5_14 years old	-2.235	-1.891	-2.311	-3.554			-4.251
Municipality Level	(5.117)	(5.178)	(5.114)	(5.887)			(5.718)
%_Indigenous	-0.041	-0.041	-0.040	-0.042	-0.039	-0.006	-0.038
Municipality Level	(0.063)	(0.063)	(0.062)	(0.060)	(0.063)	(0.053)	(0.060)
BooksperCapita_2001	0.183***	0.197***	0.191***	0.206**	0.193***	0.142***	0.211**
Municipality Level	(0.065)	(0.065)	(0.065)	(0.093)	(0.064)	(0.039)	(0.090)
%_Illiteracy_2006	0.839***	0.820***	0.840***	0.864***	0.855***		0.851***
Municipality Level	(0.234)	(0.227)	(0.232)	(0.248)	(0.229)		(0.245)
AvgSchoolingPopulation	0.070	-0.039	-0.033	-0.021	-0.031		-0.008
Municipality Level	(0.249)	(0.232)	(0.235)	(0.241)	(0.234)		(0.238)
CompIndex_P_sq		-0.004					
School Level		(0.018)					
CompIndex_V_sq		0.004					
School Level		(0.003)					
MuniSpen_EducPCapita				-6.927			-8.693
Municipality Level				(19.059)			(18.632)
HumDevelopIndex_2003						-2.351	
Municipality Level						(12.316)	
_cons	86.628***	99.888***	99.446***	99.645***	99.276***	102.992***	100.454***
	(8.556)	(4.449)	(4.437)	(4.478)	(4.366)	(9.926)	(4.512)
Number of observations	2,927	2,927	2,927	2,909	2,927	2,944	2,909
R2	0.659	0.659	0.659	0.659	0.659	0.656	0.660
note: *** p<0.01, ** p<0.05, * p<0.1							

[103]Standard errors are in brackets.

Table 3A3.4: Comp.Index Regressions: Robustness (4 Km)[104]

School Performance	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public	**0.005**	**1.352****	**1.150****	**1.024****	**1.151****	**1.028****	**0.966****
School Level	(0.034)	(0.562)	(0.469)	(0.460)	(0.470)	(0.517)	(0.455)
CompIndex_Voucher	**0.124**	**-0.647****	**-0.520***	**-0.485***	**-0.527***	**-0.496**	**-0.490***
School Level	(0.193)	(0.298)	(0.271)	(0.272)	(0.277)	(0.326)	(0.268)
%_PerceptionClosetoPublic Transport	0.108						
Municipality Level	(0.089)						
PerceptionTranport_CompIndexVoucher (interaction)	-0.002	0.006*	0.006*	0.005	0.006*	0.005	0.005*
School Level	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
PerceptionTranport_CompIndexPublic (interaction)		-0.015**	-0.013**	-0.012**	-0.013**	-0.012**	-0.012**
School Level		(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
avgTest_2005	0.560***	0.557***	0.558***	0.558***	0.558***	0.564***	0.559***
School Level	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)
ContractHoursClass_PerStudent	0.570	0.420	0.488	0.484	0.486	0.831	0.368
School Level	(0.698)	(0.723)	(0.712)	(0.716)	(0.712)	(0.680)	(0.730)
voucher_School	14.335***	14.266***	14.192***	13.965***	14.219***	14.361***	13.330***
School Level	(1.997)	(1.992)	(1.996)	(1.990)	(1.980)	(1.947)	(2.231)
voucher_ContractHourCPS (interaction)	-5.602***	-5.560***	-5.564***	-5.468***	-5.560***	-5.718***	-5.300***
School Level	(1.118)	(1.132)	(1.130)	(1.119)	(1.131)	(1.101)	(1.136)
ComIndexPublic_VoucherSchool (interaction)							0.183**
School Level							(0.093)
ComIndexVoucher_VoucherSchool (interaction)							-0.036
School Level							(0.031)
%_Father_UniversityDegree	0.224**	0.229**	0.229***	0.229***	0.228***	0.251***	0.228**
School Level	(0.088)	(0.089)	(0.088)	(0.087)	(0.087)	(0.089)	(0.089)
%_Mother_UniversityDegree	0.236**	0.239**	0.237**	0.240**	0.236**	0.290***	0.243**
School Level	(0.099)	(0.098)	(0.099)	(0.099)	(0.099)	(0.097)	(0.099)
avgIncome_Parents	0.460	0.440	0.455	0.450	0.462	-0.070	0.471
School Level	(0.511)	(0.512)	(0.511)	(0.511)	(0.507)	(0.514)	(0.518)
boys	9.483***	9.296***	9.261***	9.279***	9.250***	9.471***	9.335***
School Level	(2.326)	(2.382)	(2.324)	(2.339)	(2.337)	(2.361)	(2.325)
girls	9.589***	9.647***	9.494***	9.516***	9.474***	9.592***	9.672***
School Level	(1.304)	(1.295)	(1.286)	(1.287)	(1.292)	(1.273)	(1.285)
fee	0.044	0.041	0.042	0.042	0.043	0.045	0.040
School Level	(0.068)	(0.068)	(0.068)	(0.069)	(0.068)	(0.067)	(0.068)
% Poverty	-0.003	-0.003	-0.012	-0.013	-0.012		-0.005
Municipality Level	(0.073)	(0.072)	(0.073)	(0.072)	(0.072)		(0.073)
Density_5_14 years old	0.675	2.387	1.363				0.036
Municipality Level	(5.531)	(5.620)	(5.708)				(6.239)
%_Indigenous	-0.035	-0.035	-0.036	-0.037	-0.036	-0.003	-0.037
Municipality Level	(0.062)	(0.063)	(0.062)	(0.060)	(0.062)	(0.052)	(0.060)
BooksperCapita_2001	0.211***	0.224***	0.225***	0.236**	0.222***	0.187***	0.235**
Municipality Level	(0.071)	(0.072)	(0.074)	(0.103)	(0.071)	(0.048)	(0.101)
%_Illiteracy_2006	0.847***	0.807***	0.863***	0.880***	0.859***		0.871***
Municipality Level	(0.241)	(0.233)	(0.243)	(0.257)	(0.243)		(0.256)
AvgSchoolingPopulation	0.051	-0.051	-0.027	-0.020	-0.027		-0.025
Municipality Level	(0.266)	(0.239)	(0.245)	(0.246)	(0.247)		(0.245)
CompIndex_P_sq		-0.002					
School Level		(0.002)					
CompIndex_V_sq		0.001					
School Level		(0.001)					
MuniSpen_EducPCapita				-5.652			-6.917
Municipality Level				(18.520)			(19.098)
HumDevelopIndex_2003						-3.237	
Municipality Level						(12.814)	
_cons	88.623***	100.026***	99.133***	99.347***	99.187***	103.629***	99.795***
	(10.123)	(4.493)	(4.555)	(4.591)	(4.564)	(10.291)	(4.595)
Number of observations	2,927	2,927	2,927	2,909	2,927	2,944	2,909
R2	0.658	0.659	0.658	0.658	0.658	0.656	0.659
note: *** p<0.01, ** p<0.05, * p<0.1							

[104]Standard errors are in brackets.

Table 3A3.5: Comp.Index Regressions: Public, Voucher with/without Fee[105]

School Performance	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public	**2.032*****	**1.375*****	**0.006**	**1.859****	**1.553****	**1.455****	**1.455****
School Level	(0.747)	(0.517)	(0.054)	(0.746)	(0.619)	(0.701)	(0.622)
CompIndex_Voucher_free	**0.202**	**-0.060**	**1.031**	**-0.261**	**-0.323**	**0.323**	**-0.308**
School Level	(1.285)	(0.113)	(1.247)	(1.134)	(1.127)	(1.260)	(1.122)
CompIndex_Voucher_fee	**-0.615**	**-0.082*****	**-0.047**	**-0.964***	**-0.831**	**-0.891**	**-0.844***
School Level	(0.449)	(0.031)	(0.344)	(0.542)	(0.507)	(0.578)	(0.504)
%PerceptionClosetoPublicTransport	0.108	0.131	0.105				
Municipality Level	(0.086)	(0.080)	(0.088)				
PerceptionTranport_CIndexPublic (interaction)	-0.022***	-0.016***		-0.020**	-0.018**	-0.017**	-0.018**
School Level	(0.008)	(0.006)		(0.008)	(0.007)	(0.008)	(0.007)
PerceptionTranport_CIndexVoucherFree (interaction)	-0.003		-0.012	0.002	0.003	-0.004	0.004
School Level	(0.014)		(0.014)	(0.012)	(0.012)	(0.014)	(0.012)
PerceptionTranport_CIndexVoucherFee (interaction)	0.005		-0.000	0.009	0.009	0.009	0.009
School Level	(0.005)		(0.004)	(0.006)	(0.006)	(0.007)	(0.006)
avgTest_2005	0.559***	0.560***	0.560***	0.559***	0.559***	0.564***	0.558***
School Level	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)
ContractHoursClass_PerStudent	0.511	0.488	0.550	0.491	0.467	0.818	0.306
School Level	(0.708)	(0.689)	(0.695)	(0.728)	(0.712)	(0.681)	(0.727)
voucher_School	14.364***	14.050***	14.279***	14.172***	13.913***	14.288***	13.187***
School Level	(2.012)	(1.999)	(2.005)	(2.028)	(2.014)	(1.972)	(2.293)
voucher_ContractHourCPS (interaction)	-5.560***	-5.508***	-5.590***	-5.513***	-5.461***	-5.707***	-5.236***
School Level	(1.122)	(1.110)	(1.117)	(1.127)	(1.119)	(1.104)	(1.143)
ComIndexPublic_VoucherSchool (interaction)							0.291*
School Level							(0.151)
ComIndexVoucherFree_VoucherSchool (interaction)							-0.171
School Level							(0.240)
ComIndexVoucherree_VoucherSchool (interaction)							-0.019
School Level							(0.052)
%_Father_UniversityDegree	0.228**	0.227***	0.224**	0.227**	0.228**	0.250***	0.228**
School Level	(0.089)	(0.088)	(0.089)	(0.090)	(0.090)	(0.090)	(0.090)
%_Mother_UniversityDegree	0.238**	0.235**	0.241**	0.243**	0.242**	0.294***	0.249**
School Level	(0.098)	(0.099)	(0.097)	(0.098)	(0.098)	(0.097)	(0.098)
avgIncome_Parents	0.442	0.455	0.438	0.446	0.444	-0.085	0.464
School Level	(0.510)	(0.506)	(0.514)	(0.519)	(0.520)	(0.515)	(0.514)
boys	9.180***	9.271***	9.558***	9.271***	9.347***	9.561***	9.470***
School Level	(2.376)	(2.330)	(2.330)	(2.374)	(2.336)	(2.369)	(2.322)
girls	9.528***	9.494***	9.630***	9.658***	9.602***	9.676***	9.865***
School Level	(1.297)	(1.301)	(1.318)	(1.305)	(1.304)	(1.285)	(1.305)
fee	0.045	0.045	0.045	0.042	0.043	0.047	0.038
School Level	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.067)	(0.068)
% Poverty	0.003	0.002	-0.006	-0.008	-0.014		-0.005
Municipality Level	(0.073)	(0.072)	(0.074)	(0.073)	(0.073)		(0.073)
Density_5_14 years old	0.060	0.040	-0.798	-1.052	-1.217		-1.681
Municipality Level	(5.343)	(5.385)	(5.290)	(6.016)	(6.052)		(5.915)
%_Indigenous	-0.044	-0.041	-0.039	-0.044	-0.039	-0.010	-0.039
Municipality Level	(0.066)	(0.066)	(0.064)	(0.064)	(0.064)	(0.056)	(0.064)
BooksperCapita_2001	0.200***	0.206***	0.190***	0.230**	0.219**	0.161***	0.222**
Municipality Level	(0.068)	(0.069)	(0.068)	(0.098)	(0.097)	(0.043)	(0.094)
%_Illiteracy_2006	0.808***	0.836***	0.814***	0.844***	0.863***		0.848***
Municipality Level	(0.239)	(0.243)	(0.243)	(0.256)	(0.259)		(0.258)
AvgSchoolingPopulation	0.010	0.066	0.049	-0.042	-0.019		-0.017
Municipality Level	(0.262)	(0.268)	(0.272)	(0.255)	(0.257)		(0.256)
CompIndex_P_sq	-0.007			-0.006			
School Level	(0.005)			(0.005)			
CompIndex_V_sq	0.001			0.001			
School Level	(0.001)			(0.001)			
MuniSpend_EducPCapita				-9.766	-6.823		-7.772
Municipality Level				(19.637)	(19.185)		(18.893)
HumDevelopIndex_2003						-1.371	
Municipality Level						(12.301)	
_cons	89.541***	86.833***	89.294***	100.084***	99.608***	102.398***	100.208***
	(9.460)	(9.303)	(9.935)	(4.523)	(4.583)	(10.029)	(4.627)
Number of observations	2,927	2,927	2,927	2,909	2,909	2,944	2,909
R2	0.659	0.659	0.658	0.659	0.659	0.656	0.659
note: *** p<0.01, ** p<0.05, * p<0.1							

[105] Standard errors are in brackets.

Table 3A3.6: Comp.Index Regressions: Average Quality of Schools[106]

School Performance	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**
CompIndex_Public	**0.293**	**0.149*** **	**0.635**	**0.303**	**0.203**	**0.216**	**0.283**
School Level	(0.415)	(0.037)	(0.660)	(0.396)	(0.387)	(0.402)	(0.371)
CompIndex_Voucher	**-0.063**	**-0.031**	**-0.323**	**-0.164**	**-0.063**	**-0.073**	**-0.117**
School Level	(0.039)	(0.416)	(1.461)	(0.344)	(0.334)	(0.345)	(0.333)
%_PerceptionClosetoPublic Transport	0.310	0.013					
Municipality Level	(1.098)	(1.283)					
PerceptionTranport_CompIndexVoucher (interaction)		-0.000	0.000	0.001	0.000	0.000	0.000
School Level		(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
PerceptionTranport_CompIndexPublic (interaction)	-0.002		-0.001	-0.002	-0.001	-0.001	-0.001
School Level	(0.005)		(0.005)	(0.004)	(0.004)	(0.005)	(0.004)
avgTest_2005	0.562***	0.562***	0.562***	0.564***	0.565***	0.573***	0.563***
School Level	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
ContractHoursClass_PerStudent	-0.359	-0.354	-0.303	-0.362	-0.368	-0.009	-0.469
School Level	(0.980)	(0.979)	(0.971)	(0.982)	(0.976)	(0.947)	(0.981)
voucher_School	14.513***	14.536***	14.734***	14.054***	13.988***	14.269***	15.900
School Level	(2.506)	(2.502)	(2.534)	(2.480)	(2.499)	(2.431)	(21.290)
voucher_ContractHourCPS (interaction)	-3.941**	-3.971***	-4.049***	-3.785**	-3.796**	-3.908**	-3.668**
School Level	(1.545)	(1.540)	(1.559)	(1.541)	(1.552)	(1.531)	(1.526)
ComIndexPublic_VoucherSchool (interaction)							-0.102
School Level							(0.071)
ComIndexVoucher_VoucherSchool (interaction)							0.084
School Level							(0.070)
%_Father_UniversityDegree	0.208	0.208	0.208	0.210	0.220	0.273*	0.216
School Level	(0.141)	(0.140)	(0.139)	(0.140)	(0.140)	(0.146)	(0.140)
%_Mother_UniversityDegree	0.335*	0.332*	0.334*	0.344*	0.343*	0.382**	0.340*
School Level	(0.179)	(0.185)	(0.179)	(0.178)	(0.178)	(0.179)	(0.180)
avgIncome_Parents	0.958	0.969	0.984	0.943	1.054	0.164	1.118
School Level	(0.720)	(0.726)	(0.725)	(0.729)	(0.740)	(0.736)	(0.735)
boys	9.027***	9.011***	9.100***	8.994***	9.109***	9.439***	9.290***
School Level	(2.488)	(2.486)	(2.465)	(2.495)	(2.458)	(2.492)	(2.440)
girls	8.458***	8.491***	8.468***	8.446***	8.379***	8.500***	8.411***
School Level	(1.689)	(1.701)	(1.690)	(1.691)	(1.665)	(1.663)	(1.654)
fee	-0.133	-0.133	-0.133	-0.133	-0.146	-0.116	-0.150
School Level	(0.090)	(0.090)	(0.090)	(0.089)	(0.094)	(0.093)	(0.095)
% Poverty	0.103	0.099	0.097	0.098	0.044		0.063
Municipality Level	(0.093)	(0.094)	(0.095)	(0.093)	(0.095)		(0.092)
Density_5_14 years old	1.544	1.675	1.713	-0.023	-4.995	-3.501	-5.690
Municipality Level	(5.223)	(5.445)	(5.363)	(6.268)	(5.173)	(6.422)	(5.149)
%_Indigenous	-0.038	-0.039	-0.036	-0.035	-0.055	-0.002	-0.062
Municipality Level	(0.102)	(0.102)	(0.101)	(0.096)	(0.089)	(0.092)	(0.085)
BooksperCapita_2001	0.075	0.072	0.064	0.102	0.172**	0.067	0.172**
Municipality Level	(0.051)	(0.052)	(0.050)	(0.072)	(0.077)	(0.066)	(0.073)
%_Illiteracy_2006	1.076***	1.081***	1.075***	1.126***	0.895***		0.860***
Municipality Level	(0.271)	(0.278)	(0.274)	(0.283)	(0.271)		(0.267)
AvgSchoolingPopulation	0.380	0.390	0.388*	0.441*	0.404		0.411
Municipality Level	(0.235)	(0.246)	(0.234)	(0.246)	(0.265)		(0.252)
CompIndex_P_sq			-0.001				
School Level			(0.001)				
CompIndex_V_sq			0.000				
School Level			(0.003)				
MuniSpend_EducPCapita				-14.762	-25.408	7.587	-26.369
Municipality Level				(18.907)	(18.490)	(18.526)	(17.983)
HumDevelopIndex_2003	27.719**	27.171*	28.030**	26.086*		0.026	
Municipality Level	(14.047)	(14.165)	(14.138)	(14.453)		(13.694)	
_cons	25.734	51.461	31.523	51.109***	67.776***	71.431***	63.191***
	(99.513)	(107.830)	(174.887)	(16.657)	(13.442)	(17.033)	(17.715)
Number of observations	1,771	1,771	1,771	1,755	1,755	1,761	1,755
R2	0.660	0.659	0.660	0.660	0.659	0.656	0.660
note: *** p<0.01, ** p<0.05, * p<0.1							

[106] Standard errors are in brackets.

Table 3A3.7: Com.Index Regressions: Number of Schools (by Population 5-14 years old) [107]

School Performance	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public_pop	**0.418*****	**0.202****	**0.382****	**0.291****	**0.323****	**0.303****	**0.301****
School Level	(0.150)	(0.101)	(0.157)	(0.141)	(0.141)	(0.147)	(0.137)
CompIndex_Voucher_pop	**-0.092**	**-0.003**	**-0.153***	**-0.136**	**-0.147**	**-0.149**	**-0.142***
School Level	(0.072)	(0.005)	(0.083)	(0.088)	(0.090)	(0.097)	(0.086)
%_PerceptionClosetoPublicTransport_2010	0.100	0.111					
Municipality Level	(0.081)	(0.078)					
PerceptionTranport_CompIndexVoucher (interaction)	-0.005***	-0.002**	-0.004**	-0.003**	-0.004**	-0.004**	-0.004**
School Level	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
PerceptionTranport_CompIndexPublic (interaction)	0.001		0.002*	0.002	0.002	0.002	0.002*
School Level	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
avgTest_2005	0.559***	0.559***	0.558***	0.558***	0.558***	0.565***	0.560***
School Level	(0.016)	(0.016)	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)
ContractHoursClass_PerStudent	0.715	0.743	0.628	0.630	0.691	1.249*	0.621
School Level	(0.693)	(0.680)	(0.718)	(0.708)	(0.700)	(0.665)	(0.705)
voucher_School	14.503***	14.299***	14.331***	14.165***	14.342***	14.739***	14.597***
School Level	(1.997)	(1.981)	(2.010)	(1.986)	(1.987)	(1.946)	(2.087)
voucher_ContractHourCPS (interaction)	-5.611***	-5.598***	-5.532***	-5.491***	-5.617***	-5.899***	-5.539***
School Level	(1.126)	(1.120)	(1.125)	(1.118)	(1.133)	(1.101)	(1.117)
ComIndexPublicPop_VoucherSchool (interaction)							0.328**
School Level							(0.135)
ComIndexVoucherPop_VoucherSchool (interaction)							-0.116***
School Level							(0.037)
%_Father_UniversityDegree	0.232***	0.234***	0.235***	0.238***	0.235***	0.266***	0.230***
School Level	(0.088)	(0.088)	(0.089)	(0.089)	(0.088)	(0.091)	(0.087)
%_Mother_UniversityDegree	0.239**	0.237**	0.242**	0.240**	0.237**	0.305***	0.243**
School Level	(0.099)	(0.099)	(0.100)	(0.100)	(0.099)	(0.098)	(0.101)
avgIncome_Parents	0.467	0.466	0.434	0.428	0.470	-0.179	0.462
School Level	(0.507)	(0.504)	(0.518)	(0.516)	(0.508)	(0.515)	(0.509)
boys	9.288***	9.350***	9.367***	9.410***	9.395***	9.653***	9.683***
School Level	(2.318)	(2.295)	(2.327)	(2.311)	(2.302)	(2.329)	(2.317)
girls	9.649***	9.569***	9.708***	9.610***	9.609***	9.830***	9.853***
School Level	(1.313)	(1.305)	(1.307)	(1.295)	(1.300)	(1.284)	(1.292)
fee	0.043	0.044	0.042	0.043	0.041	0.045	0.041
School Level	(0.068)	(0.068)	(0.069)	(0.069)	(0.068)	(0.067)	(0.068)
% Poverty	0.005	-0.002	-0.002	-0.008	-0.008		-0.009
Municipality Level	(0.072)	(0.073)	(0.072)	(0.072)	(0.072)		(0.072)
%_Indigenous	-0.040	-0.041	-0.033	-0.035	-0.036	0.004	-0.039
Municipality Level	(0.066)	(0.065)	(0.064)	(0.064)	(0.063)	(0.053)	(0.061)
BooksperCapita_2001	0.196***	0.188***	0.200**	0.179**	0.194***	0.143***	0.183**
Municipality Level	(0.070)	(0.068)	(0.097)	(0.088)	(0.068)	(0.049)	(0.088)
%_Illiteracy_2006	0.946***	0.968***	0.904***	0.907***	0.951***		0.898***
Municipality Level	(0.233)	(0.238)	(0.251)	(0.250)	(0.233)		(0.249)
AvgSchoolingPopulation	0.027	0.098	-0.063	-0.037	-0.004		-0.070
Municipality Level	(0.263)	(0.262)	(0.251)	(0.252)	(0.252)		(0.252)
CompIndex_P_pop_sq	-0.000**		-0.000*				
School Level	(0.000)		(0.000)				
CompIndex_V_pop_sq	0.000*		0.000				
School Level	(0.000)		(0.000)				
MuniSpend_EducPCapita			3.394	6.530			3.443
Municipality Level			(17.275)	(16.758)			(16.974)
HumDevelopIndex_2003						-2.927	
Municipality Level						(12.736)	
_cons	88.537***	86.799***	98.379***	97.976***	97.618***	101.760***	98.049***
	(9.276)	(9.032)	(4.508)	(4.554)	(4.428)	(10.405)	(4.583)
Number of observations	2,927	2,927	2,909	2,909	2,927	2,944	2,909
R2	0.658	0.658	0.658	0.657	0.657	0.654	0.658
note: *** p<0.01, ** p<0.05, * p<0.1							

[107] Standard errors are in brackets.

Table 3A3.8: Comp.Index Regressions: Chilean Regions[108]

	a: II	b:V	d: VIII	e: XIII
School Performance	**coef/se**	**coef/se**	**coef/se**	**coef/se**
CompIndex_Public	**0.256**	**2.631**	**-0.607**	**0.246**
School Level	(2.151)	(2.831)	(2.013)	(0.668)
CompIndex_Voucher	**-12.109*** **	**0.077**	**0.816**	**-0.218**
School Level	(3.127)	(0.916)	(2.625)	(0.259)
PerceptionTranport_CompIndexVoucher (interaction)	0.001	-0.034	0.008	-0.002
School Level	(0.017)	(0.032)	(0.025)	(0.008)
PerceptionTranport_CompIndexPublic (interaction)	0.128***	-0.000	-0.010	0.001
School Level	(0.033)	(0.011)	(0.032)	(0.003)
avgTest_2005	0.599***	0.582***	0.569***	0.574***
School Level	(0.096)	(0.029)	(0.032)	(0.031)
ContractHoursClass_PerStudent	-2.124	-0.971	-1.017	0.588
School Level	(3.494)	(1.552)	(1.762)	(1.979)
voucher_School	22.770	3.068	16.802***	12.833***
School Level	(27.397)	(6.388)	(5.131)	(3.919)
voucher_ContractHourCPS (interaction)	-9.883	-1.712	-6.119*	-5.195**
School Level	(18.819)	(3.900)	(3.451)	(2.346)
%_Father_UniversityDegree	0.149	0.055	0.030	0.086
School Level	(0.404)	(0.129)	(0.381)	(0.136)
%_Mother_UniversityDegree	0.034	0.409*	0.444***	0.399***
School Level	(0.556)	(0.209)	(0.155)	(0.132)
avgIncome_Parents	0.123	2.238*	-1.249	1.190
School Level	(1.205)	(1.336)	(2.221)	(0.961)
boys	(dropped)	15.070***	3.489	9.500***
School Level		(4.068)	(7.094)	(3.366)
girls	13.808***	4.178	13.783***	10.319***
School Level	(3.955)	(2.627)	(4.056)	(2.096)
fee	0.310***	-0.081	0.404***	-0.061
School Level	(0.048)	(0.127)	(0.119)	(0.128)
Density_5_14 years old	(dropped)	212.925**	-133.827	-5.566
Municipality Level		(106.296)	(241.131)	(8.192)
% Poverty	(dropped)	-0.923**	-0.107	0.142
Municipality Level		(0.432)	(0.699)	(0.142)
%_Indigenous	1.365***	4.773	-3.173	-0.686
Municipality Level	(0.362)	(5.000)	(2.758)	(0.531)
MuniSpend_EducPCapita	(dropped)	-279.141***	25.057	-3.596
Municipality Level		(54.322)	(109.547)	(58.567)
BooksperCapita_2001	(dropped)	-1.209	-0.572	0.195
Municipality Level		(1.740)	(0.457)	(0.192)
%_Illiteracy_2006	(dropped)	5.262**	-0.676	0.466
Municipality Level		(2.512)	(1.465)	(0.555)
AvgSchoolingPopulation	(dropped)	1.558	-0.237	-0.032
Municipality Level		(1.000)	(0.712)	(0.532)
_cons	85.717***	91.891***	117.703***	97.039***
	(8.271)	(13.422)	(13.981)	(8.937)
Number of observations	71	369	348	1,214
R2	0.797	0.685	0.726	0.646

108 Standard errors are in brackets.

Table 3A3.9: Quantile Regression Results[109]

	OLS	BSQR_10	BSQR_25	BSQR_50	BSQR_75	BSQR_90
School Performance	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
CompIndex_Public	**1.598****	**1.205**	**1.623***	**2.396*****	**1.408***	**0.423**
School Level	(0.625)	(1.779)	(0.895)	(0.702)	(0.768)	(1.876)
CompIndex_Voucher	**-0.763****	**-0.827**	**-0.621**	**-0.981*****	**-0.479**	**-0.440**
School Level	(0.377)	(0.796)	(0.417)	(0.331)	(0.358)	(0.534)
PerceptionTranport_CompIndexPublic (interaction)	-0.018**	-0.012	-0.018*	-0.028***	-0.017*	-0.006
School Level	(0.007)	(0.020)	(0.011)	(0.008)	(0.009)	(0.022)
PerceptionTranport_CompIndexVoucher (interaction)	0.008*	0.009	0.007	0.010***	0.005	0.004
School Level	(0.004)	(0.009)	(0.005)	(0.004)	(0.004)	(0.006)
avgTest_2005	0.559***	0.518***	0.541***	0.542***	0.572***	0.595***
School Level	(0.017)	(0.037)	(0.021)	(0.015)	(0.020)	(0.029)
ContractHoursClass_PerStudent	0.460	-0.649	-0.547	0.461	1.963**	2.786*
School Level	(0.712)	(1.528)	(0.794)	(0.734)	(0.942)	(1.554)
voucher_School	13.903***	13.341***	14.468***	15.179***	15.669***	14.894***
School Level	(2.014)	(4.116)	(2.395)	(2.264)	(2.249)	(3.570)
voucher_ContractHourCPS (interaction)	-5.455***	-7.482***	-6.476***	-6.112***	-4.969***	-4.843**
School Level	(1.119)	(2.751)	(1.518)	(1.489)	(1.377)	(2.281)
%_Father_UniversityDegree	0.228**	0.170	0.318***	0.224***	0.164	0.130
School Level	(0.089)	(0.211)	(0.098)	(0.087)	(0.119)	(0.123)
%_Mother_UniversityDegree	0.240**	0.261	0.372***	0.329***	0.265**	0.155
School Level	(0.100)	(0.173)	(0.114)	(0.095)	(0.104)	(0.112)
avgIncome_Parents	0.451	0.111	0.105	0.243	0.861	1.087
School Level	(0.517)	(0.844)	(0.545)	(0.414)	(0.693)	(0.734)
boys	9.320***	10.301**	7.005	9.590***	4.741	9.993**
School Level	(2.328)	(4.610)	(4.403)	(1.820)	(4.839)	(4.861)
girls	9.604***	14.729***	11.317***	9.775***	6.916***	4.463*
School Level	(1.287)	(2.905)	(2.078)	(1.514)	(1.607)	(2.665)
fee	0.043	0.152*	0.055	0.074	-0.022	0.000
School Level	(0.068)	(0.087)	(0.062)	(0.055)	(0.067)	(0.069)
Density_5_14 years old	-1.158	1.467	-6.154	0.556	-2.216	3.295
Municipality Level	(6.071)	(11.048)	(6.193)	(5.274)	(7.308)	(11.908)
% Poverty	-0.013	-0.086	0.021	0.047	-0.020	-0.108
Municipality Level	(0.072)	(0.122)	(0.075)	(0.084)	(0.087)	(0.123)
%_Indigenous	-0.040	0.081	-0.040	-0.053	-0.057	-0.044
Municipality Level	(0.060)	(0.123)	(0.070)	(0.070)	(0.073)	(0.102)
MuniSpend_EducPCapita	-6.894	5.895	3.264	14.506	-15.244	-34.535
Municipality Level	(19.103)	(28.590)	(18.582)	(17.620)	(17.160)	(29.139)
BooksperCapita_2001	0.222**	0.261	0.088	0.190**	0.182*	0.213
Municipality Level	(0.096)	(0.168)	(0.163)	(0.097)	(0.110)	(0.185)
%_Illiteracy_2006	0.869***	0.780*	0.834***	0.564**	0.703**	1.072***
Municipality Level	(0.253)	(0.404)	(0.257)	(0.223)	(0.283)	(0.383)
AvgSchoolingPopulation	-0.022	-0.012	0.031	-0.251	0.054	0.093
Municipality Level	(0.243)	(0.419)	(0.252)	(0.241)	(0.245)	(0.428)
_cons	99.609***	94.408***	95.705***	104.633***	102.350***	104.653***
	(4.532)	(9.727)	(6.417)	(4.807)	(4.884)	(8.695)
Number of observations	2,909	2,909	2,909	2,909	2,909	2,909
R2	0.659	0.659	0.658	0.659	0.657	0.659
note: *** p<0.01, ** p<0.05, * p<0.1						

[109] Standard errors are in brackets.

4 Is Assortative Mating a Limitation for Intergenerational Mobility? : The Role of the Chilean Privatisation Educational Reform

4.1 Summary Chapter 4

- The way that couples are formed could influence the socioeconomic openness in society. Assortative Mating is understood as the level of association between socioeconomic characteristics of couples in education, income, occupation, etc.
- Assortative Mating has been suggested as a consequence of people's interaction in similar environments and educational institutions could be one of the most common contexts where people meet and interact.
- Chile seems to present a high level of assortative mating, and it could be playing a role in terms of intergenerational earnings dependency. If individuals reproduce the socioeconomic condition of their parents, and their parents have similar characteristics (similar education, earnings and background), then the intergenerational earnings dependency could be even higher.
- The data utilised is the Cross-sectional CASEN survey (National Socio-economic Characterisation Survey) of 1990 and 2009, a nationally representative survey used as the main instrument to design and evaluate social policies in the country. The interesting aspect of these data is that the 2009 survey asked individuals about their parents when they were 15 years old, including information about education, occupation and age (but not income). This data set is the same as the one utilised in the chapter 2 of this research.
- The results found indicate that assortative mating explains 20% of intergenerational earnings dependency variance.

- In addition, the influence of father-in-law's earnings is similar to the influence of father's earnings on an individual's earnings, which would suggest that individuals marry individuals with similar parents.
- Finally, the Chilean 1980s educational reform had an impact on the level of assortative mating in the country, increasing segregation of individuals at least those with lesser education.

4.2 Introduction to Chapter 4

The way that couples, in particular married ones, are conjoined could play an active role in terms of reproducing and confirming the levels of income transmission between parents and their offspring. If richer and well educated individuals get married to similar individuals and similarly for the way that poorer individuals, in terms of income and/or education, are matched, the socioeconomic condition of these individuals could be reinforced into the next generation. In particular, if people also reproduce their parents' socioeconomic condition, the level of homogenisation will help perpetuate the level of inequality in society (Hirvonen, 2008). Therefore, there could exist a relationship between the level of association between the socioeconomic characteristics of couples, also called 'assortative mating' or matching, and the level of intergenerational mobility. This could become relevant for analysing one of the causes of the level of intergenerational mobility in societies, especially if it is considered that "the transmission of economic success across generations remains something of a black box" (pp. 2, Bowles and Gintis, 2002). In this respect, it is believed that if the level of assortative mating is high, intergenerational mobility will be lower, because if couples are not formed randomly in terms of their education or income then the persistence and reproduction of the socioeconomic status of their parents seems more likely.

Assortative mating and more specifically marital homogamy can be understood as the partnership between individuals of the same (or similar) social background, ethnic group or religious affiliation, or the level of human capital (Birkelund and Heldal, 2003), among other things. Educational assortative mating seems to be one of the most important types because of the role that education plays in determining future earnings and socioeconomic situation (Schwartz and Mare, 2005). It has been suggested, therefore, that educational assortative mating can be one of the channels through which intergenerational mobility can be limited (Raaum *et al.*, 2007). On the other hand, the benefits of heterogeneous marriages can be given by the fact that children will grow up in wider diversity and more tolerance, potentially promotingan openness in society.

Non-random sorting among couples has been suggested as being a consequence of people's interaction in similar environments, where individuals meet people with similar interests, values and in many cases, with similar socioeconomic status (Kalmijn and Flap, 2001). Educational institutions have been mentioned to be one of the most important contexts where people meet and interact, in particular peer group effects would be very important in terms of influencing educational outcomes, creating social networks and as small clubs of individuals with high entry barriers. In particular, if an educational system is characterised by sorting of students by family background or income, or student ability, then the peer group will likely be homogenous and the members of potential couples formed in that environment will also be alike as shown by Nielsen and Svarer (2006) who for the case of Denmark find that levels of educational assortative mating are due to individuals' opportunities in the marriage market.

The empirical evidence related to assortative mating is plentiful in descriptive terms, considering that the levels of correlation between characteristics of members of couples has been analysed not only from the economics perspective, but is also commonly in sociological and psychological research (see for example, Nakosteen and Zimmer, (2001)). The change over time of this phenomenon has also been considered, with a general consensus that assortative mating has been increasing over time. In this respect, Benardi (2003) analyses different levels of assortative mating in Europe concluding that in Italy, for example, levels of educational homogamy have increased over time, and Halpin and Chan (2003) propose the possibility that the change in the patterns of educational mating could be a result of the increase of women's participation in the labour market in the UK. However, very few researchers have focused on the effect of educational reforms and the impact on assortative mating and intergenerational mobility, and on the differences between the level of assortative mating considering the income distribution (see Hussain *et al.*, (2011) who found that assortative mating at the top of the income distribution is higher than in the lower part).

Blanden (2005) analyses the relationship between assortative mating and intergenerational mobility for the case of Canada, concluding that a daughter's and her partner's income are influenced by her parent's income, suggesting that assortative mating tends to increase income persistence between generations. She found that individuals that get married later in life seem to be more homogeneous in terms of parental income, and married couples are more homogeneous than those that are only cohabiting. Couples living in urban areas also seem also to be more homogenously matched. In addition, she shows that if male partners contribute in a larger proportion to the total income of their related household, assortative mating has a higher influence on the intergenerational income dependency of daughters.

In addition, analysing the effect that assortative mating has on intergenerational mobility, Lam and Schoeni (1993), using a Brazilian working male sample between 30 and 55 years old, conclude that schooling of an invidual's parents-in-law has a larger effect on their earnings than the schooling of their own father. Chadwick and Solon (2002) who expanded upon this idea, analysing the effect of a daugther's parents' income and her income or her husband's income in the US finding that assortative mating in earnings (a similar level of correlation between the daughter's income and her parents' income and between the daughter's husband and his parents-in-law's earnings) plays an important role in terms of intergenerational earnings dependency. They conclude that the elasticity of the couple's combined earnings with respect to the wife's parents' earnings would be influenced by the share of husband's earnings in combined earnings, therefore if the proportion of the household's earnings attributed to the man is higher, then the level of dependency between him and his parents-in-law will be higher as well, probably due to the fact that richer individuals fervently want to keep their social status. Finally, Ermisch *et al.* (2006), using British and German data found that, on average, around 40-50% of the intergenerational income dependency between individuals and partner's joint income and that of the individual's parents is produced by the level of assortative mating in human capital.

Trying to contribute to the previous research, this investigation presents a theoretical model that describes the impact that assortative mating on schooling could have on intergenerational mobility of earnings, as well as some empirical evidence in the context of Chilean society. In particular, the model developed for this research is based on several previous models such as Solon (2004), which describes the earnings dependency coefficient between child and parents in terms of earnings return to human capital, the heritability ability coefficient between parents and child, the technology that translates investment in human capital and the progressivity of social policy, but not on the level of assortative mating among members of a couple. In addition, the model developed by Ermisch *et al.* (2006) has been considered, which analyses the effect of schooling assortative mating on the level of intergenerational mobility. Their model implies an initial separate evaluation of the intergenerational dependency between a child's earnings and their parents' and a child's partner's earnings and his/her parents-in-laws. The first depends on the level of altruism of parents and the price of human capital investment and earnings return to human capital and the second depends on the same variables plus the level of assortative mating in human capital. They then calculate a joint dependency of the child's and his/her partner's earnings, calculating the intergenerational earning dependency between child and partner's earnings (joined) and the child's parents' earnings, concluding that it only depends on the level of assortative mating of the couples and the child and partner's earnings returns to human capital (which are assumed to be different considering the differences in terms of earnings between women and men in the labour market). This differs to the model presented in this research, as there is no initial separation of effects, but a relationship between individual and partner's joint earnings and the individual's father's earnings is considered.

Holmlund (2008) also considers assortative mating in terms of human capital of the members of couples (developing a very similar model to the one developed in this research), but considering 2 options of matching: The human capital is perfectly matched (non-random) with probability *p* (also understanding it as the level of assortative mating), or the human capital is matched randomly with the average peer group human capital with probability *1-p*. Using these specifications the intergenerational mobility is calculated between individuals and their own parents and between partners and their parents-in-law as in Ermisch *et al*. (2006). The former would depend on earnings returns to human capital (which are not different between women and men), on the technology that translates investment into human capital and on the level of progressivity of the educational policy. The latter would depend on the same variables but includes a positive effect of assortative mating (as all the other models mentioned before predict). Therefore, for the partners and his/her parent-in-law's earning dependency, more assortative mating produces a decrease in intergenerational mobility.

Hence, this investigation combines the models above, in a way that there is a clear causality of levels of dependency in school among members of a couple on the level of intergenerational earnings dependency is established. In addition, and considering that the Chilean educational reforms of the 1980s[110] could have influenced a change in the way that Chilean couples sort with each other (especially due to potential segregation effects mentioned above) the effect of the reform on the level of assortative mating in society has also been analysed. This seems to be worth analysing as high levels of assortative mating in society could indicate a lack of interaction between people from different social groups, so it would be a good indicator of social openness and integration (Birkelund and Heldal, 2003). Certainly, if marriage selection is random then intergenerational mobility will be higher. This would be particularly important in the Chilean context where the 1980s educational reform seems to have created higher levels of segregation between the socio-characteristics of students.

[110] Characteristics and consequences of the 1980s Chilean educational reform have been discussed in the introduction of this research, and in Chapter 3, where an analysis of school competition after this reform has been included.

4.3 Out of Sight, Out of Reach: How People Choose a Mate

People tend to live most of their lives as couples; the explanation could be purely biological and related to the instinct of reproduction, other reasons could be related to sharing experiences, ideals, hopes and dreams and enjoying the benefits of not being alone - something that could be called love. As mentioned earlier, Becker (1973) formalised this and explained that people get married when it is supposed that their utility increases compared to staying single (but this potential increase in utility would not only be related to the benefits given by economies of scale, because these kinds of benefits could be obtained by living with friends or relatives without necessarily getting married). The reasons for choosing a partner are varied, for example physical attraction, chemical and hormonal reactions, similar religion, values or race. On the other hand, reasons could be related to levels of human capital accumulated by individuals, their income or social background, and in the most undesirable cases, by force or early family arrangements. Therefore, 'love' may not operate arbitrarily (Birkelund and Heldal, 2003).

In terms of assortative mating, two complementary perspectives have been described that explain the choice process: Demand-side theories focus on the preferences that individuals have in order to choose their ideal partner, this theory is also called cultural matching, as people match with similar individuals, those that share the same religious or cultural values and interests. On the other hand, the supply-side perspective explains that people participate in different social contexts, which shapes their options in terms of potential partners (Torche, 2010). Therefore, assortative mating could be influenced not only by preferences of individuals, but also by structural constraints. The second perspective is of particular relevance to this research, as it is founded in the belief that people spend most of their time in determined contexts, for example at work, in a club, in their neighbourhood and at school or university. This setting, where individuals want to find a partner and they choose (based on their preferences) between their possibilities, is understood as a marriage market, where people interact, meet and potentially find a partner taking account of some criteria and considering certain limitations like age, for example Becker (1973).

Environments where people spend most of their time become relevant as one of the places where people could likely meet and form a couple. These settlements could differ in the level of opportunities that they offer in order to find a spouse. Contexts where people interact are obviously not designedly created to give couples opportunities, but they give the opportunity for individuals to be in contact with each other. If these social environments suffer from segregation, it is likely that people choose people with similar characteristics, especially if they are very segregated into groups that are difficult to penetrate (Kalmijn and Flap, 2001). In particular, societies become more stratified when individuals interact to a greater extent with relatively similar people than with relatively different people (Fernandez and Rogerson, 2001). For example, in societies with high social segregation it would be more difficult for someone with a low level of education to meet someone with a high educational attainment (Fernandez, 2001). But also, people may only have the opportunity to meet potential spouses with similar educational backgrounds, so the homogeneity of a couple's human capital will naturally be influenced by the proportion of individuals with the same level of education in the society (Lee, 2008)[111]. This could be exacerbated even more if people prefer or feel obligated,

[111] This has been classified as a macro-level interaction in terms of the opportunities to find a partner, which basically depends on the relative size of a particular group in terms of the whole population (Kalmijn and Flap, 2001).

due to social pressure, to choose someone similar to them in terms of education, which could also delay marriage for a long time (Lewis and Oppenheimer, 2000).

Schools would be an ideal place for people to meet as students are normally homogenoeus within them, normally with similar ages and there are usually similar numbers of girls and boys. Kalmijn and Flap (2001) point out that schools promote most of the types of couple homogeneity, finding that in the Netherlands 15% of couples attended the same school, findings similar to those of Laumann *et al.* (1994) who found that 23% of couples in the US attended the same school. On the other hand, the workplace could be a less favourable environment because people are more segregated by gender and there is a lower female labour force participation.

Mare (1991) points out that the age at which people decide to get married could affect the probability that they will find a partner with similar socioeconomic characteristics. So, people who marry many years after finishing school will decrease their chances to find someone alike. But, if the same is true in terms of different levels of educational attainment, each level of education creates barriers to marriage, that is, people who attended university will probably meet many more people who also attended university than people that did not finish secondary school. Because of the consecutive schooling process, a couple who met at school would have less probability of having educational homogeneity than a couple that met at university because in the first case one member of the couple can decide to stop studying at secondary level but the other member might decide to carry onto a degree at university. Furthermore, the second couple would be much more likely to be homogeneously matched, as university degrees are among the last levels of education possible to achieve. In this sense, schools/universities play an important role as most of them are homogeneous in terms of age, level of education, or social situation of students (that is particularly true in the Chilean case) and it could be possible that a bigger educational attainment gap between members of a couple will be more common amongst those who met at lower levels of schooling.

4.3.1 Assortative Mating and Human Capital

As was mentioned before, assortative mating can be understood as the level of association between members of a couple in terms of age, education, class destination, class background and religious background, among others. It is also possible that people focus on psychological aspects, for example, Vaillant and Wolff (2011) using data from France and focusing on the non-desirable characteristics of partners, find that men reject women that seem vulgar or unfaithful because of potential infidelity in the marriage, and women avoid alcoholic, selfish or violent men. In spite of all the potential dimensions in which assortative mating can be found, educational homogamy among members of a couple is what will be mainly considered for the extent of this research, as if it is positive it may increase and reinforce social and earnings inequality between families (Becker, 1974). In particular, if individuals are likely to care about their future socioeconomic condition, so they will prefer a partner that potentially offers them the best possibility for fiscal security. Therefore, if education is considered a better predictor of the future social position than other characteristics such as social origin or race, then spouse selection will be mostly driven by educational levels of potential partners, therefore increasing the levels of educational assortative mating (Smits *et al.,* 1998), especially if it is considered that some women seek to attain levels of human capital as a signal of their abilities in order to find better partners.

The best way to design an educational system is controversial, especially because even though education creates benefits by itself, it could also create an elitist society where there are fewer opportunities for children from poorer backgrounds (Cremer *et al.,* 2010). Therefore, the way in which educational systems are organised has implications for economic and social outcomes and for the distribution of welfare in society (Machin, 2004), for example, separating children among streams in early stages can make differences in terms of the levels of mobility in society but also in terms of assortative mating of couples (Ermisch *et al*., 2006).

The Chilean educational system has been suggested as being very segregated (Elacqua, 2009c). In particular, it has been claimed that the 1980s Chilean educational reform exacerbated the levels of segregation among students, where children from better socioeconomic backgrounds are concentrated in to voucher schools and poorer children into public schools, and that could be playing an important role in terms of the level of association between the characteristics of members of a couple. Furthermore, if it is considered that each member of a couple will bring their social networks to the partnership, then this could reinforce the segregation among individuals as they do not necessarily prefer a partner with a similar level of education, but they would like to secure a better social status through an homogeneous marriage (Blossfeld and Tim, 2003).

4.3.2 Differences between Cohabitating and Married Couples

Cohabitating can be understood as an informal marriage, so partner choice in a cohabitational context should be similar to the partner preferences in marriage, but if cohabitation is understood as a light version of marriage, so, cohabitating couples could be more heterogeneous than married couples (Halpin and Chan, 2003). However, it is possible to think that the cohabitating choice should give more importance to short term and achieved characteristics such as education, and less importance to characteristics such as age, religion and race because cohabitation normally involves less commitment (at least financially) and more independency. Schoen and Weinick (1993), point out that it could be possible that married women are more interested in the economic characteristics of men. On the other hand, men pay more attention to non-economic characteristics such as age, race or looks. Education should be very important for men, as education is highly correlated with earnings. Therefore, women will marry men with more education than their own in a larger proportion than men would get married with women with more education than themselves. In the case of cohabitating couples, there could be more homogeneity in terms of education, because in general both members of the couple contribute to household income, so they will probably care about education, and less homogeneity with regards to religion and age. In this respect, Hamplova (2005), studying cohabitating and marriage patterns in some European countries finds that among individuals with higher levels of education, cohabitating partners are more educationally homogenous than partners when they are married, but the opposite is found among couples with lower levels of education.

4.4 A Theoretical Model of Assortative Mating and Intergenerational Mobility

This section develops a simple model that presents a formal relationship between assortative mating and intergenerational earnings dependency. It has been considered that the education of members of a couple is positively correlated. It is clear that reality is much more complex than a model can try to represent, but for the purposes of simplicity, the main assumptions considered are:

- Individuals live 2 periods of time (t and t+1). In the former, parents consume part of their income and invest in their offspring's human capital. In the second period, their child is an adult and has his/her own household, earnings and a partner.

- Couples have only 1 child.

- Assortative mating is positive (more educated people mate with people of a similar educational level and similarly for less educated people).

- Richer parents have the same level of altruism compared to poorer parents (it could be the case that richer parents face a social pressure for investing more in their children)[112].

The utility function of individual *i*'s parents depends on their own consumption at period*t* (c_{it}) and their child's future permanent household income (${y_{it+1}}^{Household}$). The proportion of concern between one and the other (understanding that for budget constraint reasons they will act as substitute goods) will be expressed as α (the level of altruism of parents), where $0 \leq \alpha \leq 1$.

$$(1)\ U^{Parents}{}_{it} = (1-\alpha)\log(c_{it}) + (\alpha)\log({y_{it+1}}^{Household})$$

The total household permanent income of the child *i* when adult in *t+1* will be the joint individual permanent income (${y_{it+1}}^{Household}$) and his/her partner's permanent income (${y_{it+1}}^{P}$).

[112] Mulligan (1997) suggests the possibility that altruism could be influenced by the economic status of parents.

$$(2)\quad {y_{it+1}}^{Household} = y_{it+1} + {y_{it+1}}^{P}$$

Educational homogamy has been considered,because in general, women are part of the labour market in a small proportion, especially in the oldest cohorts, therefore this will be a more suitable factor for couples to match on that than on earnings (Birkelund and Heldal, 2003). Originally, the role of assortative mating is understood as the correlation between the human capital of the individual *i* (H_{it+1}) and the human capital of his/her partner (${H_{it+1}}^{P}$): $\rho = Corr(H_{it+1}, {H_{it+1}}^{P})$. However, this association between human capital held by the members of the couple will be interpreted as a selection process, where individuals who normally take human capital decisions before establishing a formal relationship (marriage or cohabitation) choose a partner with a relative homogeneity in human capital among the possible candidates in the "marriage market", which is supposed to exist as individuals compete to find their partners (Becker, 1973).

The aim is not to claim an unlikely causality between couple members' human capital (which could exist, in the sense that many individuals could meet at university for example and decide to extend their undergraduate studies to masters or doctorate degrees simply because their partner decided to do so), but simply to represent the process of picking up a partner with similar educational characteristics (human capital will be understood as the level of education, more specifically as the number of years of schooling of individuals). The benefits in terms of schooling due to marriage will therefore depend on the decision of other individuals, who also have to decide how much schooling to achieve. Nevertheless, because most of the schooling decisions effectively take place before marriage, potential partners cannot agree on their levels of investment in education, so they take their decision considering that it may affect their choice in the future as regards their appropriate partner (Chiappori *et al.*, 2009).

Unmarried men and women interact in a marriage market, where individuals consider different characteristics of their potential partners. A potential wife's human capital would be attractive for men because it could give husbands access to wider networks and they can be useful in terms of a husband's career (Kalmijn, 1998). Therefore, the level of assortative mating will be represented by Ω_1, or how much influence the human capital of the partner has when the individual chooses them over other potential partners (in the same spirit as Ermisch *et al.* (2006)).

$$(3) \quad {H_{it+1}}^{P} = \Omega_0 + \Omega_1 H_{it+1} + {\omega_{it+1}}^{P}, \ \ \Omega_1 > 0 \quad \text{(positive assortative mating)}$$

In equation (3), ${\omega_{it+1}}^{P}$ represents the other factors that influence the matching process decision (other factors that affect the partner's decision of acquiring more human capital).

In addition, the human capital of an individual plays an important role on the level of earnings, so the earnings of the individual *i's* household would be mostly determined by their own human capital and their partner's human capital. This will be represented in a semi-logarithm earnings function in equation (4), where ρ_1 and ρ_2 represents the individual *i's* and their partner's returns to education respectively, assuming that there is a disparity between returns to human capital for men and women[113]. It is also believed that

[113] Specifically for the case of Chile, the returns to years of schooling for female individuals are higher (9.4% per year of schooling) than for male individuals (8.2% per year of schooling) according to Psacharopoulos and Chu (1992).

"husband's wage and wife's education are positively correlated, because maybe a wife's education contributes to her husband's earnings, as mothers' education contributes to her children's earnings." (Becker, 1973), therefore a partner's human capital would have a double effect: Increasing the household's earnings through their own earnings and increasing the household's earnings through his/her spouse's earnings.

$$(4)\ \log({y_{it+1}}^{Household}) = \rho_0 + \rho_1 H_{it+1} + \rho_2 {H_{it+1}}^{P}$$

A traditional budget constraint for parents is considered, assuming that they divide their income (or earnings) between their own consumption and the amount of monetary resources invested in their child's human capital (τ).

$$(5)\ y_{it} = c_{it} + \tau_{it}$$

Following Solon (2004), the technology that translates the parental investment (private investment) and public investment in education (G_{it}) into their child's human capital is represented by equation (6), where $\theta > 0$ is considered to obtain positive marginal productivity of human capital and μ_{it} corresponds to the child's attributes which are solely influenced by nature.

$$(6)\ H_{it+1} = \theta \log(\tau_{it} + G_{it}) + \mu_{it+1}$$

Additionally, to include the child's endowment dependency with his/her parents endowment, equation (7) represents a first-order autoregressive process (AR), where λ represents the heritability coefficient between parents and their offspring.

$$(7)\ \mu_{it+1} = \delta + \lambda\mu_{it} + \nu_{it+1}$$

In order to maximise the utility function described in equation (1), it has been left in terms of parents' investment as this will represent a decision made by the parents. Therefore replacing equation (4) and (5) in the utility function (1):

$$(8)\ U^{Parents}{}_{it} = (1-\alpha)\log(y_{it} - \tau_{it}) + \alpha(\rho_0 + \rho_1 H_{it+1} + \rho_2 H_{it+1}{}^{P})$$

Replacing (3) and (6) in (8):

$$(9)\quad U^{Parents}{}_{it} = (1-\alpha)\log(y_{it} - \tau_{it}) + \alpha(\rho_0 + \rho_1[\theta\log(\tau_{it} + G_{it}) + \mu_{it+1}] + \rho_2[\Omega_0 + \Omega_1 H_{it+1} + \omega_{it+1}{}^{P}])$$

Replacing (6) in (9):

$$(10)\qquad = (1-\alpha)\log(y_{it} - \tau_{it}) + \alpha(\rho_0 + \rho_1[\theta\log(\tau_{it} + G_{it}) + \mu_{it+1}] + \rho_2[\Omega_0 + \Omega_1[\theta\log(\tau_{it} + G_{it}) + \mu_{it+1}] + \omega_{it+1}{}^{P}])$$

Rearranging (10)

$$(11)\qquad = (1-\alpha)\log(y_{it} - \tau_{it}) + \alpha\rho_0 + \alpha\rho_1\theta\log(\tau_{it} + G_{it}) + \alpha\rho_1\mu_{it+1} + \alpha\rho_2\Omega_o + \alpha\rho_2\Omega_1\theta\log(\tau_{it} + G_{it}) + \alpha\rho_2\Omega_1\mu_{it+1} + \alpha\rho_2\omega_{it+1}{}^{P}$$

To obtain the family investing behaviour, the utility function in (11) is maximised:

(12)

$$Max\ U^{Parents}{}_{it} = (1-\alpha)\log(y_{it} - \tau_{it}) + \alpha\rho_0 + \alpha\rho_1\theta\log(\tau_{it} + G_{it}) + \alpha\rho_1\mu_{it+1} + \alpha\rho_2\Omega_o + \alpha\rho_2\Omega_1\theta\log(\tau_{it} + G_{it}) + \alpha\rho_2\Omega_1\mu_{it+1} + \alpha\rho_2\omega_{it+1}{}^{P}$$

Therefore, the first order condition involves:

$$(13) \qquad \frac{\partial U^{Parents}{}_{it}}{\partial \tau_{it}} = \frac{-(1-\alpha)}{y_{it}-\tau_{it}} + \frac{\alpha\rho_1\theta}{\tau_{it}+G_{it}} + \frac{\alpha\rho_2\Omega_1\theta}{\tau_{it}+G_{it}} = 0$$

Solving equation (13):

$$<=> \frac{(1-\alpha)}{y_{it}-\tau_{it}} = \frac{\alpha\rho_1\theta}{\tau_{it}+G_{it}} + \frac{\alpha\rho_2\Omega_1\theta}{\tau_{it}+G_{it}}$$

$$<=> (1-\alpha)(\tau_{it}+G_{it}) = \ y_{it}(\alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta) - \ \tau_{it}(\alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta)$$

$$<=> (1-\alpha)\tau_{it} + \tau_{it}(\alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta) \ = \ y_{it}(\alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta) - (1-\alpha)G_{it}$$

$$<=> \tau_{it}[1-\alpha + \ \alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta] \ = \ y_{it}(\alpha\rho_1\theta + \ \alpha\rho_2\Omega_1\theta) - (1-\alpha)G_{it}$$

Obtaining the optimal level of private (parental) investment in human capital of their child:

$$(14) \qquad \tau_{it}{}^{*} = \frac{y_{it}\theta\alpha(\rho_1 + \rho_2\Omega_1) - (1-\alpha)G_{it}}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}$$

Therefore, it is possible to see that parental investment would depend on their income (y_{it}), their level of altruism (α), the technology that translates public and private investment into human capital (θ), the returns to education of the members of the couple (ρ_1 and ρ_2), the government spending on education (G_{it}) and the level of human capital assortative mating (Ω_1). The effect of each of them on the optimal level of private investment in human capital is calculated by estimating the first derivative of (14) with respect to the variables mentioned above:

- $\frac{\partial \tau_{it}}{\partial \theta} =$

$$\frac{y_{it}\alpha(\rho_1+\rho_2\Omega_1)[1-\alpha+\alpha\theta[\rho_1+\rho_2\Omega_1]]-[y_{it}\theta\alpha(\rho_1+\rho_2\Omega_1)-(1-\alpha)G_{it}]\,[\alpha\rho_1+\alpha\rho_2\Omega_1]}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$$

$$=\frac{y_{it}\alpha(\rho_1+\rho_2\Omega_1)-y_{it}\alpha^2(\rho_1+\rho_2\Omega_1)+y_{it}\alpha^2\theta(\rho_1+\rho_2\Omega_1)^2-y_{it}\alpha^2\theta(\rho_1+\rho_2\Omega_1)^2+(1-\alpha)G_{it}\alpha(\rho_1+\rho_2\Omega_1)}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$$

$$=\frac{y_{it}\alpha(\rho_1+\rho_2\Omega_1)-y_{it}\alpha^2(\rho_1+\rho_2\Omega_1)+(1-\alpha)G_{it}\alpha(\rho_1+\rho_2\Omega_1)}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$$

$$=\frac{y_{it}\alpha(\rho_1+\rho_2\Omega_1)(1-\alpha)+(1-\alpha)G_{it}\alpha(\rho_1+\rho_2\Omega_1)}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$$

$$\text{(15)} \qquad \frac{\partial \tau_{it}}{\partial \theta}=\frac{\alpha(1-\alpha)(\rho_1+\rho_2\Omega_1)(y_{it}+G_{it}) \quad >0}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2>0} > 0$$

Therefore, an increase in the efficiency of the technology that translates public and private investments into human capital is associated with an increase in the private investment.

- $\frac{\partial \tau_{it}}{\partial \rho_1}=\frac{y_{it}\alpha\theta[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]-[y_{it}\alpha\theta(\rho_1+\rho_2\Omega_1)-(1-\alpha)G_{it}]\alpha\theta}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$

$$=\frac{y_{it}\alpha\theta-y_{it}\alpha^2\theta+(1-\alpha)G_{it}\alpha\theta}{[1-\alpha+\alpha\theta(\rho_1+\rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\alpha\theta(1-\alpha) + (1-\alpha)G_{it}\alpha\theta}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

(16) $$\frac{\partial\tau_{it}}{\partial\rho_1} = \frac{\alpha(1-\alpha)\theta(y_{it}+G_{it}) \quad >0}{[1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)]^2 >0} > 0$$

❖ $$\frac{\partial\tau_{it}}{\partial\rho_2} = \frac{y_{it}\alpha\theta\Omega_1[1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)] - [y_{it}\alpha\theta(\rho_1+ \rho_2\Omega_1) - (1-\alpha)G_{it}]\alpha\theta\Omega_1}{[1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\alpha\theta\Omega_1 - y_{it}\alpha^2\theta\Omega_1 + (1-\alpha)G_{it}\alpha\theta\Omega_1}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\alpha\theta\Omega_1(1-\alpha) + (1-\alpha)G_{it}\alpha\theta\Omega_1}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

(17) $$\frac{\partial\tau_{it}}{\partial\rho_2} = \frac{\alpha(1-\alpha)\theta\Omega_1(y_{it}+G_{it}) \quad >0}{[1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)]^2 >0} > 0$$

Both returns to education (individual and their partner) are positive, so an increase in them results in more private investment in education.

❖ $$\frac{\partial\tau_{it}}{\partial\alpha} =$$

$$\frac{[y_{it}\theta(\rho_1+ \rho_2\Omega_1)+ G_{it}][1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)] - [y_{it}\theta\alpha(\rho_1+ \rho_2\Omega_1) - (1-\alpha)G_{it}][-1+\theta(\rho_1+ \rho_2\Omega_1)]}{[1-\alpha+ \alpha\theta(\rho_1+ \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\theta(\rho_1 + \rho_2\Omega_1) + G_{it}\theta\alpha(\rho_1 + \rho_2\Omega_1) + [1-\alpha]G_{it}\theta(\rho_1 + \rho_2\Omega_1)}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\theta(\rho_1 + \rho_2\Omega_1) + G_{it}\theta(\rho_1 + \rho_2\Omega_1)[\alpha + 1 - \alpha]}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$= \frac{\theta(\rho_1 + \rho_2\Omega_1)[y_{it} + G_{it}]}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$(18)\ \frac{\partial\tau_{it}}{\partial\alpha} = \frac{\theta(\rho_1 + \rho_2\alpha_1)[y_{it} + G_{it}]>0}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2>0} > 0$$

Therefore, parental altruism affects their investment in human capital positively.

❖ $$\frac{\partial\tau_{it}}{\partial\Omega_1} = \frac{y_{it}\alpha\theta\rho_2[(1-\alpha)+\alpha\theta(\rho_1 + \rho_2\Omega_1)] - [y_{it}\alpha\theta(\rho_1 + \rho_2\alpha_1) - (1-\alpha)G_{it}][\alpha\theta\rho_2]}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\alpha\theta\rho_2 - \alpha^2 y_{it}\theta\rho_2 + (1-\alpha)G_{it}\alpha\theta\rho_2}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$= \frac{y_{it}\alpha\theta\rho_2(1-\alpha) + (1-\alpha)G_{it}\alpha\theta\rho_2}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]^2}$$

$$(19)\quad \frac{\partial\tau_{it}}{\partial\Omega_1} = \frac{\alpha\theta\rho_2(1-\alpha)[y_{it} + G_{it}] \quad >0}{[\alpha + (1-\alpha)\theta(\rho_1 + \rho_2\alpha_1)]^2>0} > 0$$

Finally, the level of assortative mating affects the level of investment in education positively, therefore an increase in the level of homogeneity in human capital increases how much parents invest in their child’s education. On the other hand, to ensure the maximisation of the private investment in education, the second order condition is given by:

$$(20)\quad \frac{\partial^2 U}{\partial\tau_{it}^{\,2}} = -\left[\frac{1-\alpha}{(y_{it} - \tau_{it})^2} + \frac{\alpha\theta[\rho_1 + \rho_2\Omega_1]}{(\tau_{it} + G_{it})^2}\right] < \quad 0$$

Therefore, it is ensured that the optimal level of private investment in education is a maximum of the utility function described previously.

Taking into account equation (4), the implication given by the optimal level of private investment in human capital in equation (14) would imply:

(21) $\log({y_{it+1}}^{Household}) = \rho_0 + \rho_1[\theta \log(\tau_{it} + G_{it}) + \mu_{it+1}] + \rho_2[\Omega_0 + \Omega_1[\theta \log(\tau_{it} + G_{it}) + \mu_{it+1}] + {\omega_{it+1}}^P]$

$$\log({y_{it+1}}^{Household}) = \rho_0 + \rho_1\theta \log(\tau_{it} + G_{it}) + \rho_1\mu_{it+1} + \rho_2\Omega_0 + \rho_2\Omega_1\theta \log(\tau_{it} + G_{it}) + \rho_2\Omega_1\mu_{it+1} + \rho_2{\omega_{it+1}}^P$$

$$= \rho_0 + \rho_1\mu_{it+1} + \rho_2\Omega_0 + (\rho_1 + \rho_2\Omega_1)\theta \log(\tau_{it} + G_{it}) + \rho_2\Omega_1\mu_{it+1} + \rho_2{\omega_{it+1}}^P$$

Replacing by the optimal level of investment:

(22)

$$\log({y_{it+1}}^{Household}) = \rho_0 + \rho_1\mu_{it+1} + \rho_2\Omega_0 + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{y_{it}\theta\alpha(\rho_1 + \rho_2\Omega_1) - (1-\alpha)G_{it}}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]} + G_{it}\right) + \rho_2\Omega_1\mu_{it+1} + \rho_2{\omega_{it+1}}^P$$

$$= \rho_0 + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{y_{it}\theta\alpha(\rho_1 + \rho_2\Omega_1) - (1-\alpha)G_{it} + G_{it}(1-\alpha) + G_{it}\alpha\theta(\rho_1 + \rho_2\Omega_1)}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}\right) + [\rho_1\mu_{it+1} + \rho_2\Omega_0 + \rho_2\Omega_1\mu_{it+1} + \rho_2{\omega_{it+1}}^P]$$

$$= \pi + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{y_{it}\theta\alpha(\rho_1 + \rho_2\Omega_1) + G_{it}\alpha\theta(\rho_1 + \rho_2\Omega_1)}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}\right) + \rho_1\mu_{it+1}$$

$$+ \rho_2\Omega_1\mu_{it+1} + \rho_2{\omega_{it+1}}^P$$

Where $\pi = \rho_0 + \rho_2\Omega_o$

$$= \pi + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{\theta\alpha(\rho_1 + \rho_2\Omega_1)(y_{it} + G_{it})}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}\right) + \mu_{it+1}(\rho_1 + \rho_2\Omega_1) + \rho_2{\omega_{it+1}}^P$$

$$= \pi + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{\theta\alpha(\rho_1 + \rho_2\Omega_1)}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}\right) + (\rho_1 + \rho_2\Omega_1)\theta \log(y_{it} + G_{it})$$

$$+ \mu_{it+1}(\rho_1 + \rho_2\Omega_1) + \rho_2{\omega_{it+1}}^P$$

(24)

$$\log({y_{it+1}}^{Household}) = \gamma + (\rho_1 + \rho_2\Omega_1)\theta \log(y_{it} + G_{it}) + \epsilon_{it+1}$$

When $\gamma = \pi + (\rho_1 + \rho_2\Omega_1)\theta \log\left(\frac{\theta\alpha(\rho_1 + \rho_2\Omega_1)}{[1-\alpha + \alpha\theta(\rho_1 + \rho_2\Omega_1)]}\right)$ and

(26) $\epsilon_{it+1} = \mu_{it+1}(\rho_1 + \rho_2\Omega_1) + \alpha\rho_2{\omega_{it+1}}^P$

It is important to note that ϵ_{it+1} corresponds to the sum of an autoregressive process or AR(1), μ_{it+1}, and a white noise error ${\omega_{it+1}}^P$ which is equal to an AR(1) process (see Granger and Morris (1976)).

(27) $\log({y_{it+1}}^{Household}) = \gamma + \theta(\rho_1 + \rho_2\Omega_1)\log(y_{it}\left(1 + \frac{G_{it}}{y_{it}}\right)) + \epsilon_{it+1}$

It is assumed that the ratio $\frac{G_{it}}{y_{it}}$ is small, i.e. that the public investment in education per child *i* at time*t* should be smaller than the child i's parents' permanent income. So, Taylor's approximation can be used:

$$(28)\ \log(y_{it+1}{}^{Household}) = \gamma + \theta(\rho_1 + \rho_2\Omega_1)\log(y_{it}) + \theta(\rho_1 + \rho_2\Omega_1)\frac{G_{it}}{y_{it}} + \epsilon_{it+1}$$

In addition, following Solon (2004), an empirical social policy implementation is utilised, which will be described as a "Policy Rule":

$$(29)\qquad \frac{G_{it}}{y_{it}} = \delta - \sigma\log(y_{it}) \text{ , with } \quad 0 < \sigma < 1$$

Using this policy rule, if σ is more positive, the largest effect of the policy would be thaton the income of children from low income families. Therefore, σ corresponds to the degree of progressivity of the education policy (Holmlund, 2008). The idea is that if σ is larger, the $\frac{G_{it}}{y_{it}}$ ratio is smaller, which means that the relationship between government spending on education and parental income will decrease or that government spending will be lower when parental income increases. A higher public spending on education will increase intergenerational income mobility as the higher resources will benefit poorer children more than richer children, that is because richer children will be able to get a high level of education with or without public investment (because their parents can increase their private investment).

Taking equation (29) and replacing it into equation (28):

(30)

$$\log({y_{it+1}}^{Household}) = \gamma + \theta(\rho_1 + \rho_2\Omega_1)\log(y_{it}) + \theta(\rho_1 + \rho_2\Omega_1)[\,\delta - \sigma\log(y_{it})] + \epsilon_{it+1}$$

(31)

$$\log({y_{it+1}}^{Household}) = \gamma + \theta(\rho_1 + \rho_2\Omega_1)\log(y_{it}) + \theta(\rho_1 + \rho_2\Omega_1)\delta - \theta(\rho_1 + \rho_2\Omega_1)\sigma\log(y_{it}) + \epsilon_{it+1}$$

(32)

$$\log({y_{it+1}}^{Household}) = \varphi + \theta(\rho_1 + \rho_2\Omega_1)(1 - \sigma)\log(y_{it}) + \epsilon_{it+1}$$

With (33) $\varphi \cong \gamma + \theta(\rho_1 + \rho_2\Omega_1)\delta$

Therefore, the intergenerational earnings dependency coefficient (between a parent's permanent earnings and their child's household earnings), using equation (32) is: $\mu = \theta(\rho_1 + \rho_2\Omega_1)(1 - \sigma)$ and it depends on the technology that translates investment into human capital (θ), the returns to education (ρ_1, ρ_2), the progressivity of the educational policy (σ) and the level of assortative mating (Ω_1). However, it is interesting to note that intergenerational dependency does not depend on the levels of parental altruism. A simple interpretation of this coefficient is that when the educational policy progressivity increases (when a larger proportion of the public spending on education goes to poorer families) the level of intergenerational mobility increases (the intergenerational earnings dependency decreases) as would be expected. On the other hand, higher levels of earnings return to education would decrease intergenerational mobility. If technology translates human capital in a more efficient way, then the levels of intergenerational mobility also decrease. Finally, the level of human capital homogeneity among the members of the couple increases the level of earnings dependency between a child's household earnings and the child's parents' earnings. It is important to consider that even though assortative mating can take values equal to zero (Ω_1=0), intergenerational dependency will take values which are non-zero, depending only on the technology, the individual's earnings returns to human capital and the progressivity of the educational policy: $\mu = \theta\rho_1(1-\sigma)$. Also note that differences in the parameters of the model could make a difference in terms of the level of intergenerational mobility in countries.

Table 4.1 gives a summary of the direction of the effect that each factor has on the level of private investment in human capital and the level of intergenerational earnings dependency.

Table 4.1: Summary of Effects on Private Investment in H.C and Intergenerational Earnings Dependency

Variable	**Effect**
Private Investment in Human Capital (τ)	α : +
	θ : +
	ρ_1, ρ_2: +
	Ω_1: +
Intergenerational Earnings Coefficient (μ)	σ : -
	θ : +
	ρ_1, ρ_2: +
	Ω_1 : +

4.5 Data

The data used for this research come from the cross-sectional National Socio-economic Characterisation Survey (CASEN) of 1990 and 2009, collected by the Ministry of Social Development of Chile. These surveys are used as the main source for social policy decisions and were also used in the second chapter of this research, but for this chapter information related to individual's partners and partner's parents will be included. The data consist of information about households and individual characteristics in terms of education, occupation, income and living conditions and are suitable for analysing the effect that educational assortative mating has on intergenerational earnings dependency, but also for analysing the effect of the 1980s educational reform in Chile and its impact in terms of educational assortative mating among couples. The survey in 2009 is particularly interesting for the first analysis because it asked individuals for information about their parents when the individuals were 15 years old. The questions are related to educational level, occupation and age. However, the survey does not include information related to income or earnings of parents. Therefore, individuals in 1990 are used as potential parents in a process that is fully detailed in the methodology section, respecting of course some restriction of age (not all individuals in 1990 could be parents of individuals in 2009 as they might have been too young or even too old). The sample in 1990 is therefore called 'the synthetic parents' sample.

As the synthetic father/parents survey of 1990 is totally independent of parents described by individuals in 2009, it is important to have a sample that is consistent in terms of age, the proportion of people with a determined level of education and the occupation that they describe. It is particularly important as earnings of parents will be predicted using these characteristics. Table 4.2 presents a comparison between the average age of male individuals' fathers reported by the individuals in 2009 and the age of their synthetic father (reported by the fathers themselves in 1990). It is possible to see that the average age of fathers of male individuals in 2009 is 60 years old, which is the same average age of the synthetic fathers observed in 1990 (once the 19 years difference between surveys is allowed). In addition, it is important to consider consistency between fathers of female individuals observed in 1990 and the ones reported by their daughters in 2009, in particular, this is relevant because the assortative mating relationship will include an analysis of the father in law of male indivduals. Table 4.3 presents the average father's age in 2009, which is claimed by their daughters (partner of male individual) and then compared to the age of the synthetic fathers in 1990 and again it is possible to see that these are very similar (see Appendix 4A1., Table 4A1.1 and Table 4A1.2 for the age of mothers reported by sons and daughters in 2009 respectively). The daughter's report now becomes important (in contrast to the analysis in the second chapter of this research) as the analysis of individuals (son when adult) and their partner's (daughter when adult) earnings is considered to analyse the effect of intergenerational earnings dependency. It is important to notice that this congruency in terms of the 1990 and the 2009 sample is similar, but not the same as the one presented in the second chapter of this investigation, because now the female partner's information (and her father's) has been included as explained above, therefore the congruency is a bit more complicated as it also included individuals, partners, individual's parents and individual's partner's parents.

Table 4.2: Father's Age in 2009 (reported by sons) versus 1990

Age of Father in 2009			
2009 (reported by sons)		1990 (synthetic fathers)	
t=0		t1=t+19	
Mean Age	59.98	Mean Age	59.7
Min Age	40	Min Age	44
Max Age	68	Max Age	84
St Dev.	5.93	St Dev.	11.45

Source: CASEN Surveys, 2009 and 1990

Table 4.3: Father's Age in 2009 (reported by daughters) versus 1990

Age of Father in 2009			
2009 (reported by daughters)		1990 (synthetic fathers)	
t=0		t1=t+19	
Mean Age	58.89	Mean Age	57.46
Min Age	40	Min Age	34
Max Age	73	Max Age	102
St Dev.	6.75	St Dev.	8.66

Source: CASEN Surveys, 2009 and 1990

The individual's and their partner's age is also important, and it should also be consistent with the age of their parents, but also with the age that they would be in 1990, because that year they are supposed to be 15 years old (as the survey asks individuals information about their parents at that age). Table 4.4 shows that the average age of sons in the 2009 sample was 34.53 years old; this figure should be congruent with the expected average age of sons if fathers in the 1990 sample are considered. That is, if the synthetic fathers in 2009 (the ones obtained using the sample in 1990 pushed forward 19 years) were on average 59.98 years old, then they must have been born in 2009-59.98=1949 and it is supposed that they have a child at the age of 25 years old (which was also checked as the most popular age on average to have children in the survey) then, the sons were born on average around 1949+25=1974. Therefore, sons in the year 2009 should be 2009-1974=35 years old, which is in fact the average age of children observed in 2009 (34.53). In addition, sons in 1990 were on average 16 years old, being consistent with the correspondent survey question. A similar consistency can be seen for daughters in Table 4.5.

Table 4.4: Son's Age

Son's Age in 2009	
Mean	34.53
Min	25
Max	56
St Dev.	5.86

Source: CASEN Survey, 2009

Table 4.5: Daughter's (Partner) Age

Daughter's Age in 2009	
Mean	32.11
Min	15
Max	57
St Dev.	6.66

Source: CASEN Survey, 2009

Graphically, this relationship between the parent's and child's age can be understood using a time line:

Figure 4.1 Time Line for Son and his Father

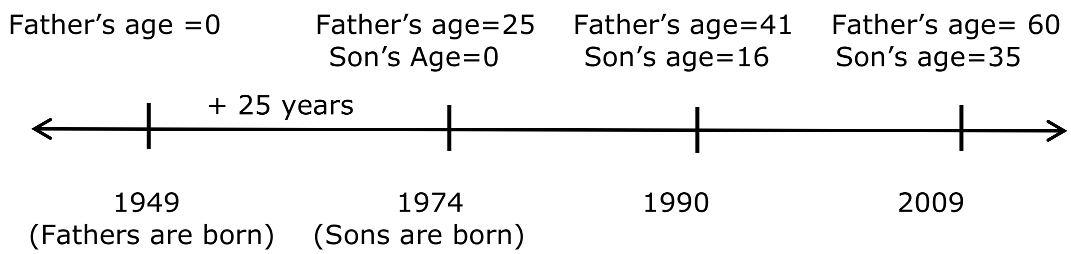
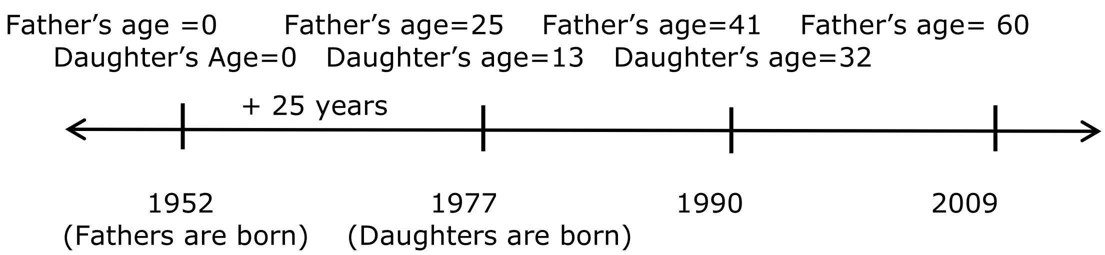


Figure 4.2 Time Line for Daughter and her Father



The procedure is very similar to the one used in Chapter 2 of this research, but with a modification of the limits on age for parents, as now congruency with a partner'sand partner's parents' age is also required. Working individuals have been included independent of their partner's employment status.

Using the samples mentioned above, in total it is possible to find 4,926 male individuals and female partner and father pairs, 5,717 male individuals and fathers-in-law pairs, and 4,664 male individuals and female partner and parent pairs, these figures are presented in Table 4.6:

Table 4.6: Sample Sizes with Information of Occupation, Education and Age of Fathers/Parents

Sub-Sample size	
Number of Son & Partner Pairs	6,763
Number of Daughter & Partner Pairs	1,811
Number of Father & Son Pairs	5,110
Number of Father in Law&Son Pairs	5,717
Number of Father & Daughter Pairs	1,517
Number of Father_Son & Partner Pairs	4,926
Number of Father_Daughter & Partner Pairs	1,481
Number of Parents & Son Pairs	4,841
Number of Parents & Daughter Pairs	1,462
Number of Parents_Son & Partner Pairs	4,664
Number of Parents_Daughter & Partner Pairs	1,427

Source: CASEN Surveys, 2009 and 1990

Table 4.7 shows some additional descriptive statistics, where for example, the number of married couples compared to cohabitating ones are presented, or the proportion of rural households in the year 2009 for the sample of male individuals, his partner and his father.

Table 4.7: Descriptive Statistics

Avg. Number of people in the household (St.Dev.)	4.3 (1.53)
Avg. Number of children in the household (St.Dev.)	1.6 (1.10)
% Rural	32.31%
Avg. Number years of SchoolingMale Individuals(St.Dev.)	11.01 (3.32)
Avg. Number years of SchoolingFemale Partners(St.Dev.)	11.06 (3.21)
Avg. Number years of SchoolingFathers of Male Individuals(St.Dev.)	8.30 (4.24)
Avg. Number years of SchoolingMothers of Male Individuals(St.Dev.)	8.15 (4.11)
% Married	64.18%
% Cohabitating	35.82%
Income ratio of richest to poorest decile(couples)	16.79
Income ratio of richest to poorest decile(individual)	25.28

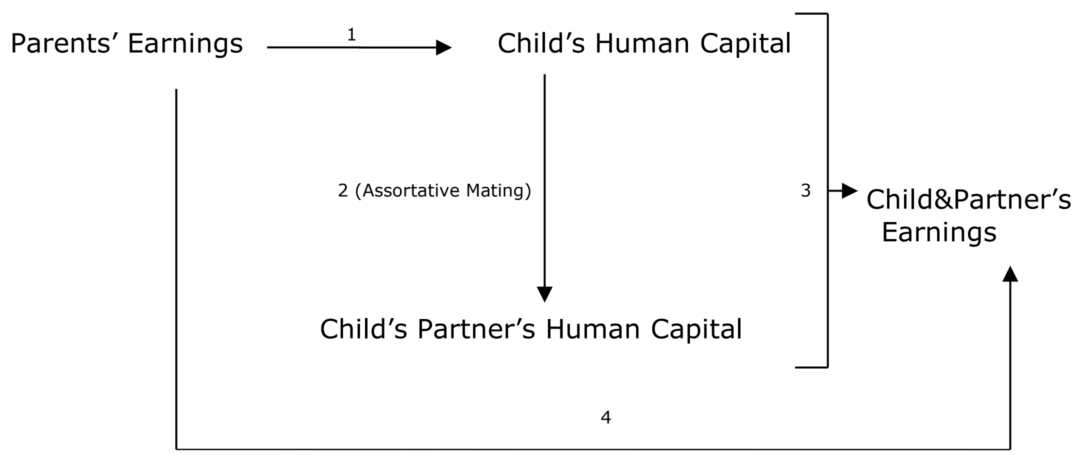
Source: CASEN Surveys, 2009 and 1990

In addition, when the role of the educational reform is considered, only the data of the year 2009 is utilised, using 47,825 couples between the ages of 25 and 90 years old. However, this sample is also restricted to compare closer generations of couples, limiting their age to between 40 and 55 years old reducing the sample to 24,279 couples.

4.6 Methodology

One of the most important aims of this research is to analyse the effect that human capital assortative mating has on the level of intergenerational earnings dependency between a father's earnings (or parents') and their child's household's earnings, following the idea that parents that have higher incomes will invest a larger amount of resources on their offspring's human capital; allowing their children, when adults, to get better jobs and higher earnings, but also be able to choose a higher quality partner (a partner with higher human capital and potentially higher earnings too) reinforcing the pure human capital effect in terms of the level of association between parents' earnings and their child's household's earnings, and this is shown in Figure 4.3:

Figure 4.3: Assortative Mating



In particular, the number of years of schooling of male individuals and their female partner has been considered (understanding marriage beyond legalisation, but as living in the same household as a couple) to analyse the effect of assortative mating on human capital, and to measure the levels of intergenerational dependency between the joined earnings of male individuals and their female partner and their father's (or their parents'). But also, intergenerational earnings dependency has been considered using female individuals and their male partner's earnings with the female individual's father (or parents).

4.6.1 The impact of Assortative Mating on Intergenerational Mobility

In order to analyse the effect that assortative mating has on the level of intergenerational mobility in society, the level of intergenerational dependency between male individuals plus their partners' earnings and the father's (or parents') earnings has to be available. The main problem of estimating this intergenerational dependency is that as was mentioned before, individuals in 2009 gave information related to education, occupation and age of their parents, but not of their earnings.

Therefore, the Two Sample Two Stage Least Squares (2STSLS) estimation is employed. This technique allows the connection of two totally independent data sets, in this case the 1990 and 2009 surveys. The first will represent the parents of individuals in 2009 as was explained in the first chapter of this research. Therefore, the main relationship used is the following (including control variables for the age of father, individual and partners):

$$\ln(y_{it+1}^{Individual+Partner}) = \varphi + \mu \ln(\hat{y}_{it}^{Father}) + \xi_{it+1}^{Individual+Partner}$$

Where μ corresponds to the intergenerational earnings dependency between the individual's and partner's earnings and his father's predicted earnings (details of the calculation were explained in Chapter 2). In the general case, only male individuals are considered with their respective female partner, but the analysis also considers a case using female individuals with their respective male partners[114].

It is also necessary to estimate the level of assortative mating in society, understanding it as the level of dependency between the years of schooling of individuals and their partners (controlling for their age), estimated using OLS.

$$H_{it+1}^{Partner} = \Sigma + \Omega H_{it+1}^{Individual} + \omega_{it+1}^{Partner}$$

Finding the value of μ should be of interest by itself. However, a focus on the level of intergenerational mobility has already been done in Chapter 2 of this

[114] Homosexual couples were not included in Chilean surveys until very recently, as it is a less open situation than in more developed economies.

research, and also one of the most important aims is actually to calculate how much assortative mating impacts the level of intergenerational dependency.

Therefore, the first stage was to create two bi-dimensional pairs of matrices, one containing 40 different cells with 40 different intergenerational earnings coefficients and the other containing 40 different cells with 40 different levels of assortative mating. The dimensions to create these matrices have been chosen with the expectation that different levels for each cell will be obtained. Hence, creating variability between the 40 cells. It is expected that, intergenerational mobility could change across age (because it could increase over time) and across the earnings distribution (as shown with the quantile estimation in Chapter 2 of this research). Similarly, assortative mating could also vary with age (because marriage market structure could vary over time due to the implementation of specific social policies) and with the level of earnings of the members of a couple (as people with higher earnings, probably are also more educated and have likely been around people with similar level of schooling). Four age cohorts and municipality earnings per capita deciles (considering first the earnings of male individuals in the household, but also, in a robustness check, the joint earnings of individuals and their partner) were originally utilised. In terms of the municipality earnings per capita deciles, they were calculated considering male individuals, with the average earnings per capita calculated for the municipality in which they live, so every individual in a municipality will have the same earnings municipality per capita, and then earnings deciles are calculated. Considering this calculation, the possibility that the dimensions chosen (age and particularly, deciles of earnings by municipality) could create an endogeneity problem, that is, the variability created by them within the 40 cells follows a pattern seems unlikely, because individual's earnings are considered for the estimation, and this breaks the link between the estimation and the dimension of every cell .

For the assortative mating matrix, an individual's age and partner's age were used as control variables and the relationship estimated using the OLS technique. For the intergenerational earnings dependency matrix, the control variables considered were the individual's age, individual's age squared, partner's age, partner's age squared, individual father's age and individual father's age squared (using the OLS technique). In addition, the age cohorts only included individuals between 25 and 45 years old, because if they were too young they would not have earnings, and if they were too old, their parents would also be too old to consider their earnings or likely it will not even be possible to find them in the data available.

These dimensions were also modified to test the robustness of the results. For example, the addition of an extra dimension was considered, namely rural versus urban households. In that way 80 cells were obtained for the levels of assortative mating and for the intergenerational earnings coefficients. In addition, the municipality earnings deciles were replaced by the sectors of occupation in which invididuals worked. Finally, both parents instead of just fathers were used to obtain the intergenerational earnings coefficients (for this case, the intergenerational earnings matrix in the first stage adds to the control variables the mothers' age and mothers' age squared).

An example of the assortative mating matrix is presented in Figure 4.4 and an example of intergenerational earnings persistence is presented in Figure 4.5. In both tables in the first cell of the matrix (k=1 and j=1); the level of assortative mating or intergenerational earnings dependency is found for individuals with ages between 25-30 and within the first deciles of individual's earnings by municipality.

Figure 4.4: Assortative Mating in Schooling[115]

Coefficients Schooling/Schooling Partner										
Age/Decil	I	II	III	IV	V	VI	VII	VIII	IX	X
25-30	$S^P = \Sigma + \Omega_{11} S^i$ if Age^i >=25 and Age^i <=30 and Decil Earnings Municipality=1									
30-35	Ω_21				Ω_{kj}					
35-40	Ω_31									
40-45	Ω_41									

Figure4.5: Intergenerational Earnings Dependency[116]

Coefficients Earnings/Father's Earnings										
Age/Decil	I	II	III	IV	V	VI	VII	VIII	IX	X
25-30	$Y^{Individual+Partner} = \phi + \mu_{11} Y^{Father}$ if Age^i >=25 and Age^i <=30 and Decil Earnings Municipality=1									
30-35	μ_21				μ_{kj}					
35-40	μ_31									
40-45	μ_41									

Independent of the dimensions used to create the matrices, every value in each cell of the matrix of intergenerational earnings coefficients becomes an observation by itself, and each cell of the matrix of assortative mating becomes an observation on assortative mating. Hence, a simple OLS equation (controlling for mean age of individuals, their partners and their fathers/parents obtained in each cell of the first stage) is estimated using these observations, calling it the second stage regression:

[115] In Ω_{kj} , k corresponds to the age cohort utilised (1 for 25-30 years old, 2 for 30-35 years old, 3 for 35-40 years old and 4 for 40-45 years old), j corresponds to the earnings deciles utilised, and it ranges from 1 to 10 for the first and 10th decile respectively.

[116] In μ_{kj} , k corresponds to the age cohort utilised (1 for 25-30 years old, 2 for 30-35 years old, 3 for 35-40 years old and 4 for 40-45 years old), j corresponds to the earnings deciles utilised, and it ranges from 1 to 10 for the first and 10th decile respectively.

$$\mu_g = \Theta + \psi\Omega_g + v_g$$

Where ψ corresponds to the change in the level of intergenerational earnings dependency that is produced by a change in the level of assortative mating in society[117] and g corresponds to the 40 observations created by 4 age cohorts and 10 earnings deciles for the baseline case. The estimation of this equation is weighted, taking as weights the number of observations that were used to calculate the assortative mating values[118] (i.e. the cell sizes in the 40 cell matrix described above).

It is important to notice that the most important result of the previous regression will be the multiple coefficient of determination or R^2, which corresponds to the proportion of the variation in the response variable that is explained by the model; that is how well the variance in the level of intergenerational earnings dependency is explained by the level of assortative mating together with the age of individuals, partners and fathers. Formally:

$$R^2 = ESS/TSS$$

[117] It would perhaps be interesting to analyse the effect of other factors (such as progressivity of social policy or returns to education mentioned in the theoretical model proposed previously), but it is not clear that these factors are going to vary by a pair of categories (dimensions). For example, it is not clear that progressivity of social policy will vary with age or by municipality per capita earnings.

[118] There were two possibilities, to use the number of observations used to create the cells for different values of assortative mating or to use the number of observations used to create the cell for different values of intergenerational earnings dependency (they should not be very different, but the first should be higher than the second, as information related to parental education and occupation to predict their income is more scarce than information related to schooling of individuals and their partners).

Where ESS corresponds to the Explained Sum of Squares, that is, the sum of the squared differences between the predicted y and the mean of *y* ($ESS = \sum(\hat{y} - \bar{y})^2$) and TSS corresponds to the sum of the squared differences between the actual y and the mean of *y* (TSS=$\sum(y - \bar{y})^2 = ESS + RSS$). In simple terms, ESS shows how much of the variation in the dependent variable *y* is explained by the model, and RSS or Residual Sum of Squares, corresponds to how much of the variation in the dependent variable *y* is not explained by the model, that is, the sum of the squared differences between the actual *y* and the predicted *y* ($RSS = \sum(y - \hat{y})^2$).

When no control variables are included, the R^2 will measure how much assortative mating explains the level of intergenerational earnings dependency. However, when more control variables are considered (average per cell of individuals', partners' and fathers' age and age^2) R^2 needs to be re-considered, because it will by itself calculate the proportion of the variation in the response variable (intergenerational earnings dependency) that is explained by the whole model (which includes assortative mating and ages), therefore it would not measure the pure effect of assortative mating, which is the main interest.

Therefore, the partial R^2 is needed. That allows us to obtain the proportion that one explanatory variable (x_1) explains of the dependent variable (y) after removing the effect of the other independent variables (x_2) on y and x_1 (Acock, 2008). For the case of y as the dependent variable and x_1 and x_2 as explanatory variables, the contribution of x_1 to the variance of y is:

Partial[119] $R^2 y,x_1/x_2 = [\frac{R_{y,x_1} - R_{y,x_2} * R_{x_1,x_2}}{\sqrt{(1-R^2{}_{y,x_2})}\sqrt{(1-R^2{}_{x_1,x_2})}}]^2$

The whole procedure described above has also been extended to the analysis of female individuals, their male partners and their fathers (and parents).

4.6.2 The Impact of the Educational Reform on the Level of Assortative Mating

To analyse the effect of the 1980s educational reform on the level of assortative mating (considering years of schooling), an OLS estimation is utilised, adding to the original estimation of assortative mating an interaction variable that considers years of schooling of the individual together with a dummy variable that indicates if the individual was affected (at least one year affected by the reform) and/or also fully affected by the reform, i.e the individual entered the new education system in the first year of primary education. Therefore, if it is considered that individuals enter primary education when they are 6 years old and leave secondary education when they are 17 years old, they will be fully affected by the reform if in 2009 they were younger than 36 years old and at least affected for one year if they are younger than 47 years old. Initially, the full sample of 2009 is utilised, but also a restricted sample (considering ages between 30 and 50) was used as 25 years old are likely very different to 90 years old and so a narrow range of ages was used. In addition, individuals are separated depending on the highest levels of education they have

[119] The calculation of the partial coefficient of determination bearing several explanatory variables is not simple. However, STATA allows the possibility to obtain it easily as the semi-partial R^2.

achieved (primary, secondary or tertiary) and the effect of the reform is evaluated taking this into account. In formal terms, the analysis of the effect of the educational reform is described below:

$$(1)\ Schooling_{Partner} = \alpha Schooling_{Individual} + \beta Dummy_{Affected} + \gamma Dummy_{Affected} * Schooling_{Individual}$$

The coefficient of interest above corresponds to γ , which captures the difference, in the level of assortative mating between members of a couple before and after the reform. Therefore, for an increase in the level of assortative mating in schooling for couples affected by the educational reform this coefficient is expected to be positive.

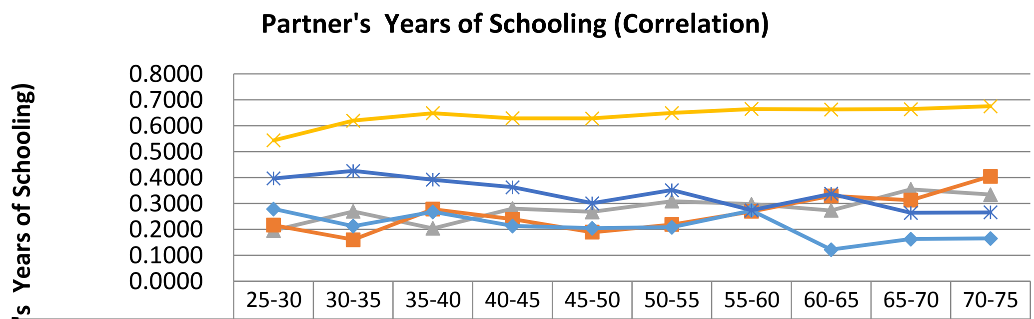
4.7 Results

4.7.1 Levels of Assortative Mating

The level of assortative mating in terms of years of schooling seems to be high in Chilean society, and similarly within the age cohorts of individuals. For example, the correlation among individuals' years of education and their partners' years of education is between 0.54 to 0.67 if all couples are considered where older couples seem to present slightly higher assortative mating levels than younger couples. When only individuals with no education or only primary education are taken into account (leaving the possibility that their partner's years of schooling vary) the correlation is found to be between 0.20 to 0.35 and 0.16 to 0.4 respectively, and again older cohorts seem to present slightly higher assortative mating levels. It is important to notice that individual's education but not their partner's has been considered in order to separate the couples into different levels of education.

A different pattern is found when only individuals studying or that have finished secondary or tertiary education are considered, finding that over time, assortative mating has increased (See Graph 4.1). That could be associated with the educational reform implemented in the 1980s which concentrated pupils from similar backgrounds and maybe with similar expectations in life in terms of human capital achievement. However, it is important to notice that older couples are scarce in the sample; therefore there are few observations for the older cohorts (that is why only individuals below 75 years old have been considered).

Graph 4.1: Assortative Mating (Years of Schooling Correlation) by Age Cohort



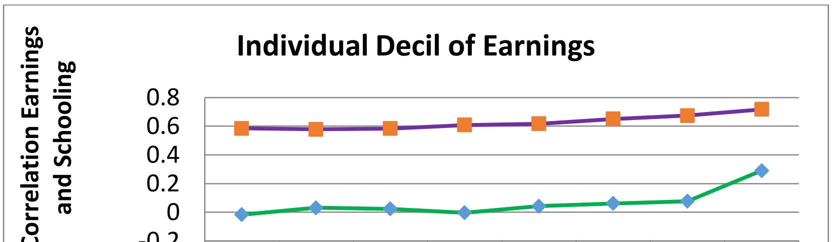
	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75
Total	0.5438	0.6198	0.6488	0.6291	0.6285	0.6495	0.6650	0.6632	0.6646	0.6755
Non-Education	0.1961	0.2695	0.2041	0.2809	0.2675	0.3093	0.2973	0.2732	0.3549	0.3344
Primary	0.2167	0.1601	0.2781	0.2394	0.1893	0.2192	0.2695	0.3296	0.3131	0.4050
Secondary	0.2787	0.2126	0.2675	0.2134	0.2047	0.2083	0.2734	0.1219	0.1627	0.1652
Tertiary	0.3970	0.4257	0.3918	0.3627	0.3012	0.3518	0.2739	0.3376	0.2640	0.2661

Considering the correlation among members of couples, the correlation in terms of years of schooling is higher (between 0.57 to 0.71) than in terms of earnings (between 0.0165 and 0.289) (See Graph 4.2[120]). However, the correlation between individuals' earnings by deciles is clearly higher in higher

[120] More details in Appendix 4A2., Graph 4A2.1.

deciles, particularly for the last deciles. This is surprising, as it was expected that many female individuals only study more in order to find a "better" husband, and that they do not enter effectively into the labour market. However, this does not seem to happen, probably due to the fact that the last decile of earnings is composed of individuals that are not the richest in the country but are probably upper-middle class and due to the empowerment of Chilean women - they believe that working not only gives them back their investment in education, but also gives them more bargaining power in the household. This could be related to the neoliberal reforms that Chile has experienced in the '70s and '80s (when Pinochet was in power), where many male workers lost their jobs in state companies and women felt forced to support their households in monetary terms which was also encouraged by the creation of some social programmes (Bosch, 1998). It is therefore possible, that younger couples have higher levels of earnings assortative mating than older couples (the correlation between members of a couple aged 35-40 years old is around 0.40 which is twice the correlation that couples aged 60-65 years old exhibit).

Graph 4.2: Earnings and Years of Schooling Correlations by Individual's Earnings Decile



	D3	D4	D5	D6	D7	D8	D9	D10
Earnings	-0.0165	0.0305	0.0233	-0.0038	0.0416	0.0611	0.0765	0.2894
Schooling	0.5849	0.5776	0.5828	0.608	0.6164	0.6498	0.6734	0.717

It has been suggested that these high levels of schooling assortative mating are due to the educational reform implemented nationwide in the country in 1980, which was based on privatisation and decentralisation of the educational market.

4.7.2 How the Educational Reform affected the Level of Assortative Mating

The 1980s Chilean educational reform, which has previously been claimed to have produced sorting among children and segregation of pupils depending on their social status and parents' background, seems to have increased the levels of assortative mating in terms of schooling. These results are presented in Table 4.8, where an interaction variable was created to establish this relationship between years of schooling of the individual together with a dummy variable that indicates if the individual was affected at least one year by the reform (partially affected) and/or also fully affected by the reform, i.e the individual entered the new education system in the first year of primary education. That is, an individual is partially affected if he was younger than 47 years old in 2009 and fully affected if he was 36 years old or younger in 2009. See equation (1) in section 4.6.2 of the methodology for more details. In column 1, the total effect of the reform on the level of aassortative mating is found for individuals that have been partially affected by it, indicating that when individuals are affected by the reform, the schooling of their partner increases by 0.031 years more for each additional year of the individuals' schooling compared to older individuals who were unaffected by the reform. In column 2, only individuals with primary education or lower are considered, in columns 3 and 4, individuals with secondary (or lower, but with higher than primary education) and tertiary (completed or not completed) education are found. Similarly, in columns 5 to 8, the results obtained when those individuals were fully affected by the reform are considered (if they started school in 1980 or later, which is if they were 36 years old or younger in 2009), finding that the schooling of the partner increases by

0.056 years more for each year of the individual schooling compared to those unaffected by the reform. Both sets of results are quite similar in terms of direction of the effect caused by the reform on assortative mating and in terms of the size of the effect. This analysis has also been done considering individuals that have been partially affected for a different period of time by the reform (individuals that were affected for only 4 years or less, individuals that were affected by 5 to 8 years and individuals that were affected by 9 to 10 years), but no significant correlation was found.

In addition, when the pure dummy variable (which indicates if the individual has been affected by the reform) is considered, the chance of getting an educated partner seems to be higher if the individual has zero years of schooling and they were (partially or fully) affected by the reform, compared to individuals that were not affected. One interpretation of this could be that individuals with no education have been given the chance to establish relationships with people that have higher years of schooling than themselves, probably because there are more educated people in society. In fact, looking at the dummy variables "partially affected" or "fully affected" in column 1 and column 5 respectively, individuals that have been affected by the reform match with a partner with 0.315 and 0.711 years of schooling more than if the individual was not affected by the reform.These results are similar when different levels of education are considered. However, they are independent of the years of education of individuals. That is why the interaction variable previously analysed isof much more interest to analyse.

Similar results were found when restricting the sample size by age in Table 4.9, so only individuals between 30 and 50 years old were included, considering that very young and very old couples could be dramatically different. The results show that the schooling of a partner increases by 0.012 years more for each additional year of an individual's own schooling if individuals were partially affected by the reform. See column 1 of Table 4.9 for partially affected and column 5 of Table 4.9 for fully affected.

Table 4.8: Effect of the 1980's Chilean Educational Reform on Assortative Mating Levels[121][122]

Y=Partner' Schooling	Partially				Fully			
	Total	**Primary**	**Secondary**	**Tertiary**	**Total**	**Primary**	**Secondary**	**Tertiary**
	coef/se	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**
Individual' Schooling	0.580***	0.455***	0.643***	0.572***	0.576***	0.450***	0.643***	0.576***
	(0.004)	(0.009)	(0.021)	(0.041)	(0.004)	(0.008)	(0.018)	(0.031)
Individual's age	0.028***	0.032***	0.019***	-0.029***	0.029***	0.035***	0.020***	-0.030***
	(0.002)	(0.003)	(0.004)	(0.008)	(0.002)	(0.002)	(0.003)	(0.007)
age_Partner	-0.091***	-0.113***	-0.063***	-0.017***	-0.091***	-0.113***	-0.063***	-0.017***
	(0.002)	(0.002)	(0.003)	(0.006)	(0.002)	(0.002)	(0.003)	(0.006)
Individual's Earnings	0.025***	0.053***	0.042***	0.004	0.025***	0.055***	0.043***	0.004
	(0.002)	(0.007)	(0.004)	(0.003)	(0.002)	(0.007)	(0.004)	(0.003)
Earnings_Partner	0.166***	0.242***	0.219***	0.112***	0.166***	0.245***	0.219***	0.112***
	(0.005)	(0.013)	(0.009)	(0.007)	(0.005)	(0.013)	(0.009)	(0.007)
Married	0.399***	0.263***	0.462***	0.556***	0.410***	0.283***	0.488***	0.551***
	(0.032)	(0.048)	(0.048)	(0.097)	(0.033)	(0.048)	(0.049)	(0.099)
affected1980_Partially	0.315***	0.310**	0.742*	0.591				
	(0.082)	(0.132)	(0.385)	(0.861)				
schooling_Affected_Partially	**0.031*****	**0.049*****	**0.056***	**0.038**				
	(0.007)	(0.018)	(0.033)	(0.053)				
affected1980_Fully					0.711***	0.938***	1.546***	1.067
					(0.125)	(0.238)	(0.522)	(0.950)
schooling_Affected_Fully					**0.056*****	**0.094*****	**0.116*****	**0.066**
					(0.011)	(0.033)	(0.045)	(0.060)
_cons	5.993***	7.518***	4.284***	5.969***	5.935***	7.345***	4.209***	5.966***
	(0.111)	(0.164)	(0.299)	(0.713)	(0.086)	(0.129)	(0.252)	(0.514)
Number of observations	46,928	23,692	18,372	4,864	46,928	23,692	18,372	4,864
R2	0.551	0.364	0.197	0.194	0.551	0.364	0.198	0.194
note: *** p<0.01, ** p<0.05, * p<0.1								

[121] The dummy variable, for the status of being affected by the reform, and the other control variables in the regressions, correspond to the individuals (males) instead of their partners. In any case, most of the couples have been affected equally by the reform (97% and 78% for partially and fully affected by the reform). Most of the couples have similar ages and also, even though the members of the couple may not meet at school, their networks influenced by the reform could help them find their partner, although the partner was not affected by the reform (because of their respective age gap).

[122] Standard errors are in brackets.

Table 4.9: Effect of the 80's Educational Reform on Assortative Mating Levels (30 to 50 Years Old)[123]

Y=Partner' Schooling	Partially				Fully			
	Total	**Primary**	**Secondary**	**Tertiary**	**Total**	**Primary**	**Secondary**	**Tertiary**
	coef/se	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**
Schooling	0.551***	0.416***	0.666***	0.528***	0.562***	0.419***	0.631***	0.589***
	(0.010)	(0.025)	(0.049)	(0.078)	(0.006)	(0.015)	(0.026)	(0.039)
Age	0.002	0.003	-0.003	-0.027**	0.015***	0.029***	0.003	-0.027*
	(0.005)	(0.008)	(0.007)	(0.013)	(0.005)	(0.009)	(0.007)	(0.014)
age_Partner	-0.064***	-0.086***	-0.052***	-0.013	-0.064***	-0.086***	-0.052***	-0.013
	(0.003)	(0.004)	(0.004)	(0.009)	(0.003)	(0.004)	(0.004)	(0.009)
Earnings	0.021***	0.052***	0.049***	-0.005	0.021***	0.052***	0.049***	-0.005
	(0.003)	(0.011)	(0.005)	(0.004)	(0.003)	(0.011)	(0.005)	(0.004)
Earnings_Partner	0.149***	0.215***	0.243***	0.100***	0.149***	0.216***	0.242***	0.100***
	(0.006)	(0.019)	(0.011)	(0.008)	(0.006)	(0.019)	(0.011)	(0.008)
Married	0.345***	0.252***	0.427***	0.381***	0.350***	0.256***	0.431***	0.386***
	(0.042)	(0.068)	(0.057)	(0.115)	(0.042)	(0.068)	(0.057)	(0.115)
affected1980_Partially	0.152	0.219	0.892	-1.649				
	(0.120)	(0.204)	(0.629)	(1.369)				
schooling_Affected_Partially	0.012	0.010	-0.078	0.107				
	(0.012)	(0.030)	(0.056)	(0.085)				
affected1980_Fully					0.300**	0.208	1.356**	-1.422
					(0.152)	(0.304)	(0.638)	(1.130)
schooling_Affected_Fully					0.009	0.027	0.108*	0.092
					(0.013)	(0.041)	(0.055)	(0.071)
_cons	6.417***	8.100***	4.534***	6.720***	5.725***	6.773***	4.640***	5.788***
	(0.230)	(0.403)	(0.616)	(1.349)	(0.219)	(0.364)	(0.423)	(0.783)
Number of observations	22,202	9,017	10,384	2,801	22,202	9,017	10,384	2,801
R2	0.439	0.170	0.148	0.197	0.439	0.171	0.148	0.197
note: *** p<0.01, ** p<0.05, * p<0.1								

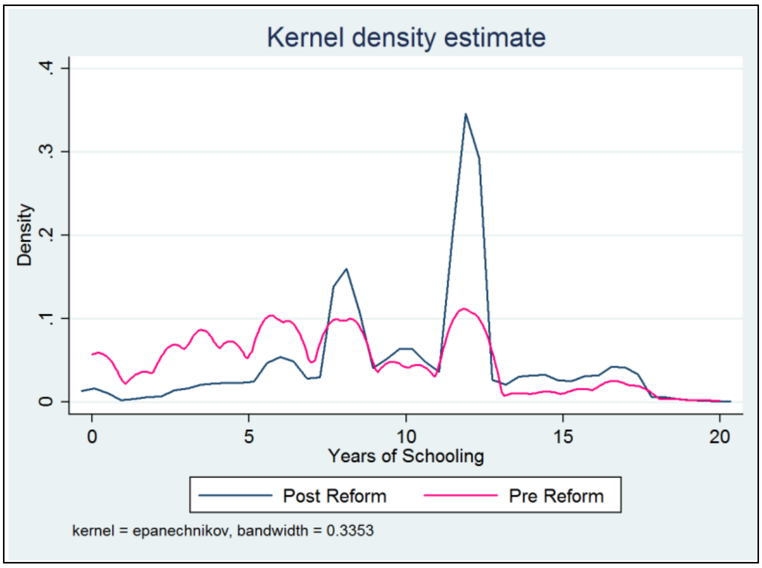
[123]Standard errors are in brackets.

The results seem to indicate that the educational reform has increased the levels of educational assortative mating at all of the levels of educational achievement. However, there is a possibility that in the segments that the educational reform increased the level of assortative mating, it was not due to segregation, but rather due to increasing the educational attainment of the whole population. If this is the case, more educated individuals would create a more homogenous society in terms of schooling, especially among the youngest (who were affected by the educational reform which increased sorting, but also increased the level of educational attainment, in particular for lower income individuals), that could be associated with an increase in assortative mating, but in a positive way, because everyone would have a similar level of education. Therefore, it would be useful to determine whether the higher levels of assortative mating observed amongst younger cohorts affected by the reform was due to increased segregation, or due to higher attainment leading to an increased homogenisation of educational performance.

Looking towards the bottom of the educational distribution should help us distinguish between the causes of the increase in assortative mating after the educational reform. If most individuals become more educated, it would be difficult for those that stay at low levels of education to find a partner with similar levels of education, and so the 'higher general attainment' effect would cause assortative mating to decrease in this section of the schooling distribution. On the other hand, if these lesser-educated individuals become more isolated from society and are unable to meet and interact with individuals with higher levels of education, assortative mating would increase in this part of the schooling distribution. In contrast, for highly educated individuals, if they become more segregated then assortative mating increases for them not only because of a larger proportion of similar, more educated people in society (increasing the number of potentially similar partners) but also because they become more isolated from lesser-educated individuals, reinforcing the former effect, so leaving us unable to distinguish between the two effects in this section of the schooling.

It was first checked whether the distribution of attainment did change after the reforms. Therefore, the distribution of years of schooling between individuals who were affected by the reform and those who were not affected was analysed. Graph 4.3 presents the distribution of years of schooling among the two groups - the young, or those that have been affected by the educational reform, who therefore have a potential possibility of achieving a better education, and the older generations, who were not affected by the reform.

Graph 4.3: Pre- and Post- Reform Years of Schooling Distributions



Both distributions have been tested to check their similarity using the Two-sample Kolmogorov-Smirnov test for equality of distribution functions, rejecting the null hypothesis of equality in distribution (p-value>0.000). It is possible to see that the reform is associated with a change in the distribution of education in society. Nevertheless, what is of more interest for the analysis here is whether or not the post-reform distribution was more homogenous than the pre-reform one (more people achieved a higher level of schooling), giving a positive explanation of why the reform increased assortative mating levels. This is what actually seems to be happening: the post-reform distribution of years of schooling is more homogenous than the pre-reform one, which can be seen in the graph above, where obvious peaks are seen, which indicates that there are more young individuals with 12 years of education (finished secondary education) than amongst older individuals. The same situation is observed for those with 8 years of schooling (finishing primary education). On the other hand, there are fewer individuals affected by the reform that have lower levels of schooling than individuals that were not affected by the reform. This could sound positive in terms of giving new generations more opportunities and hopes in life. However, it could be possible that the reform caused, as mentioned previously: a) a general increase in the level of education of the whole population, but also b) a higher level of segregation of people that have a lower level of education from those that obtained higher education, as mentioned previously.

The analysis above only considers male individuals, therefore it would not be complete without considering the change in the proportion of female individuals (which in the previous analysis were considered as partners) achieving different levels of education pre- and post- reform. This is imperative as the actual levels of assortative mating for a determined level of education will depend not only on the number of males available, but also the number of female individuals, as more men in one category will be meaningless if the number of females has been kept constant or has decreased. In Table 4.10, the proportion of female and male individuals at each level of education is presented for individuals partially affected and not affected by the reform (the proportion of individuals is enough to represent the change in the number of female and male individuals as they are equal in number due to heterosexual couple's formation[124]). First, it is important to check that the number of female individuals available does not restrict the possibility of matching. That is, if the increase of attainment of male individuals was not followed by an increase of attainment of female individuals, a higher number of males would not increase the level of assortative mating if it is not followed by a similar increase in the number of females in the same category. Table 4.10 shows that the proportion and therefore the number of female individuals "available" for male individuals does not restrict the potential matches with similar individuals, that is, a similar proportion of female and male individuals are found at each level of education.

Therefore, the main concern is to analyse if the change in assortative mating was or was not caused by social segregation or by an increase of educational attainment. As can be seen in the case of individuals that have primary education, they have decreased in number after the reform. This should mean that assortative mating is reduced after the reform for this group because of fewer potential individuals (male and female) to match with. However, in column 2 of Table 4.8, the results indicate that assortative mating increased for this level of education. Therefore, it is possible to say that the likely cause was an increase in segregation for lower educated individuals. On the other hand, in the case of individuals with secondary education, the number of male and female individuals increased after the reform. Therefore, it would be expected that the levels of assortative mating increased in this segment, which is confirmed in Table 4.8, column 3. In this case, the increase in the level of assortative mating could be caused by more individuals able to match or because of an increase in the level of segregation.

[124] This includes married and cohabitating couples.

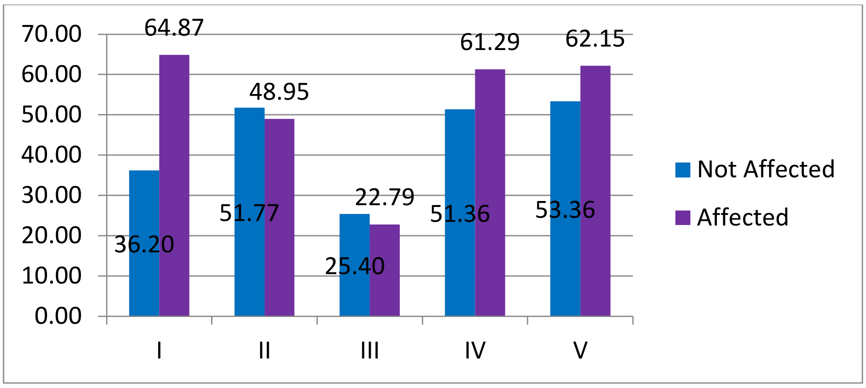
Table 4.10: Percentage of Male and Female Individuals by Level of Education, Affected (R=1)/Not Affected (R=0) by the Reform[125]

Level of Education	R=1 (male)	R=0 (male)	Difference Male	R=1 (female)	R=0 (female)	Difference Female	Expected AM	Estimated on Table 4.8	Explanation
No Education + Primary Not Completed/Completed	35.57	61.77	-26.2	34.27	64.16	-29.89	-	+***	Sign of Segregation, fewer Male individuals (and female), but AM increased
Not Completed/Completed Secondary, Not Completed/Completed Vocational	50.57	30.5	20.07	52.28	29.18	23.1	+	+*	Double Effect: A) More People in this category therefore AM incresed B) More segregation
Not Completed/Completed Tertiary	13.86	7.74	6.12	13.46	6.66	6.8	+	+	Double Effect: A) More People in this category therefore AM incresed B) More segregation, but Not Siginificant

[125] The similar proportion of females and males in each educational category was preliminarily thought to have left the levels of assortative mating unchanged pre- and post- reform. However, similar proportions of male and female individuals only ensured that they could potentially match, but not that they will in fact match.

To isolate the segregation effect, for the higher levels of education, and avoid the results being affected by the number of individuals with this level of attainment, an alternative is to divide the population into equal sized groups (chosen as quintiles), rather than into levels of attainment (so that the average attainment levels within quintiles will change over time). This is done in Graph 4.4, where quintiles of schooling of individuals and their partners have been compared for those in education before and after the reform (individuals partially affected have been considered). The results show that the proportion of males in the top quintile of the education attainment distribution, who married a woman in the same quintile, increased from 53% before the reform to 62% after the reform. This increase of assortative mating in the highest quintile of schooling could be produced by elitism and lack of contact with individuals of lower schooling. Therefore, the increase in assortative mating at the higher levels of education was likely produced by an increase in segregation of individuals, rather than by a pure effect of an increase of educational attainment. Graph 4.4 also shows that in the lower levels of education, particularly in the first quintile, the level of assortative mating has increased by almost double for individuals partially affected by the reform compared to those not affected by it. This shows that segregation is focused at the extremes of the schooling distribution.

Graph 4.4: % of Individuals in the Same Quintile of Years of Schooling as their Partner when Partially Affected/Not Affected by the Educational Reform at each Quintile of Schooling



In summary, couples from the cohorts of people born after the educational reforms seem to have a closer match of years of education, compared to those born before the reforms, with each year of additional schooling for the male partner being associated with a larger increase in his female partner's education. This seems to happen for all levels of education analysed. However, if the reform also increased the level of attainment of the whole population, lower levels of education would consist of fewer people and therefore, it would be more difficult to match in this category expecting therefore a decrease in assortative mating. However, it actually increased in this segment of attainment. Therefore, it is possible that the increase in schooling matching after the reform was due to an increase in social segregation that forced lesser educated individuals together. On the other hand, at higher levels of education, more people are found after the reform, therefore the probability of matching with someone similar seems higher. This would be associated withan increase in assortative mating, which is actually happening. However, the increase in assortative mating can also be due to the possibility that higher educated individuals are not only larger in number, but also they are segregated from those that are lesser educated both effects will increase assortative mating. In order to separate these effects, a quintile analysis has been done, finding that individuals from higher quintiles (those with a higher education) are matched to highly educated individuals after the reform excluding the issue that more individuals are able to be matched with. Therefore, it is possible to suggest that higher educated individuals also experience from segregation, which could be undesirable in terms of promoting fluidity in society[126].

4.7.3 The Effect of Assortative Mating on the Levels of Intergenerational Earnings Dependency

One of the most important aims of this research is to measure the impact that assortative mating in schooling has on the level of intergenerational mobility of earnings. This is particularly important as it could help social policy makers to identify some of the determinants of intergenerational social dependency in society, preventing higher levels of it.

The results indicate that the impact of assortative mating (in terms of schooling) on the levels of intergenerational earnings dependency seem to be around 20% as shown by the R^2 values when no control variables are included and by the same amount when age control variables are included (which corresponds to the mean ages in each cell utilised in the estimation) as shown by the semi-partial R^2 (see column 1 of Table 4.11 and column 1 of Table 4.12). The impact of assortative mating is obtained in different ways to calculate the dimensions of the cells used. Therefore, in column 1 of Table 4.11 the

[126] The relationship between school competition and assortative mating has also been considered estimating the same equation used in Table 4.8 for 2 separated samples: High level of churches and low level of churches municipalities. Considering that when the reform was implemented there was likely an increase of voucher schools in areas with a high level of churches, it is expected that there would be a segregation effect and an attainment effect in these municipalities, but only an attainment effect in low level of churches municipalities. The findings suggest that the segregation effect is larger than the attainment effect after the reform, as assortative mating increased more in areas with high level of churches than in those with low level of churches.

dimensions utilised were the earnings per capita by municipality decile and the four age cohorts, obtaining 40 observations of intergenerational earnings dependency between the father's earnings and the individual and his partner's joint earnings, and 40 observations of assortative mating. For this case, first stage regressions are found in Table 4.13 (for assortative mating) and Table 4.15 (for intergenerational earnings dependency).

Table 4.13 shows that assortative mating has increased with age, which is somewhat surprising as the opposite result was found previously in this chapter. This could be due to the fact that a larger sample was used for the former result, as restrictions on the age of parents were not required there; because the effect of the reform was calculated controlling for earnings and marital status of individuals and/or because the average assortative mating between every decile in the assortative mating matrix could be different to the overall average effect considered in the reform effect regression. Table 4.14 shows the estimation of assortative mating by age cohorts for the Restricted Sample (as used in the assortative mating matrix, first stage) and for the non-restricted sample (corresponding to the one used in the reform effect regression in section 4.7.2). These results show that it is not the change in sample size or the disaggregation of results by income decile that is driving the difference. In addition, the previous results related to those partially affected or not by the reform are not comparable with this part of the chapter, as all individuals in the matrix of assortative matrix have been partially affected (all of them are below 47 years old). Moreover, in Table 4.15, it is possible to see that higher levels of intergenational earnings dependency are present in the higher earnings deciles.

In column 2 of Table 4.11, the level of intergenerational earnings dependency has been calculated using fathers' and mothers' joint earnings instead of only fathers' earnings, obtaining an impact of assortative mating of

28% on the level of intergenerational earnings dependency. In column 3 of Table 4.11, one of the dimensions used to calculate the different levels of assortative mating and earnings dependency is changed. In this case, the calculus of the earnings per capita by municipality has been done by taking into account an individuals' and partners' joint earnings (not only individuals') and the intergenerational earnings dependency has been obtained using the parents' earnings instead of only the father's earnings. The proportion of the variance in intergenerational earnings dependency that is explained by differences in assortative mating for this case is between 16% and 25%, quite similar compared to the previous cases. Similar results are obtained when only the earnings dimension of the matrix definition is modified (column 4, Table 4.11) while the earnings coefficients themselves are obtained using only the fathers' earnings (not parents). Similar results can be found in Table 4.12, where age control variables are included. These results are presented in column 3 of Table 4.16 and are consistent in terms of the direction of the effects with the ones given by the theoretical model presented in section 4.4, Table 4.1.

Table 4.11: Estimation of Assortative Mating on Intergenerational Earnings Dependency (Not Including Control Variables)[127]

Using Assortative Mating Weights				
Intergenerational Earnings Dependency	1st stage uses Individual Earnings (A.M[128]) & uses Individuals and Father's Earnings (I. M[129])	1st stage uses Individual Earnings (A.M) & uses Individuals and Parents's Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Parents' Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Father's Earnings (I.M)
	(1)	(2)	(3)	(4)
	coef/se	**coef/se**	**coef/se**	**coef/se**
Assortative Mating	1.020***	1.153***	0.966***	0.904***
	(0.022)	(0.022)	(0.023)	(0.021)
_cons	-0.183***	-0.217***	-0.126***	-0.140***
	(0.013)	(0.013)	(0.013)	(0.012)
N. Obs Total	6,711	6,711	6,711	6,711
N obs	40	40	40	40
R2	0.237	0.284	0.214	0.217
note: *** p<0.01, ** p<0.05, * p<0.1				

[127] Standard errors are in brackets.

[128] A.M corresponds to assortative mating levels.

[129] I.M corresponds to intergenerational earnings dependency.

Table 4.12: Estimation of Assortative Mating on Intergenerational Earnings Dependency (Including Control Variables)[130]

Using Assortative Mating Weights[131]				
Intergenerational Earnings Dependency	1st stage uses Individual Earnings (A. M) & uses Individuals and Father's Earnings (I.M)	1st stage uses Individual Earnings (A. M) & uses Individuals and Parents's Earnings (I. M)	1st stage uses Individual and Partner Joint Earnings (A. M) & uses Individuals and Parents' Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A. M) &uses Individuals and Father's Earnings (I.M)
	(1)	**(2)**	**(3)**	**(4)**
	coef/se	**coef/se**	**coef/se**	**coef/se**
Assortative Mating	1.336***	1.399***	1.159***	1.073***
	(0.027)	(0.032)	(0.029)	(0.026)
Age	-0.442***	-0.574***	0.144***	0.554***
	(0.027)	(0.035)	(0.039)	(0.034)
Age_Partner	0.850***	0.893***	-0.093***	-0.208***
	(0.033)	(0.038)	(0.033)	(0.033)
Age_Dad	-1.160***	-1.639***	-2.555***	-1.357***
	(0.087)	(0.142)	(0.093)	(0.082)
Age_Mum		0.473***	1.760***	
		(0.083)	(0.085)	
Age_sq	0.006***	0.007***	-0.001*	-0.008***
	(0.000)	(0.001)	(0.001)	(0.001)
Age_Partner_sq	-0.014***	-0.014***	0.001**	0.003***
	(0.000)	(0.001)	(0.001)	(0.001)
Age_Dad_sq	0.010***	0.014***	0.021***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
Age_Mum_sq		-0.003***	-0.016***	
		(0.001)	(0.001)	
_cons	27.730***	28.814***	25.183***	34.915***
	(2.201)	(2.758)	(2.435)	(2.122)
N. Obs Total	6,711	5,312	6,711	6,711
R2	0.338	0.427	0.345	0.295
N. Observations	40	36	40	40
SemiPartial R2[132]	**0.2457**	**0.2128**	**0.1613**	**0.1789**
note: *** p<0.01, ** p<0.05, * p<0.1				

[130] Standard errors are in brackets.

[131] Estimates using Intergenerational earnings dependency weights are found in the Appendix 4A2., Table 4A2.1 and Table 4A2.2

[132] Semi-Partial R^2 of the Assortative Mating variable.

Table 4.13: Matrix Assortative Mating Levels in 40 Cells

Assortative Mating (Ω)										
With Control Variables Age + Age_Partner										
Coefficients Schooling/Schooling Partner										
Age/Decil Muni (Individual=Husband)	I	II	III	IV	V	VI	VII	VIII	IX	X
25-30	0.328***	0.327***	0.602***	0.457***	0.480***	0.585***	0.465***	0.563***	0.564***	0.570***
N. Obs	*110*	*107*	*97*	*132*	*387*	*174*	*187*	*159*	*148*	*122*
30-35	0.432***	0.505***	0.603***	0.606***	0.648***	0.645***	0.551***	0.704***	0.606***	0.697***
N.Obs	*134*	*145*	*145*	*161*	*425*	*204*	*204*	*189*	*191*	*211*
35-40	0.608***	0.558***	0.420***	0.712***	0.630***	0.608***	0.607***	0.582***	0.584***	0.668***
N.Obs	*134*	*144*	*158*	*204*	*394*	*189*	*199*	*188*	*176*	*193*
40-45	0.562***	0.594***	0.554***	0.510***	0.642***	0.706***	0.596***	0.565***	0.764***	0.771***
N.Obs	*60*	*92*	*74*	*93*	*93*	*91*	*139*	*134*	*115*	*109*
note: *** p<0.01, ** p<0.05, * p<0.1										

Table 4.14: Estimation of Assortative Mating by Age Cohort[133]

Age/Decil Muni (Husband)	Restricted by Age of Parents	Not Restricted by Age of Parents
25-30	0.501***	0.515***
N. Obs	*1623*	*2860*
30-35	0.629***	0.610***
N.Obs	*2009*	*4025*
35-40	0.623***	0.631***
N.Obs	*1979*	*5036*
40-45	0.653***	0.605***
N.Obs	*1100*	*6077*

[133] When these estimations include the same control variable used by the reform effect analysis, the results do not vary too much.

Table 4.15: Level of Intergenerational Earnings Dependency in 40 Cells

Intergenerational Earnings Dependency (μ)										
With control Variables Age + Age_Father										
Coefficients Log(Individual_Earnings)/Log(Father_Earnings)										
Age/Decil Muni (Individual=Husband)	I	II	III	IV	V	VI	VII	VIII	IX	X
25-30	-0.078	0.259*	-0.158	0.517**	0.392***	0.453***	0.210	0.325**	0.515***	0.655***
N. Obs	*72*	*81*	*73*	*96*	*271*	*119*	*132*	*122*	*113*	*90*
30-35	0.083	0.241	0.470***	0.470***	0.468***	0.523***	0.160	0.711***	0.655***	0.652***
N.Obs	*85*	*101*	*91*	*115*	*278*	*137*	*133*	*143*	*139*	*154*
35-40	0.484***	0.444***	0.082	0.374***	0.410***	0.457***	0.287**	0.448***	0.346***	0.645***
N.Obs	*94*	*109*	*107*	*143*	*261*	*146*	*126*	*133*	*128*	*142*
40-45	-0.029	0.135	0.812	0.828***	0.425**	0.546***	0.475**	0.512***	0.267	0.610***
N.Obs	*42*	*72*	*42*	*66*	*112*	*64*	*94*	*93*	*77*	*79*
note: *** p<0.01, ** p<0.05, * p<0.1										

Finally when only those individuals that are employed are considered, the influence of assortative mating is around 18% (see Table 4.16 column 1). Similar results are found in Table 4.17 when age control variables are included. In the next robustness check, a third dimension to estimate the first stage was included, the rural or urban nature of the household where individuals and their partners live. The finding is that the influence of assortative mating is around 15%, which is found in column 2 of Table 4.16. Finally, other variants were considered to calculate the first stage of the estimation. When the earnings dimension is changed to industry of activity of individuals (including agriculture, army, etc.) the impact that assortative mating has on the level of intergenerational earnings dependency is between 12% and 15% (depending on whether control variables are considered or not).

Table 4.16: Other Estimations of Assortative Mating on Intergenerational Earnings Dependency (Not Including Control Variables)[134]

Assortative Mating Weights			
Intergenerational Earnings Dependency	Employed	Urban&Rural	Industry
	(1)	(2)	(3)
	coef/se	coef/se	coef/se
Assortative Mating	0.838***	0.884***	0.883***
	(0.023)	(0.028)	(0.028)
_cons	-0.082***	-0.133***	-0.071***
	(0.013)	(0.016)	(0.016)
N. Obs Total	6,427	5,939	5,681
N obs	40	80	37
R^2	0.178	0.147	0.153
note: *** p<0.01, ** p<0.05, * p<0.1			

[134]Standard errors are in brackets.

Table 4.17: Other Estimations of Assortative Mating on Intergenerational Earnings Dependency (Including Control Variables)[135]

Alpha_Weights (control variables)			
Intergenerational Earnings Dependency	Employed	Urban&Rural	Industry
	(1)	(2)	(3)
	coef/se	coef/se	coef/se
Assortative Mating	1.002***	1.029***	0.965***
	(0.031)	(0.030)	(0.033)
Age	0.069**	-0.688***	0.091**
	(0.035)	(0.035)	(0.043)
Age_Partner	0.151***	0.729***	0.092**
	(0.038)	(0.042)	(0.044)
Age_Dad	-0.982***	-0.319***	-0.279***
	(0.079)	(0.032)	(0.108)
Age_sq	-0.002***	0.009***	-0.001
	(0.001)	(0.000)	(0.001)
Age_Partner_sq	-0.002***	-0.011***	-0.001
	(0.001)	(0.001)	(0.001)
Age_Dad_sq	0.009***	0.003***	0.001
	(0.001)	(0.000)	(0.001)
_cons	24.826***	8.207***	7.258***
	(2.043)	(0.875)	(2.743)
N. Obs Total	6,427	5,939	5,681
R2	0.210	0.219	0.216
N. Observations	40	80	37
SemiPartial R2	**0.1272**	**0.1565**	**0.1207**
note: *** p<0.01, ** p<0.05, * p<0.1			

Previous results have considered male individuals and their female partner, and their relationship with the individual's father's earnings. When female individuals and their male partners are considered, the effect of assortative mating seems to be lower than when male individuals are used. In column 1 of Table 4.18, the female version of column 1 of Table 4.11, an impact of assortative mating of 19% is observed (versus a 24% effect for the male variant). Column 2 of Table 4.18, the female version of column 2 of Table 4.11, finds a lower impact of assortative mating with respect to the male version (5%

[135]Standard errors are in brackets.

versus 28%). Columns 3 and 4 of Table 4.18 correspond to columns 1 and 2 of Table 4.12 where the values for male individuals are higher than the values for female individuals (16% versus 25% and 0% versus 21% respectively). These results are consistent with the idea that the father of the male individual's earnings are more likely to explain the earnings of his son and wife's joint income, as most of the time these joint earnings are driven by the husband rather than the wife.

Table 4.18: Effect of Assortative Mating on Intergenerational Earnings Dependency (Including Control Variables) for Female Individuals[136][137]

Intergenerational Earnings Dependency	Without Controls				With Controls			
	Female: 1st stage uses Individual Earnings (A. M) & uses Individuals and Father's Earnings (I.M)	Male: 1st stage uses Individual Earnings (A. M) & uses Individuals and Father's Earnings (I.M)	Female: 1st stage uses Individual Earnings (A. M) & uses Individuals and Parentsr's Earnings (I.M)	Male: 1st stage uses Individual Earnings (A. M) & uses Individuals and Parents's Earnings (I.M)	Female: 1st stage uses Individual Earnings (A. M) & uses Individuals and Father's Earnings (I.M)	Male: 1st stage uses Individual Earnings (A. M) & uses Individuals and Father's Earnings (I.M)	Female: 1st stage uses Individual Earnings (A. M) & uses Individuals and Parents's Earnings (I.M)	Male: 1st stage uses Individual Earnings (A. M) & uses Individuals and Parents's Earnings (I.M)
	(1)		(2)		(3)		(4)	
	coef/se	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**	**coef/se**
Assortative Mating	2.624***	1.020***	0.531***	1.153***	2.961***	1.336***	0.055	1.399***
	(0.067)	(0.022)	(0.052)	(0.022)	(0.076)	(0.027)	(0.060)	(0.032)
Age					-1.602***	-0.442***	0.344***	-0.574***
					(0.073)	(0.027)	(0.090)	(0.035)
Age_Partner					1.341***	0.850***	1.207***	0.893***
					(0.112)	(0.033)	(0.134)	(0.038)
Age_Dad					2.021***	-1.160***	1.480***	-1.639***
					(0.140)	(0.087)	(0.290)	(0.142)
Age_Mum							-1.755***	0.473***
							(0.194)	(0.083)
Age_sq					0.024***	0.006***	-0.005***	0.007***
					(0.001)	(0.000)	(0.001)	(0.001)
Age_Partner					-0.018***	-0.014***	-0.019***	-0.014***
					(0.002)	(0.000)	(0.002)	(0.001)
Age_Dad_sq					-0.018***	0.010***	-0.013***	0.014***
					(0.001)	(0.001)	(0.002)	(0.001)
Age_Mum_sq							0.016***	-0.003***
							(0.002)	(0.001)
_cons	-1.010***	-0.183***	0.037	-0.217***	-56.614***	27.730***	-19.184***	28.814***
	(0.040)	(0.013)	(0.036)	(0.013)	(3.618)	(2.201)	(5.588)	(2.758)
N. Total Obs	6,711	6,711	1,778	6,711	6,711	6,711	1,778	5,312
R2	**0.187**	**0.237**	**0.054**	**0.284**	0.309	0.338	0.265	0.427
N. of observations	40	40	40	40	40	40	40	40
Semi-Partial R2					**0.1584**	**0.2457**	**0.0004**	**0.2128**
note: *** p<0.01, ** p<0.05, * p<0.1								

[136] The standardised coefficient of male and female individuals, considering that the earnings distribution can differ by gender can be found in Appendix 4A2., Table 4A2.3 (the relevance for this research is minimal as the main interest is the coefficient of multiple determination (or its partial version) instead of the estimation coefficient.

[137] Standard errors are in brackets.

Finally a different perspective in the analysis of the effect of assortative mating on the level of earnings reproduction was also analysed. That is, the idea that there could be a relationship between an individual's earnings and the corresponding father-in-law's earnings is taken into account which would also show the way in which assortative mating plays a role on the level of intergenerational mobility. That is, male individuals would have similar earnings to their own fathers, but also to their fathers-in-law. Table 4.19 presents the levels of intergenerational dependency between an individual's and their father's earnings (column 1), and an individual's and partner's joint earnings and an individual's parents' earnings (column 2). Furthemore, the relationship between an individual's earnings and his father-in-law's and an individual's and partner's joint earnings and his parents-in-law are found in column 3 and 4 respectively. From these results it is possible to see that a father's earnings and father-in-law's earnings explain, to a similar degree, an individual's earnings (0.458 and 0.422 respectively). Similarly, an individual's and partner's joint earnings are also explained to a similar degree by the individual's parents' earnings and his parents-in-law (0.595 and 0.618 respectively). That could suggest that people find a partner with similar characteristics to their parents.

Table 4.19: Intergenerational Earnings Dependency including Father and Parents-in-Law[138]

Y=	Ln_Y_Individual	Ln_Y_Individual&Partner	Ln_Y_Individual	Ln_Y_Individual&Partner
	(1)	(2)	(3)	(4)
	coef/se	coef/se	coef/se	coef/se
ln_Income_Father(μ)	**0.458*** **			
	(0.026)			
ln_IncomeFatherLaw			**0.442*** **	
			(0.024)	
ln_IncomeParents		**0.595*** **		
		(0.025)		
ln_IncomeParentsLaw				**0.618*** **
				(0.025)
age	0.079***	0.027	0.076***	0.034*
	(0.020)	(0.024)	(0.016)	(0.019)
age_Sq	-0.001***	-0.000	-0.001***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
age_Partner		0.090***		0.087***
		(0.015)		(0.016)
age_Partner_sq		-0.001***		-0.001***
		(0.000)		(0.000)
age_Dad	0.029	0.024		
	(0.035)	(0.035)		
age_Dad_sq	-0.000	-0.000		
	(0.000)	(0.000)		
age_Dad_Partner			0.014	-0.038*
			(0.015)	(0.021)
age_Dad_Partner_sq			-0.000	0.000**
			(0.000)	(0.000)
age_mum		0.003		
		(0.017)		
age_mum_sq		-0.000		
		(0.000)		
age_Mum_Partner				0.032**
				(0.015)
age_Mum_Partner_sq				-0.000
				(0.000)
_cons	5.013***	2.960***	5.593***	3.493***
	(0.974)	(0.953)	(0.554)	(0.614)
Number of observations	4,890	4,664	5,485	5,267
R2	0.098	0.151	0.087	0.144
note: *** p<0.01, ** p<0.05, * p<0.1				

[138] Standard errors are in brackets.

Notice that this analysis is only valid for the relationship of the intergenerational earnings coefficient, but not for analysing the effect of assortative mating by itself on the levels of intergenerational mobility, which is originally possible in Blanden's (2005) estimation, as her model implies that the levels of intergenerational earnings dependency only depends on the levels of assortative mating. Therefore, only the estimated parameter μ will be important, instead of the partial R^2 considered in previous results, as it corresponds to the impact of Father's earnings on the joint earnings of his son and his son's partner rather than the proportion of assortative mating influencing intergenerational earnings dependency.

4.8 Conclusions

Most of the economic research regarding to the impact of the level of association between couples' characteristics has been focused on the level of association between the couples' income or education and how these characteristics would be associated with some kind of rigidity in creating hopes for poorer people in society. In simple words, the problem with assortative mating is that highly educated people will pool together, and that will reinforce the possible reproduction of socioeconomic status from generation to generation. In terms of intergenerational earnings dependency, the focus has been on measuring it across countries and on the difficulties that usually arise (because of a lack of data availability) in obtaining the right factor to measure it. When, the possible causes of these levels of dependence between parents' and children's income has been considered, this has been largely in terms of the nature versus nurture analysis. However, the effect of assortative mating has not been analysed very often. In particular, considering what individuals consider as important in choosing their partner could have important implications in terms of income distribution (Boulier and Rosenzweig, 1984). Especially if interaction opportunities are not randomly distributed, people would generally choose a partner with similar characteristics (Kalmijn and Flap, 2001). In addition, previous research on educational assortative mating has shown that in modern societies, education plays an important role in choosing a partner (Ultee and Luijkx 1990), that is why, in this research, assortative mating has been understood as the relation between years of schooling of members of a couple.

Therefore, this investigation considers that a proportion of the variance in intergenerational earnings dependency is explained by the level of assortative mating in terms of schooling. The findings suggest that the assortative mating explain around 20% of the total intergenerational earnings correlation (when male individuals and their female partners are considered), which implies an important effect of how individuals match with their partners through education and how that could help reproduce the socio-economic background of the couple, and reinforce the earnings relation of an individual's household and their parents' earnings. On the other hand, when female individuals and their male partners are considered, the effect is lower than the former (between 5% and 16%).

In addition, it is interesting to see that the father's and father-in-law's earnings have a similar influence on the earnings of individuals, which could be indicative of assortative mating in society, where individuals match with individuals that are similar to their parents.

The effect of the 1980's Chilean educational reform was analysed, finding that it has increased the level of educational assortative mating among members of couples: if individuals have been affected by the educational reform, the schooling of their partner increases by 0.031 and 0.056 years for each additional year of their own schooling, for partially and fully affected by the reform respectevely. In addition, the change in the average years of schooling of the partners of people with no qualifications are 0.315 and 0.711 for partially and fully affected respectively.These results give some support to the idea that the Chilean educational reform produced sorting among students, leaving the students with better social conditions (those with more parental support and with greater chances to achieve high levels of education) separated from those with fewer chances to progress in life. However, the effect of the reform might not only be associated with sorting, but also with the fact that the reform increased educational attainment, which in turn may also increase the level of assortative mating. As the whole population increases in terms of educational level achieved, different levels of attainment would produce different structural opportunities for individuals at each level to meet a similar partner. Therefore, if educational attainment increases over time, it could mean that younger cohorts would be more homogeneous in terms of education simply due to the general increase in the educational attainment of the whole population (which is true at least for more educated people, but not clear at lower levels of education). The further analysis in this respect shows, using quintiles of schooling that it is particularly at the bottom and at top of the distribution where couples have become more similar in terms of schooling after the reform, which could suggest segregation at the extremes of schooling distribution.

In addition, if poorer individuals access tertiary education, the potential contact between children from different backgrounds would also increase intergenerational income mobility (Blossfeld and Tim, 2003). Nevertheless, a higher opportunity of meeting people from different backgrounds does not necessarily decrease prejudice in society hence they might not effectively meet, as in many cases within higher educational institutions, people only interact in groups by considering their socioeconomic status.

Finally, the results presented seem to suggest that educational reforms could be very important in order to establish the mechanisms through which people find their partners. Considering that they allow for new generations to meet and interact amongst each other, the structure of educational systems would be essential to build a more open society, with more opportunities for people, but also to build a society where education not only means a degree, but also the understanding that people should be considered by their achievements and not simply by their parents' status. In particular, assortative mating can increase intergenerational mobility, and so any education policy that increases asortative mating through schools can have implications for inequality and social mobility in the next generation.

Appendix Assortative Mating

4A1. Mothers Sample

Table 4A1.1: Mother's Age in 2009 (reported by sons) versus 1990

Age of Mother in 2009			
2009 (reported by sons)		1990 (synthetic Mothers)	
t=0		t1=t+19	
Mean Age	58.03	Mean Age	58.25
Min Age	37	Min Age	44
Max Age	99	Max Age	79
St Dev.	7.24	St Dev.	10.28

Source: CASEN Surveys, 2009 and 1990

Table 4A1.2: Mother's Age in 2009 (reported by daughters) versus 1990

Age of Mother in 2009			
2009 (reported by daughters)		1990 (synthetic Mothers)	
t=0		t1=t+19	
Mean Age	56.55	Mean Age	57.42
Min Age	38	Min Age	40
Max Age	99	Max Age	99
St Dev.	7.13	St Dev.	7.23

Source: CASEN Surveys, 2009 and 1990

4A2. Results

Graph 4A2.1: Assortative Mating (Decile Earnings) by Age Cohort

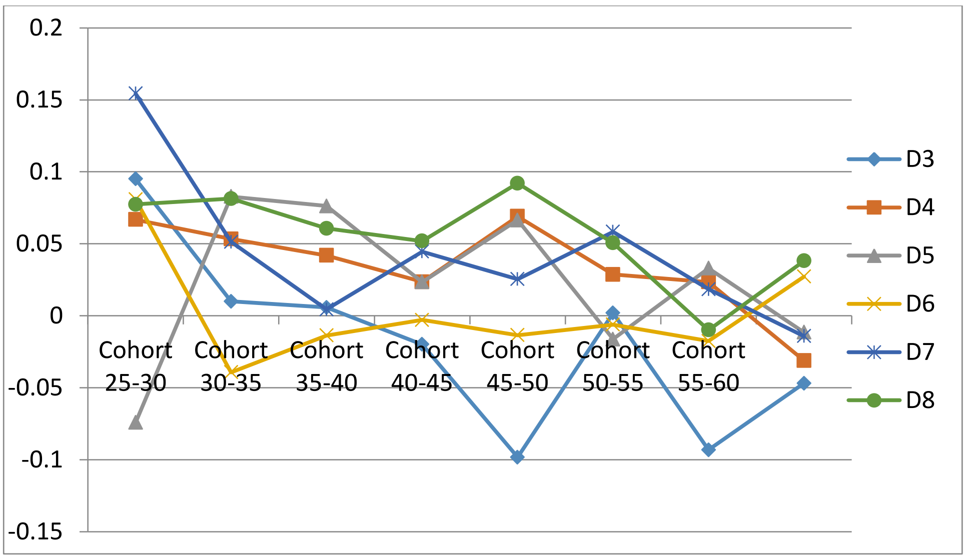


Table 4A2.1: Effect of Assortative Mating on Intergenerational Earnings Dependency (Not Including Control Variables)[139]

Intergenerational EarningsDependency_Weights				
Intergenerational Earnings	1st stage uses Individual Earnings (A.M) & uses Individuals and Father's Earnings (I.M)	1st stage uses Individual Earnings (A.M) & uses Individuals and Parents's Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Parents' Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Father's Earnings (I.M)
	(1)	**(2)**	**(3)**	**(4)**
	coef/se	**coef/se**	**coef/se**	**coef/se**
Assortative Mating	1.014***	1.141***	0.965***	0.893***
	(0.027)	(0.028)	(0.028)	(0.025)
_cons	-0.178***	-0.209***	-0.123***	-0.130***
	(0.016)	(0.016)	(0.017)	(0.015)
N. Obs Total	4,675	4,435	4,435	4,675
R2	**0.234**	**0.277**	**0.209**	**0.211**
N obs	40	40	40	40
note: *** p<0.01, ** p<0.05, * p<0.1				

[139] Standard errors are in brackets.

Table 4A2.2: Effect of Assortative Mating on Intergenerational Earnings Dependency (Including Control Variables)[140]

Intergenerational Earnings Dependency	Earnings Dependency_Weights: 1st stage uses Individual Earnings (A.M) & uses Individuals and Father's Earnings (I.M)	1st stage uses Individual Earnings (A.M) & uses Individuals and Parents's Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Parents' Earnings (I.M)	1st stage uses Individual and Partner Joint Earnings (A.M) & uses Individuals and Father's Earnings (I.M)
	(1)	(2)	(3)	(4)
	coef/se	coef/se	coef/se	coef/se
Assortative Mating	**1.377*** **	**1.522*** **	**0.605*** **	**0.526*** **
	(0.030)	(0.028)	(0.035)	(0.030)
Age	-0.094***	-0.160***	-0.041	-0.060**
	(0.024)	(0.024)	(0.033)	(0.027)
Age_Partner	0.806***	0.879***	0.707***	0.724***
	(0.031)	(0.029)	(0.041)	(0.038)
Age_Dad	-2.217***	-2.282***	-1.873***	-1.213***
	(0.080)	(0.098)	(0.133)	(0.090)
Age_Mum		0.053	0.228***	
		(0.057)	(0.079)	
Age_sq	0.001***	0.002***	0.001**	0.002***
	(0.000)	(0.000)	(0.001)	(0.000)
Age_Partner_sq	-0.012***	-0.013***	-0.010***	-0.010***
	(0.000)	(0.000)	(0.001)	(0.001)
Age_Dad_sq	0.018***	0.019***	0.015***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Age_Mum_sq		-0.000	-0.003***	
		(0.001)	(0.001)	
_cons	54.838***	54.762***	40.715***	28.910***
	(2.009)	(1.971)	(2.786)	(2.272)
Number of observations	4,521	4,215	4,206	4,503
R2	0.457	0.556	0.299	0.368
N. Observations	38	37	37	38
SemiPartial R2	**0.258**	**0.309**	**0.258**	**0.328**
note: *** p<0.01, ** p<0.05, * p<0.1				

[140]Standard errors are in brackets.

Table 4A2.3: Effect of Assortative Mating on Intergenerational Earnings Dependency (Including Control Variables) for Female and Male Individuals (Standardised Coefficients)[141]

Intergenerational Earnings Dependency	Without Controls				With Controls			
	(1)		(2)		(3)		(4)	
	Female	Male	Female	Male	Female	Male	Female	Male
	Std coef/se	Std coef/se	Std coef/se	Std coef/se	Std coef/se	Std coef/se	Std coef/se	Std coef/se
Assortative Mating	0.432***	0.487***	0.233***	0.533***	0.488***	0.638***	0.024	0.605***
	(0.067)	(0.022)	(0.052)	(0.022)	(0.076)	(0.027)	(0.060)	(0.032)
Age					-1.602***	-0.442***	0.344***	-0.574***
					(0.073)	(0.027)	(0.090)	(0.035)
Age_Partner					1.341***	0.850***	1.207***	0.893***
					(0.112)	(0.033)	(0.134)	(0.038)
Age_Dad					2.021***	-1.160***	1.480***	-1.639***
					(0.140)	(0.087)	(0.290)	(0.142)
Age_Mum							-1.755***	0.473***
							(0.194)	(0.083)
Age_sq					0.024***	0.006***	-0.005***	0.007***
					(0.001)	(0.000)	(0.001)	(0.001)
Age_Partner					-0.018***	-0.014***	-0.019***	-0.014***
					(0.002)	(0.000)	(0.002)	(0.001)
Age_Dad_sq					-0.018***	0.010***	-0.013***	0.014***
					(0.001)	(0.001)	(0.002)	(0.001)
Age_Mum_sq							0.016***	-0.003***
							(0.002)	(0.001)
_cons	-1.010***	-0.183***	0.037	-0.217***	-56.614***	27.730***	-19.184***	28.814***
	(0.040)	(0.013)	(0.036)	(0.013)	(3.618)	(2.201)	(5.588)	(2.758)
N. Total Obs	6,711	6,711	1,778	6,711	6,711	6,711	1,778	5,312
R2	**0.187**	**0.237**	**0.054**	**0.284**	0.309	0.338	0.265	0.427
Number of observations	40	40	31	40	40	40	31	36
Semi-Partial R2					**0.1584**	**0.2457**	**0.0004**	**0.2128**
note: *** p<0.01, ** p<0.05, * p<0.1								

[141]Standard errors are in brackets.

5 Conclusions and Implications

5.1 Summary of Findings and Conclusions

This research has as its main aim to understand education as an important challenge to the process of intergenerational mobility in Chile, with the possibility of being a facilitator, but also a barrier to creating opportunities for new generations. In order to achieve this aim, this thesis has been divided into three main topics:

- The measurement of the levels of intergenerational earnings and schooling dependency, to show that Chile experiences low levels of earnings mobility and that levels of dependency between father and individual's earnings are lower than levels of schooling dependency.

- The analysis of the effect of school competition in a highly privatised educational system, finding that competition from public schools has a positive impact on school performance and that voucher schools have the opposite effect, probably due to sorting of students.

- The research of the effect that assortative mating has on the level of the cross-group variation in intergenerational earnings mobility, explaining around 20%.

5.1.2 Conclusion of Chapter 2

High levels of social mobility are understood as living in a society where there are hope and beliefin opportunities. Chapter 2 focused on the measurement of intergenerational earning and schooling mobility. It is found that Chile has low intergenerational earnings mobility and high intergenerational education mobility compared to other countries. However, the former comparison is relative to high income countries and the last one relative to developing countries, due to alack of data availability. On the other hand, a child's schooling seems to be very important in terms of reducing his father's earnings influence on his own earnings, but children's schooling would also depend strongly on their parents' schooling. It is also found that intergenerational mobility has been maintained over time quite constantly, except for the youngest cohorts. In addition, it is found that a son's earnings dependency is higher in the lowest quantiles of the sons' earnings distribution and lower in the highest quantiles. The opposite is found when considering intergenerational schooling dependency. Finally, results suggest that, contrary to what was expected, that when comparing standardised estimation of schooling and earnings dependency, the first is higher than the later.

5.1.3 Conclusions of Chapter 3

Chapter 3 focused on the effect of spatial competition through privatisation of the educational market, between schools in Chile. The major conclusion of this chapter is that an increasing number of voucher schools have negatively impacted the academic performance of other schools in the area, showing some of the dangers produced by a highly privatised educational market. This negative effect on performance from public schools seems to be due to sorting of students, concentrating less able or less supported students in public schools. However, competition from public schools seems to have a positive effect from public schools, which shows that competition can alsobe beneficial. It is also found that these school competition effects seem to be largest amongst middle-class families and in middle-ranking schools, probably because rich families do not use public schools and more successful schools are not threatened by competition, while poorer pupils in low-performing schools are less likely to move between schools to better performing ones.

5.1.4 Conclusions of Chapter 4

Chapter 4 focused on finding how much intergenerational earnings dependency is explained by assortative mating of members of a couple in terms of schooling. It is found that assortative mating produced around 20% of the intergenerational earnings dependency betweenan individual and their partner's joint earnings and the individual's father's earnings. Moreover, father's and father-in-law's earnings seem to have a similar impact on the earnings of individuals, suggesting some assortative mating effect on earnings transmission. In addition, this chapter found that the 1980s Chilean educational reform increased the level of educational assortative mating among members of couples. These results seem to be consistent with the idea explored in the previous chapter, where sorting was produced among students attending public and voucher schools. Nevertheless, the increase of assortative mating because of the reform could have other causes, such as a general increase of educational attainment in the whole population.

5.2 Implication of Findings

This research has been completed keeping always in mind that its implications may potentially be used for the development of social policies. In particular, the measurement of the levels of intergenerational mobility in Chile confirms that the social fluidity in its society is not the best, and the need for policies that encourage it are necessary, in particular, in the educational level. The analysis of the educational market and the effect of competition are also interesting as the equity-efficiency trade off emerges when social policies struggle in trying to use the resources in the best way without leaving behind students from poorer backgrounds or with limited household support. Finally, the concentration of richer families into fee-based voucher schools could also cause social segregation and the impossibility of interaction among individuals from different backgrounds, therefore, confirming that the 1980s educational reform created sorting and increased the levels of assortative mating, in particular, within the least educated group. This in turn calls for government intervention and for changes in the current dynamic of the educational market in Chile.

5.2.1 The Implications of the Level of Intergenerational Mobility

The levels of intergenerational mobility in Chilean society reflect how much reproduction of inequality exists; this could influence how much people end up believing in an equal and fair system that allows them to progress in life according to their effort. The transmission of educational and economic levels from parents to children is of particular interest as these could affect other areas of individual welfare, such as health, occupation and position in society. On the other hand, intergenerational elasticity of earnings and/or education could also be affected by inheritance of health conditions that are transmitted from parents to children or affected by some ability or personality that the labour market is interested in. Nevertheless, social policy cannot do anything about that except to try to equalise opportunities for people that are obviously different.

For example, even though the health of an individual is largely determined by genetics, if the government provides better health care and child nutrition, then health should not be a hindrance. The same can be said of the educational system - obviously some people will be born more able than others and social policy cannot change that. However, if someone is of average ability but is poor and has never developed his/her abilities to their full extent because of the lack of educational quality and his/her outcome is lower than someone who was rich with the same natural ability but did develop it, then changing the situation of the poorer individuals should be the purpose of potential social policies in order to firmly achieve equality of opportunity. Therefore, educational policies and structure of educational systems that better understand the way that educational inequality arises and persists are necessary (Machin, 2004).

In Britain, for example, there is evidence that intergenerational mobility has decreased over time (the same has been reported for Canada by Magee *et al.* (2000)) and that an increase in dependency between parental and child income has been parallel to the expansion of educational coverage, suggesting that maybe it is the richer children who actually benefit from it, instead of children from poorer backgrounds, reinforcing inequalities among generations. Even though poorer children could potentially improve their level of educational achievement, when they do it, richer children have already done it in advance, moving even further forward from the poorer individual educational achievement (Machin, 2004).

The levels of intergenerational earnings dependency in Chile seem to be quite high, in particular in the highest quantiles of income, suggesting that richer people transmit their social position to their offspring more than poorer people. For example, considering the transition matrix results, almost 28% of fathers that are located in the 10^{th} decile of the earnings distribution had children that were also in this position of the earnings distribution, contrasting with the middle and lower deciles in which around 10% of fathers have children in the same earnings position. This is consistent with the idea that Chile has high level levels of inequality explained by the highest part of the earnings distribution, which could create an elitist and segregated society. This could not only reduce opportunities for individuals from more disadvantaged backgrounds, but also reduce their hope and, with that, waste the effort that they could exert in order to have a better future. Chile also seems to have a high intergenerational earnings elasticity (0.46) in comparison to the average of other countries (to 0.37), but it is important to notice that the majority of the countries with studies that measure the level of intergenerational earnings dependency are developed countries. Chile is experiencing a transitional process with higher levels of intergenerational earnings dependency together with a general process of economic development. However, not a lot of empirical evidence exists in relation to this point (OECD, 2010).

The analysis of the level of intergenerational earnings dependency over time in Chile, is confounded by the lack of data, hence, only different age cohorts can be used. It is found that the levels of mobility have been maintained over time, and improved slightly in that the youngest cohorts present lower levels of earnings dependency than the oldest cohorts. This could mean that social policies have been working, but they have not been enough to equalise opportunities for individuals of new generations. However, this could be associated with a cohort effect, but not with a time effect.

The transmission of education also seems to be very high at the highest levels of education - 60% of fathers have a son who has achieved the same level of education as themselves. Similarly, in Chile, the intergenerational educational dependency (average across the full distribution) is around 0.38 which is quite low compared to the average intergenerational educational dependency across other countries (around 0.6). However, in comparing countries, one must be aware that this could be misleading, because in this case the majority of studies that measure the levels of intergenerational educational dependency have been done in developing countries, due to the lack of data in terms of parents-children earnings.

An important aim of this research is to compare the levels of intergenerational earnings and educational mobility, expecting to find higher levels of educational mobility, but lower levels of earnings mobility, following the idea that even though social and educational policies have increased the educational level of individuals (giving the opportunity to have better jobs and better salaries in the future), the earnings mobility has not been improved. Therefore, a standardised version of intergenerational earnings dependency and educational dependency was considered, finding that educational mobility (around 0.31) is lower than earnings mobility (around 0.47), which is exactly the opposite of what was expected. These results indicate that one of the most important areas in which social policy could intervene in order to increase opportunities for new generations is to give them better educational chances, providing them with better schools and better access to higher education. However, this unexpected result could be due to the lack of data. In particular, there is no information about where individuals attended school or university, which could result in the estimated standard deviation of fathers' earnings being lower than the real one (the former being predicted on the basis of their level of education, but not considering where it was obtained). Therefore, because of the measurement error, the standardised earnings coefficients potentially will be lower than the real coefficient obtained that if would have been if the effect of quality or prestige of the educational institution where the individual studied had been considered.

In terms of education, policy could be important, for example, in trying to reduce the elitism among schools or in trying to maintain a general good standard of education in the majority of them, instead of only a few of them. Furthermore, it is important to understand which segments of society have to be helped the most, and where social policy efforts could best be focused. For this case, the quantile regression estimation was useful, indicating that the earnings intergenerational elasticity increases with earnings decile. That is, richer people transmit their levels of earnings to a larger extent than poor people. On the other hand, educational levels are highly transmitted among poorer families. Poor families likely do not have the incentive to support their children to attend school or access higher levels of education, because they might not have enough money and education might be considered a luxury or because they do not believe that studying would actually take them out of poverty.

In this respect, high levels of social mobility are desirable. However, the question of how to best to achieve them is a big challenge for social policy. Social policies that favour less qualified workers in terms of employment opportunities or salary would probably increase earnings mobility, but are associated with a high social cost. These policies would reduce the incentives and efficiency for human capital accumulation. Hence, they would not be particularly desirable. On the other hand, if a society presents low levels of social mobility and it is found that this is due to a big gap in educational investment or due to nepotism that would also be inefficient and undesirable. It is therefore suggested that social policy should be focused on reducing difference in terms of parental investment in education, increasing for example public spending on education, to give better educational opportunities to families with parents that would tend to invest less in human capital (due to their budget constraints) and that nepotism should be eradicated as it favours social connections and not personal ability.

In addition, even though more has been learnt about why intergenerational income/educational dependencies are at a particular level, there is an open debate about the transmission mechanisms that are involved (Solon, 1999). D'Addio (2007) suggests that educational systems and policies that governments decide to implement have an impact on the level of social mobility of their countries. In particular, public provision of education would increase social mobility by reducing the cost of education to individuals and removing credit constraints. It would also be a substitute for family income in the educational process. There is almost a general agreement that countries with better public education systems, in particular with higher expenditures on primary school education, have lower intergenerational earnings elasticity (Black and Devereux, 2010).

On the other hand, the question ofwhether or not perfect mobility should be achieved becomes a basic one. With this in mind, Mulligan (1997) understands perfect mobility (measured as the intergenerational income elasticity) as perfect equality of opportunity, which is seen as desirable. Weil (2005) explains that this is due to the impact that social mobility has in terms of economic growth as the allocation of talent would be more efficient and, due to the effect that social mobility has on political economy issues, as a high level of social mobility would balance the 'class-fighting' and the desire for redistribution, because of the hope that poor families have that their children become richer in the future. On the other hand, Ichino *et al.* (2008) suggest that mobility would not be desirable, because it would not just depend on nature and nurture, but also on redistributive institutions that emerge from their own society and which distort an individual's incentives. Therefore, there would be costs associated with intergenerational mobility and there would be no reason to expect that the social optimal income intergenerational elasticity should be equal to zero. This is supported by Nunn (2011) who points out that even though social mobility is desirable, an optimal level cannot be established and by Corak (2006) who states that a β=0 would require a huge governmental intervention that in manysocieties would not be possible. Therefore, political economy issues are relevant in influencing the level of social mobility in a country.

As Solon (2002) points out, cross-country comparisons may help in understanding how income is transmitted generation by generation and the reasons why the level of intergenerational transmission varies among countries. In particular, it is of interest to know if the differences between countries are due to real differences among the elasticities in terms of social mobility or because of differences in the way that they were estimated.

Therefore, since redistributive policies generate a trade-off between insurance and incentives, the optimal level of mobility is not necessarily zero and the amount of dependency between parent and child income in equilibrium would depend, for example, on the costs and benefits of public education (Ichino *et al.*, 2010).

5.2.2 Equity and Efficiency Implications of the 1980 Educational School Reform and School Competition

Equity and efficiency have always been the aim of welfare policy in many countries. However, the idea that an increase in one of them will necessarily reduce the other is a permanent concern (Le Grand, 1990). In the educational policy context, efficiency is related to the best way in which resources are allocated (Wößmann and Schütz, 2006), in particular the level of output (for example, performance of students) relative to the resources utilised in obtaining them (for example, public spending in education). On the other hand, the concept of equity could have many meanings, and defining it is controversial enough, but it is generally understood as equal opportunities (Roemer, 1998). That is, equity means a student can achieve irrespective of their background or family socio-economic characteristics. Therefore, the implementation of a privatised educational system has particular relevance in terms of efficiency and equity implications.

The introduction of voucher school systems and school competition have been claimed to increase efficiency in the educational system, increasing the performance of students, in particular the ones attending public schools, without increasing spending on education, even more by decreasing it. In addition, the voucher school reform was implemented based on the belief that voucher schools will be able to administrate their resources in a way that favours their students the most and will have the incentive to attract students by offeringa quality service.

Additionally, the 1980 Chilean educational reformwas also implemented to widen the coverage of education (without a high public burden) and increase the educational attainment of the population. This was probably based on the idea that better educated individuals reduced the possibility of their being unemployed, for example in OECD countries the unemployment rate among the lowest skilled workers is higher than amongst the highly skilled (OECD, 2011). The objective of widening the educational coverage and educational attainment seems to have been achieved rapidly, when many schools were opened during the first five years of the reform. The number of individuals finishing secondary education increased from 28.8% in 1990[142] to 58.4% in 2006 in the poorest decile of income. This should have real importance, if it is considered that to

[142] There is no previous information related to educational attainment.

have a more educated society contributes not only to growth, but also to having 'better' citizens - ones that create more social cohesion and more political stability in society (Russell, 1988). In particular, schooling is positively associated with reducing, for example, alienation and social inequalities and reducing levels of crime (Lochner and Moretti,2001).

People also have the freedom to choose their school, which is difficult to measure, but considering that there was a big movement from public to voucher schools over time (enrolment in primary voucher schools increased from 31.8% in 1990 to 48% in 2008) this seems to indicate that people like to be able to choose and that voucher schools give them something that public schools do not. It was intended that the allocation of resources would be more efficient, as money destined to support public schools decreased, expecting that they would become more efficient when they suffer competition. However, this did not seem to happen because, even though voucher schools seem to obtain better results than public schools by around 13 points, they seem to negatively affect the quality of public schools (one more voucher school in the area reduces the exam results of local public schools by 0.761 points compared to their performance in the previous year) even when ruling out the possibility that this effect is produced by voucher schools locating in areas where public school experience a bad reputation and bad results or produced by voucher school locating in areas where students seem to have better results.

On the other hand, as mentioned previously, equity is by itself a controversial concept, but normally involves the ideas of fairness and justice in society. It could be understood as equality of outcomes, thus aiming that everyone achieves the same grade at school. However, this definition of equality also seems unfair, because individuals exert different levels of effort in terms of learning or studying. It seems reasonable to believe that inequality of outcomescan be tolerated if and only if it is a consequence of different levels of effort that individuals choose to put in to their activities, but not if it is a product of circumstances that are out of an individual's control such as ethnic background, gender, parental characteristics, etc. (Wößmann and Schütz, 2006). Therefore, educational outcomes (measures such as academic test scores or labour market performance) could be different among individuals, but the opportunities given to them must be equally independent of their circumstances in life. Hence, equality in education is basically understood as the reduction of influence of family characteristics.

Voucher systems could create more segregation, as students would be sorted according to their abilities or their socio-economic backgrounds. School choice educational systems would therefore divide students into more homogenous groups which would not be in line with the diversity of society (Hawley, 1996). This is precisely what seems to be happening in Chile - "better" children seem to be grouped together and do not integrate with children from different backgrounds: The public schools receive the poorest and the most vulnerable students (around 80% of their students), voucher schools without fees receive also some of the poorest (around 70%) and in contrast, voucher schools with fees accept the middle class (around 86%) and the private schools obviously take the richest students. Moreover, it is likely that these socio-economic inequalities among students attending schools are reflected in terms of academic performance, in fact, public schools obtain the worst results in the SIMCE academic test (238 points). In contrast voucher schools that take fees obtain 25 points more (263 points). It could also be possible that initial inequalities can be reproduced, as peer effects could play an important role and thusbeing associated with a polarisation of the political power that some families can exert. Students with parents who are more educated or have higher earnings are likely to be in an advantageous position, because parents can support them more. Therefore, if theyare all together, they will benefit from each other; the opposite will happen if students from low income families are put together. Hence, one aim should be to create equal opportunities in education, in order to avoid costly redistribution in the future (Ammermuller, 2005).

An educational policy that gives opportunities to children from different backgrounds to share schools would be particularly useful in the effort to reduce the problem of segregation (Acemoglu, 2003). In this respect, from a theoretical point of view, the increase in welfare through the implementation of a voucher system would be given by an apparent satisfaction of parents that decide to move their children from a public to a voucher school. However, the increase in welfare for those that can move can be cancelled out by the decrease in welfare for those that cannot, but want to (Carnoy, 1998). Actually, using economic theory, it is possible to suppose that competition would influence the allocation of resources positively and consumers would play an active role in choosing their favourite supplier. Nevertheless, free provision does not seem to be equal to free consumption as families have to incur some private costs such as transportation, and it is precisely these additional costs which make poorer families use educational services less than richer families, especially when many families move from one area or city to another whilst trying to find jobs and cheaper places to live, and educational choice would not be an important priority for them. Increasing commuting time for students (to move between houses to school), for example (which could also imply an extra-cost) could also be a concern among families who have to decide where to send their children to school. In terms of segregation related to school choice, Becker (1995) points out that poorer families in particular need better education to overcome their lack of family support and that they are normally destined to accept the schools in their neighbourhood as they cannot afford to move house, or the travelling costs. The author states his belief that a good voucher system should only be limited to poor families because students from poorer backgrounds are those who receive the most benefits from voucher education and its competition effects.

Moreover, an educational policy that changes financing characteristics of schools will affect the fundamental incentives schools face and, thus, over the long term, the goals they pursue (Hoxby, 1996). This has been largely debated in Chile, as ideological tendencies may claim that education cannot be privatised and that it is the role of the state to provide it to a high standard. On the other hand, others believe firmly in the right of choice and in the "invisible hand" that regulates markets, including the educational one. The reality is that incentives that encourage schools to offer a better service could potentially be beneficial for students and for school's owners. However, because quality of education is difficult to measure or subject to a lack of information, schools with profit aims will be able to cheat and keep their benefit without caring about their student performance. School performance in Chile improves the most on average, amongst free voucher schools (63% improve at least 1 point between 2005 and 2009) compared to public and fee voucher schools (around 50% improved at least 1 point between 2005 and 2009). This could be due to what was mentioned before, that schools that charge tuition fees have profit maximisation aims, and could change their incentives to provide a better quality service.

Hence, the important issue will be to design and to implement a voucher system that faces the efficiency-equity trade-off, and challenge it, finding ways to increase both important aims, for example increasing information for parents and the level of regulation and financial incentives or limiting their school's right to choose their students as in the Swedish educational reform, where voucher schools cannot select students (Björklund *et al.*, 2004) and where the levels of intergenerational earnings mobility are much higher than in the Chilean case. In addition, increasing the resources available for schools is important, and thoughthis does not increase the quality of the service by itself, focusing on areas that affect student achievement and therefore can raise educational outcomes, for example, teacher training, increasing teacher support equipment, among other thingsthat have an effect (Kazal, 1993). In addition, it has been suggested that in order to overcome segregational problems, the quality of teachers must be increased, in particular in schools with more disadvantaged pupils, or more facilities must be given to children in terms of access to technology and books, but it is also necessary to realise that better teachers will tend to go to better schools.

In summary, the implications of an educational system based on school competition therefore becomes relevant, as it could bring efficiency to the educational system through choice (among other things), but at the same time increase the levels of inequality and social segregation in the country by sorting pupils from better backgrounds into certain schools. This sorting effect could put children from similar socio-economic backgrounds together in the same schools, which could meanthat they create networks and friendships with individuals that are very similar to them. Therefore, assortative mating issues become relevant, as members of a couple that share the same background could reinforce the transmission of their levels of education and income to their children, creating even more inequality in society and exacerbating the issue. Such issues are considered in Chapter 4 of this research.

5.2.3 The Implication of High Levels of Assortative Mating

Reasonable policy implications regarding the study of intergenerational social mobility are not clear (Blanden, 2009). They depend on the causes of the levels of intergenerational mobility found in society, for example if it is mostly due to the transmission of genetic ability or other family characteristics, it would suppose a huge state intervention which could lead to huge inefficiencies. That is why knowing the precise factors that play a role in determining the level of intergenerational socioeconomic characteristics is very important.

Assortative mating could be one of the explanations for the level of intergenerational earnings dependency found in society and it also seems to be a reinforcing process, because individuals tend to segregate themselves into socially similar groups (like neighbourhood, for example). These small groups will therefore become more homogenous, and people that could potentially become couples meet in that neighbourhood, and would be even more homogenous than if they were never to meet in an already similar context. Actually, parents provide the most immediate and influential "neighbourhood" for their children. Therefore, children of similar parents (in terms of social characteristics) are likely to narrow the range of social interactions compared to children with parents from different backgrounds (Mare, 2008), mostly because the latter would have the opportunity to make friends with individuals from different parts of society and they would widen their choices of potential future partner.

Educational assortative mating could be considered one of the most important ways in which people socially separate themselves, in particular because the effect that education has on earnings and therefore in the transmission of socioeconomic conditions from one generation to another (Mare, 2008). This situation is particularly worrying when individuals with higher levels of education and earnings are those that present higher levels of assortative maiting as in the case of Chile where the correlation in terms of earnings in the 10^{th} decile is around 0.29 compared to the 1^{st} decile of earnings where the correlation is negative and in terms of years of schooling where the 10^{th} decile of earnings has couples that have a correlation of 0.72 and the 1st decile has a correlation of 0.58.

Additionally, the way that students are sorted in their schools could have an effect on intergenerational mobility levels, and for example, it is possible to assume that higher levels of education of both parents can be transferred to their children (d'Addio, 2007). The questions of whether or not schools are judged according to the kinds of children they are able to enrol or by the quality of the service they provide can be raised. This is particularly important because abilities and background of pupils can have an effect on the other pupils, and also group attributes can change the future decision of individuals, in particular in terms of education (Gibbons and Telhaj, 2005). Peer effects could be important in improving performance, but additionally, parents' efforts to send their children to schools with good peers would probably be directed towards obtaining benefits that good quality peer groups can provide, such as more emotional security or familiarity or maybe simply a feeling of elitism and exclusivility.

Therefore, assortative mating could be one of the important factors that influence the levels of intergenerational earnings mobility. The Chilean case shows high levels of segregation in the educational market, as mentioned before; the poorest students attend public schools being in close contact with students that have very similar family backgrounds. It has been proved that this level of segregation has an impact on the level of intergenerational earnings dependency, in fact, around 20% of the variance on the latter can be explained by the level of assortative mating in terms of years of schooling among members of a couple, the other part could be given by the impact of returns to education (so, how much people are going to receive in return for their human capital investment), or the progressivity of social policies implemented among other things. Therefore, in order to create a system that encourages integration and the possibility to create a varied enviroment, where people interact seems relevant, but also policy interventions would perhapsnot be enough to abolish firmly-established social institutions, such as the accent or last name that an individual has.

Nowadays, due to increasing female representation in the labour market not only women areevaluating the education and therefore the potential partner's potential future earnings, but men may also be doing the same. This would increase the educational assortative mating of couples even more (Mare, 2000). Women with a higher earnings potential (using education as a proxy) would be more attractive in the marriage market and, of course, men with more education would be in a better position to attract them. This would produce higher levels of educational assortative mating (Halpin and Chan, 2003). However, women realise that education could be useful for attracting men as a sign of future earnings (even though they are not planning to have a job in the future), and education then becomes not only an investment in terms of personal earnings but also in terms of future husband's earnings. In Mexico, for example, social institutions create a close relationship between schooling attainment and the marriage market, in particular for girls. Even more, in Mexican culture there exists an acronym "MMC" or "in the mean time, I am getting married" (mientras me caso) which demostrates the idea that girls should pursue higher levels of education in order to try to find a good husband (Attanasio and Kaufmann, 2012)

On the other hand, it is perfectly reasonable to expect that individuals will have different preferences for finding a partner - religion, race, hobbies, physical characteristics, or potential economic success. However, if individuals only match with similar partners this could increase the variance of socioeconomic characteristics among families and increase the gap of the socioeconomic characteristics of families of next generations, which could reinforce educational inequality (Mare, 2000). Individuals could marry similar individuals in terms of schooling because of their personal preferences, but also because of the structure of the marriage market (Mare, 1991). In this context, it is believed that the Chilean 1980 educational reform could have had an impact on the levels of assortative mating experienced in the country as it put together similar students into the same schools, narrowing their marriage market. In particular, if it is considered that relationships and friendships depend initially on the opportunities available for meeting people, including the contacts made at school, but also the friends of friends to whom they could potentially be introduced (Blossfeld, 2009), then the role of educational assortative mating becomes even more relevant. This research actually finds that when individuals are affected by the reform their partner's schooling increases by 0.049 years more for each year of schooling of the individual when individuals achieve primary education, which would suggest an increase in segregation in this segment of educational achievement as the number of individuals with lower levels of education has decreased, therefore, one could expect a decrease in assortative mating.

Increasing assortative mating over time could be due to an increasing average educational attainment (more homogeneity among individuals), or because of an increase in the age at which individuals leave school or an increase in the age of marriage, i.e. assortative mating in terms of schooling is more likely among highly educated individuals and among individuals who do not get married soon after leaving school (Mare, 1991). The effect of the Chilean reform on the level of assortative mating was probably a combination of all these possibilities.

Chile actually increased its level of educational attainment after the reform (this being one of the aims of the reform), therefore new generations achieved higher educational levels and became more homogenous, in particular at higher levels of schooling. This was associated with more people with higher levels of schooling finding partners with similar characteristics more easily (as there were more of them), increasing the level of assortative mating in that segment of the population. On the other hand, this increase in educational attainment would reduce the number of individuals with lower levels of education. Therefore the level of assortative mating should be reduced in this segment of population. However, if segregation of the least educated has increased, the level of assortative mating may be increased in this segment, suggesting educational segregation as this is actually what seems to have happened.

Finally, it is interesting to notice that a father-in-law's earnings explains, to a similar degree, an individual's household earnings as the individual's own father's does, indicating assortative mating, especially if it is considered that household earnings are mostly driven by the male, meaning that women are getting married with individuals who are very similar to their fathers.

5.3 Limitations of Theses and Future Research

Intergenerational Mobility has not been absent of controversy, in particular, as mentioned in Chapter 2, different age of fathers and/or parents can be associated with a significant variation in the measurement of intergenerational earnings dependency. The main limitation is not only related to the lack of data on parent's earnings, because the TS2SLS has solved the problem of not having information in the same data set for individuals and their father's earnings, but the inability to predict father's earnings using more information than their occupation (which is limited to only 6 categories) and level of education. It would be better to have information about the job experience of parents, place of living, and most importantly school and/or university where they study, as it would help to predict their earnings in a more accurate way. In particular, the place of study would be of importance, as it is believed that some schools and universities havemore prestige in Chile, therefore finishing a determined programme at a university with a good reputation would not be the same in terms of providing potential earnings or access to better jobs. In addition, the measurement of intergenerational earnings and schooling mobility is also limited to obtain a value at a determined point of time. Therefore, another limitation would be the impossibility of obtaining measurement over time, that would allow the analysis of potential improvements in terms of social mobility in the Chilean society.

Future research could involve to the analysis of the sources of intergenerational mobility, for example in addition to the impact of assortative mating which was analysed already in this research, the effect of taxes in particular, would be interesting to analyse as the effect of potential tax reforms has taken relevance in the country in the last few years, given that it could dramatically change the income redistribution. Additionally, the role of social institutions could be analysed, the role of having an indigenous background or last name, the importance of accents, Basque or European sounding last name or even physical appearance could be considered. In this context, Nunez and Perez (2007) found that certain types of last names which seem to be related to Basque-Castellan aristocracy are associated with high levels of socio-economic status and a combination between English origin first name and Spanish last name seems to be associated with low levels of income (these relationships would be expressed subjectively by individuals when they are asked but also reflect the reality in Chilean society).

In chapter 3, the main aim was to find out if school spatial competition would effectively create an increase in student performance. However, in terms of empirical evidence, the lack of data limited the analysis, as for example information of school locations is available, but it is not possible to find information about student residential addresses which would certainly help to analyse separately the effect of school choice availability and the effect of school competition as done by Gibbons *et al.* (2008) for the case of primary schools in South East London, UK. Information related to the number of schools available for each student according to geographic constraints will be interesting to obtain to see the real situation of whether or not families can really exercise their right to choose any school. In addition, it would be interesting to have information about marketing strategies that schools could use to attract students, to evaluate if they are more cost-effective than increasing the quality provided to compete with surrounding schools. Urban density effects could also establish certain limitations for this research, that is certain areas will have more schools because more children live in the area, therefore competition indeces would depend on the population density of individualsof the age to attend to school. An attempt to solve this limitation has been to control for population density of individuals between 5 and 14 years of age by municipality, the problem is that the information is not found for narrow areas which would allow the specific calculation of population density where every school is located. For example, some cities such as Valparaiso, which is located in the Chilean Central Valley, has a small city centre and more than 40 hills surrounding it. Most of the families live on the hills, but they send their children to schools which are mostly located in the city centre. School size is also an important limitation as only the number of schools in the area was considered, but not the size of schools in the area.

Nevertheless, the most important limitation of this study is that its results are only applied to the Chilean case. There is no typical voucher system, they differ in terms of their finance, regulation and information (how much information parents have about their alternatives), and academic outcomes likely depend on how the reforms are structured in terms of funding, targeting (all the people, or only poor, or only women, etc.), admission regulations etc. Therefore, the results of this research are not intended to be extended to other countries, understanding every case as unique, especially because voucher reforms are not necessarily unrelated to political and economic circumstances (Belfield, 2001).

Additionally, further research could be conducted to analyse the impact of profit and non-profit institutions providing education; will profit organisations try to reduce the quality of the service in order to reduce their cost, attracting students by other means? In fact, such non-profit organisations would exist to serve people who are less informed who need someone to trust. However, it could also be that non-profit organisations do not have the incentive to act more efficiently because the earnings have to be reinvested and the quality of the service could also deteriorate as teachers for example do not enjoy the benefits of working harder to provide a better service. The increasing research in this area should open up a lot of discussion and will probably show the need for innovative ideas to reduce the social gap in education (Perry and Francis, 2010).

In terms of the analysis of one of the factors contributing to the levels of intergenerational mobility, chapter 4's first limitation is about trying to create a model that simply connectsjoint earnings of individuals and their partners with the individual's father and the way that individuals can choose their partner in life. First of all, assortative mating is reduced to merely schooling, and in real life individuals would take account of many other characteristics in choosing a partner. However, to reduce the choice to a proxy of the human capital held by individuals helps to understand how similar members of a couple are, only considering their education, which is easy to identify and maybe can be affected by social and educational policy. Secondly, the relationship between earnings and human capital of individuals is also simplified, especially considering that in Chilean society other factors could favour earnings of people with better social connections. In addition, many other aspects of the modelling were simplified which in one respect raises the possibility of solving the model and finally obtaining a simple equation that relates levels of assortative mating and intergenerational earnings dependency linearly.

Finally, in terms of future research, it would be interesting to analyse when and where members of a couple meet, as has been done in other international studies mentioned in this research (where the percentage of individuals that have found their partner in school has been presented), to see for example if individuals that go to university match with other individuals that also go to university independent of their background, or if people keep their social circles and do not really meet people from different social classes even though they share the same classroom. It would also be interesting to analyse the fertility effect related to the levels of intergenerational mobility in society, which was excluded in this research for reasons of simplicity, in particular, the quality-quantity trade-off of children should contribute to understanding the process of transmitting socioeconomic characteristics from parents to their offspring.

References

Acemoglu, D. (2003) Human Capital Policies and the Distribution of Income: A Framework for Analysis and Literature Review, Treasury Working Paper, Massachusetts Institute of Technology, January.

Acock, A. (2008) A Gentle Introduction to Stata.2nd Edition. Stata Press.

Ammermüller, A. (2005) Educational Opportunities and the Role of Institutions, Discussion Paper 05-44.

Andersen, L. (2001) Social Mobility in Latin America: Links with Adolescent Schooling Inter-American Development Bank

Andrews, D. and Leigh, A. (2009) 'More Inequality, Less Social Mobility' *Applied Economics Letters* 16(15), pp. 1489-1492.

Angrist, J., Chernozhukov, V. and Fernandez-Val, I. (2006) 'Quantile Regression under Misspecification, with an Application to the US Wage Structure' *Econometrica 74 (2) pp. 539-563, March.*

Angrist, J. and A. Krueger (1995) 'Split-Sample Instrumental Variables Estimates of the Return to Schooling' Journal of Business and Economic Statistics 13, pp. 225-235.

Angrist, J. and A. Krueger (1992) 'The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples' *Journal of American Statistical Association* 87(468), pp. 328-366.

Arellano, M. and Meghir, C. (1992) 'Female Labour Supply and on the Job Search: An Empirical Model Estimated Using Complementary Data Sets' *The Review of Economic Studies* 59(3), pp. 537-559.

Arenas, A. (2004) 'Privatization and Vouchers in Colombia and Chile' International Review of Education 50 (3) July pp.379-395.

Arum, R. (1996) 'Do Private Schools Force Public Schools to Compete?' *American Sociological Review* 61(1), February, pp. 29-46.

Attanasio*, O.* and Kaufmann, K.(2012)Education Choices and Returns on the Labor and Marriage Markets: Evidence from Data on Subjective Expectations, January.

Azevedo, V. And Bouillon, C. (2009) 'Intergenerational Social Mobility in Latin America: A Review of Existing Evidence' *Inter-American Development BankWorking Paper* 689.

Becker, G. (1995) 'Human Capital and Poverty Alleviation' Human *Resources Development and Operations Policy'* Working Paper 52, March.

Becker, G. (1974) *'A Theory of Marriage: Part II: Marriage, Family Human Capital and Fertility'* The Journal of Political Economy 82(2), Mar-April.

Becker, G. (1973) 'A theory of Marriage Part I' *Journal of Political Economy* 81(4), pp 813-846, July.

Becker, G. and Tomes, N. (1976) 'Child Endowments and the Quantity and Quality of Children' *Journal of Political Economy*, University of Chicago Press 84(4), pp. 143-62, August.

Behrman, J., Gaviria, A., and Szekely, M. (2001) 'Intergenerational Mobility in Latin America' *Economia* 2, pp. 1–31.

Behrman, J., Birdsall, N. and Székely , M. (1999) Intergenerational Mobility in South America: Deeper Markets and Better Schools Make a Difference *WDR on Poverty and Development 2000/01 Stiglitz Summer Research Workshop on Poverty*, Washington DC

Belfield, C. (2001) 'International Expenditure with Demand-led Financing: Education Vouchers in the USA, Great Britain and Chile' *Occasional Paper 23, National Center for the Study of Privatization in Education.* Teacher College, Columbia University.

Bernardi, F. (2003) 'Who Marries Whom in Italy?' in Who Marries Whom? Educational Systems as Marriage Markets in Modern Societies.Edited by Blossfeld, H. and Timm, A., pp. 113-141.

Birdsall, N. and Szekely, M. (1999) 'Intergenerational Mobility in Latin America: Deeper Markets and Better Schools Make a Difference' *Carnegie Paper* 3, July.

Björklund, A. (1993) 'A comparison between Actual Distributions of Annual and Lifetime Income: Sweden 1951–89' *The Review of Income and Wealth* 39(4), pp. 377-386.

Bjorklund, A. and Salvanes, K. (2010) 'Education and Family Background: Mechanisms and Policies' *IZA Discussion Papers* 5002.

Bjorklund, D., Roine, J. and Waldenstrom, D. (2008) 'Intergenerational Top Income Mobility in Sweden: A Combination of Equal Opportunity and Capitalistic Dynasties. *IZA Discussion Papers* 3801, October.

Björklund, A., Jäntti, M. and Solon, G. (2007) 'Nature and Nurture in the Intergenerational Transmission of Socioeconomic Status: Evidence from Swedish Children and Their Biological and Rearing Parents', IZA Discussion Papers 2665, March.

Bjorklund, A., Eriksson, T., Jantti, M, Raaum, O. and Osterbacka, E. (2004a) 'Family Structure and Labour Market Success: The Influence of Siblings and Birth Order on the Earnings of Young Adults in Norway, Finland and Sweden' In: Corak, M. *Generational Income Mobility in North America and Europe*. Cambridge, University Press, pp. 207-225.

Björklund, A., Edin. P, Fredriksson, P. and Krueger, A. (2004b) Education, equality, and efficiency – An analysis of Swedish school reforms during the 1990s, January.

Birkelund, G. and Heldal, J. (2003) 'Who Marries Whom? Educational Homogamy in Norway' *Demographic Research* 8(1), pp. 1-30, January.

Björklund, A. and Jäntti, M. (1997) 'Intergenerational Income Mobility in Sweden Compared to the United States' *The American Economic Review* 87(5), pp. 1009-1018.

Black, S. and Devereux, P. (2011) 'Recent Development in Intergenerational Mobility' *Handbook of Labor Economics 4 (B) pp. 1487–1541*

Black, S., Devereux, P. and Salvanes, K. (2005) 'Why the Apple Doesn't Fall Far: Understanding Intergenerational Transmission of Human Capital' *The American Economic Review* 95(1), pp. 437–449.

Blanden, J. (2009) 'How Much Can We Learn from Intergenerational Comparisons of Intergenerational Mobility?' *Centre for the Economics of Education, London School of Economics and Political Science Discussion Papers* 111, London, UK.

Blanden, J. (2005) 'Love and Money: Intergenerational Mobility and Marital Matching on Parental Income' *Analytical Studies Branch Research Paper Series* 272, Family and Labour Studies Division, December.

Blanden, J. and S. Machin (2007) 'Recent Changes in Intergenerational Mobility in Britain' *Report for the Sutton Trust,* December.

Blanden, J., Gregg, P. and Machin, S. (2005) Intergenerational Mobility in Europe and North America, A Report Supported by the Sutton Trust. Centre for Economic Performance, London School of Economics, April.

Blossfeld, H and Timm, A. (2003) Who Marries Whom? Educational Systems as Marriage Markets in Modern Societies Edited by Blossfeld, H and Timm, A. European Studies in Population.

Böhlmark, A. and Lindahl, M. (2008) 'Does School Privatization Improve Educational Achievement? Evidence from Sweden's Voucher Reform' *Institute for the Study of Labor Discussion Papers* 369, September.

Bosch, A. (1998) 'Popular Education, Work Training, and the Path to Women's Empowerment in Chile' Comparative Education Review 42(2), pp. 163-182, May.

Boulier, B. and Rosenzweig, M. (1984) 'Schooling, Search, and Spouse Selection: Testing Economic Theories of Marriage and Household Behavior' *Journal of Political Economy* 92(4), pp. 712-732, August.

Bowles, S. and Gintis, H. (2002) 'The Inheritance of Inequality' *The Journal of Economic Perspectives* 16(3), pp. 3-30.

Bradley, S. and Taylor, J. (2002) 'The Effect of the Quasi-Market on the Efficiency-Equity Trade-off in the Secondary School Sector' Bulletin of Economic Research 54(3) pp. 3307-3378.

Bradley, S., Johnes, G. and Millington, J. (1999) School Choice, Competition and the Efficiency of Secondary Schools in England, Working Paper, Lancaster University Management School

Bratsberg, B. Roed, K. Raaum, O., Naylor, R, Jantti, M., Eriksson, T. and and Osterbacka, E. (2006) 'NonLinearities in Intergenerational Earnings Mobility: Consequences for Cross-Country Comparisons' Working Paper 782, September, University of Warwick, Department of Economics, Coventry.

Bravo, D., Mukhopadhyay, S. and Todd, P. (2010) 'Effects of Schools Reform on Education and Labor Market Performance: Evidence from Chile's Universal Voucher System' Quantitative Economics 1(1) pp. 47-95, July.

Breen, R. (2001) 'A Rational Choice Model of Educational Inequality' *Working Paper 166*, October.

Brezis, E. (2010) The Effects of Elite Recruitment on Social Cohesion and Economic Development. Center for Economics Policy, Department of Economics, Bar-Ilan University, Ramat-Gan, Israel, December.

Burgess, S., Greaves, E., Vignoles, A. and Wilson, D. (2009) Parental choice of primary school in England: What 'Type' of School Do Parents Choose?, CMPO Working Paper Series 09/224, November.

Burgess, S., McConnekk, B., Propper, C. and Wilson, D. (2005) 'The Impact of School Choice on Sorting by Ability and Socio-Economic Factors in English Secondary Education' CMPO University of Bristol.

Cameron, A. and Trivedi, P (2005). Microeconometrics: Methods and Applications, Cambridge University Press.

Card, D. and Krueger, A. (1996) 'Labor Market Efects of School Quality: Theory and Evidence' *National Bureau of Economic Research Working Paper* 5450, February.

Cardak, B. (2001) Education, Vouchers, Growth and Income Inequality. Discussion Papers Series A 01.06 School of Business La Trobe University

Carnoy, M. (1998) 'National Voucher Plans in Chile and Sweden: Did Privatization Reforms Make for Better Education?' *Comparative Education Review* 42(3), August.

Carnoy, M. (1997) 'Is Privatization Through Education Voucher Really the Answer? : A Comment on West' The World Bank Research Observer 12(1) February 1997, pp. 105-116.

Carnoy, M. and McEwan, P. (2000) 'Is Private Education More Effective and Cost-Effective than Public? The Case of Chile' Educational and Evaluation Policy Analysis, Fall 22(3), pp. 213-223.

Chadwick, L. and Solon, G. (2002) 'Intergenerational Income Mobility among Daughters' The American Economic Review 92(1) March, pp. 335-334

Checchi, D. (1997) 'Education and Intergenerational Mobility in Occupations' The*American Journal of Economics and Sociology*56(3): 331-351.

Checchi, D. and Jappelli, T. (2002) School Choice and Quality, Working Paper, November Universita degli Studi di Milano.

Checchi, D, Ichino, A. and Rustichini, A. (1999) 'More Equal but Less Mobile? Education Financing and Intergenerational Mobility in Italy and in the US' *Journal of Public Economics* 74, pp. 351-393.

Chen, H. (2005) Educational Systems, Growth and Income Distribution: A Quantitative Study Journal of Development Economics 76, pp. 325– 353.

Chiappori, P., Murat, I., and Weiss, Y. (2009) 'Investment in Schooling and the Marriage Market' *American Economic Review*, 99(5), pp. 1689-1713.

Chumancero, R., Gallegos, J. and Paredes, P. (2011) School Choice and Switching Costs, Working Paper, Department of Industrial Engineering, PUC.

Chumancero, R., Gomez Caorsi, D. and Paredes, R. (2009) 'I Would Walk 500 Miles (If It Paid)' *Munich Personal RePEc Archive* 15125, May.

Comi, S. (2004) 'Schooling and Human Capital Formation in the Global Economy' *CESifo Conference Centre, Munich.*

Contreras, D., Sepulveda, P. and Bustos, S. (2010) 'When Schools Are the Ones that Choose: The effects of Screening in Chile' Social Science Quarterly 91(5), December.

Contreras, D., Larranaga, O., Puentes, E. and Rau, T. (2009) The Evolution of Opportunities for Children in Chile 1990-2006, Santiago, October

Contreras, D., Fuenzalida, M. and Acero, C. (2008) 'The Determinants of Intergenerational Low Income Mobility in Chile' Informe de Desarrollo Humana para America Latina y el Caribe Background Paper, September.

Contreras, D. and Macias, V. (2002) Competencia y Resultados Educacionales, Mayo.

Corak, M. 2012. Inequality from generation to generation: the United States in comparison. The Economics of Inequality, Poverty, and Discrimination in the 21st century.

Corak, M. (2006) 'Do Poor Children become Poor Adults? Lessons from a Cross Country Comparison of Generational Earnings Mobility' *Research on Economic Inequality*13(1): 143-188.

Corak, M. and Heisz, A. (1998) *'The Intergenerational Earnings and Income Mobility of Canadian Men: Evidence from Longitudinal Income Tax Data'* The Journal of Human Resources 34(3), pp. 504-533.

Couch, K. and Dunn, C. (1997) '*Intergenerational Correlations in Labor Market Status: A Comparison of the United States and Germany'*The Journal of Human Resources, 32(1) Winter, pp.210-232.

Cox, C. (1997) 'La Reforma de la Educación Chilena: Contexto, Contenidos, Implementacion' Programa de la Reforma Educativa en America Latina 8, May.

Cremer, H., De Donder, P. and Pestieau, P. (2010) 'Education and Social Mobility' CESifo working paper 2951, February.

D'Addio, A. (2007) 'Intergenerational Transmission of Disadvantage: Mobility or Immobility Across Generations?' *OECD Social, Employment and Migration Working Papers* 52.

Darville, P. and Rodriguez, J. (2007) Institucionalidad, Financiamiento y Rendicion de Cuentas en Educacion. Ministerio de Hacienda, Direccion de Presupuestos.

Dee, T. (1998) 'Competition and the Quality of Public Schools' Economics of Education review 17(4), pp. 419-427.

Dearden, L., Machin, S. and Reed, H. (1997) 'Intergenerational Mobility in Britain' *The Economic Journal*, 107 January, pp. 47-66.

De Ferrati, D., Perry, G., Ferreira, F. and Walton, M. (2004) 'Historical Roots of Inequality in Latin America' Chapter 4 in Inequality in Latin America and the Caribbean: Breaking with History?. World Bank Latin American and Caribbean Studies

Dunn, C. (2007) 'Intergenerational Transmission of Lifetime Earnings: Evidence from Brazil'*The B.E. Journal of Economic Analysis & Policy* 7(2).

Elacqua, G. (2009a) 'For-profit schooling and the politics of education reform in Chile: When ideology trumps evidence' Centro de Politicas Comparadas de Educacion, Universidad Diego Portales. Working Paper 5, July.

Elacqua, G. (2009b) 'Parent Behabour and Yardsitck Competition: Evidence from Chile's National Voucher Program' *Centro de Politicas Comparadas de Educacion* Working Paper 2, Junio.

Elacqua, G. (2009c) 'The Impact of School Choice and Public Policy on Segregation: Evidence from Chile' *Centro de Politicas Comparadas de Educacion Working Paper* 10, October.

Elacqua, G., Schneider, M. and Buckley, J. (2006) 'School Choice in Chile: Is it Class or the Classroom?' *Journal of Policy Analysis and Management* 25 (3), pp. 577-601.

Epple, D. and Romano, R. (2002) 'Educational Vouchers and Cream Skimming' *National Bureau of Economic Research* Working Paper 9354, November.

Epple, D. and Romano, R., (2000) 'Competition between Private and Public Schools: Testing Stratification and Pricing Predictions' *National Bureau of Economic Research* Working Paper 7956, October.

Ermisch, J. F., and Nicoletti, C. (2006)*'Intergenerational Earnings Mobility: changes across cohorts in Britain'* ISER working papers 2005-19, Institute for Social and EconomicResearch.

Ermisch, J., Francesconi, M. and Siedler, T. (2006) 'Intergenerational Mobility and Marital Sorting' *The Economic Journal* 116, pp.659-679, July.

Fernandez, R. (2001) 'Education, Segregation and Marital Sorting: Theory and an Application to UK Data' *Working Paper* 8377, National Bureau of Economic Research. July.

Fernandez, R. and Rogerson, R. (2001) *'Sorting and Long-Run Inequality'*The Quarterly Journal of Economics 116 (4), pp. 1305-1341, November.

Fernandez, R. and Rogerson, R. (1994) 'Public Education and Income Distribution: A Quantitative Evaluation of Education Finance Reform' *National Bureau of Economic ResearchWorking Paper4883*, October.

Fertig, A. (2001) 'Trends in Intergenerational Earnings' *Working Paper*, November.

Figlio, D. and Page, M. (2000) School Choice and the Distributional Effects of Ability Tracking: Does Separation Increase Equality, Working Paper 8055, National Bureau of Economics Research, December.

Fischer, J. (2009) 'The Welfare Effects of Social Mobility' *OECD Social, Employment and Migration Working Papers* 93.

Fiske, E. and Ladd, H. (2001) 'Lessons from New Zealand ' in *Charters, Vouchers and Public Education*, Peterson, P. and Campbell, D. (2001) editors. Brookings Institution Press.

Folbre, N. (1984) 'Market Opportunities, Genetic Endowments, and Intra-family Resource Distribution: Comment' *The American Economic Review* 74(3) June, pp. 518-520.

Fortin, N. and Lefbvre, S. (1998) 'Intergenerational Income Mobility in Canada'. In: Corak, M. *Labour Markets, Social Institutions and the Future of Canadian's Children*, November.

Friedman, M. (1962) 'The Role of Government in Education' In *Capitalism and Freedom*, pp. 85-107.The University of Chicago Press.

Galindo-Rueda, F. and Vignoles, A. (2004) The Heterogeneous Effect of Selection in Secondary Schools: Understanding the Changing Role of Ability, *IZA* Discussion Paper No. 1245, August.

Gallego, F. (2006) 'Voucher-School Competition, Incentives, and Outcomes: Evidence from Chile' Department of Economic, MIT.

Gallego, F. and Hernando, A. (2002) On the Determinants and Implications of School Choice: Structural Estimates and Simulations for Chile, March

Gibbons, M. (2010) Income and Occupational Intergenerational Mobility in New Zealand, New Zealand Treasury.

Gibbons, S., Machin, S. And Silva, O. (2008) *'Choice, Competition and Pupil Achievement'Journal of the European Economic Association 6 (4), June, pp. 912-947.*

Gibbons, S. and Telhaj, S. (2005) Peer Effects and Pupil Attainment: Evidence from Secondary School Transition, July.

Glennerster, H. (1991) 'Quasi-Markets for Education' *The Economic Journal* 101(408), pp.1268-1276, September.

Goldthorpe, J. and Mills, C. (2004) 'Trends in Intergenerational Class Mobility in Britain in the Late Twentieth Century' In: Breen. R. *Social Mobility in Europe*, Oxford, University Press.

Gong, H., Leigh, A. and Meng, X. (2012) 'Intergenerational Income Mobility in Urban China' Review of Income and Wealth 58(3), pp. 481-503, September.

Granger, C. and Morris, M. (1976) 'Time Series Modelling and Interpretation' Journal *of the Royal Statistical Society* Series A (General) 139(2), pp. 246-257.

Grawe, N. (2006) 'Lifecycle Bias in Estimates of Intergenerational Earnings Persistence' *Labour Economics* 13(5), pp. 551-570.

Grawe, N. (2004) 'Reconsidering the Use of Non-Linearity in Intergenerational Earnings Mobility as a Test for Credit Constraints' *The Human Resources Journal* 39(3) Summer, pp. 813-827.

Guyon, N., Maurin, E. and McNally, S. (2012) 'The Effect of Tracking Students by Ability into Different Schools: a Natural Experiment' *J. Human Resources* 47, pp. 684-72, June.

Haddad, L. and R. Kanbur (1990) 'How Serious Is the Neglect of Intra-household Inequality?' *Economic Journal* Royal Economic Society 100(402), September, pp. 866-881.

Haider, S. and Solon, G. (2006) 'Life-Cycle Variation in the Association between Current and Lifetime Earnings' The American Economic Review 96(4), pp. 1308-1320, September.

Halpin, B. and Chan, T. (2003) 'Educational homogamy in Ireland and Britain: Trends and Patterns' *Br J Sociol* 54(4), pp. 473-96, December.

Hamplová, D. (2005) Educational Homogamy in Marriage and Cohabitation in Selected European Countries. International Sociological Association

Research Committee 28 on Social Stratification and Mobility: Los Angeles Meeting, August 18-21.

Han, S. and Mulligan, C. (2001) 'Human Capital, Heterogeneity and Estimated Degrees of Intergenerational Mobility' *Economic Journal, Royal Economic Society*, 111(470), pp. 207-43, April.

Hanushek, E. (1986) 'The Economics of Schooling: Production and Efficiency in Public Schools' *Journal of Economic Literature* 24(3), September, pp. 1141-1177.

Hastings, J., Kane, T. and Straiger, D. (2005) 'Parental Preferences and School Competition: Evidence from a Public School Choice Program' *National Bureau of Economic Research Working Paper* 11805.

Heckman, J., Layne-Farrar, A. and Todd, P. (1995) 'Does Measured School Quality Really Matter? An Examination of the Earnings-Quality Relationship' *National Bureau of Economic Research Working Paper* 5274, September.

Hertz (2008) "Rags, Riches and Race: The Intergenerational Economic Mobility of Black and White Families in the United States'. In: Bowles, S., Gintis, H. and Osborne, M*. Unequal Chances: Family Background and Economic Success*, Princeton University Press.

Hertz, T., Selcuk, S. Jayasundera, T. Piraino, P. Smith, N. and Verashchagina, A. (2007) 'Intergenerational Mobility around the World'*The B.E. Journal of Economic Analysis & Policy* 7(2) Article 10.

Hirvonen, L. (2008) 'Intergenerational Earnings Mobility Among Daughters and Sons: Evidenc from Sweden and a Comparison with the United States' *American Journal of Economics and Sociology* 67(5), pp. 777-826, December.

Holmlund, H. (2008) Intergenerational Mobility and Assortative Mating: Effects of an Educational Reform. Centre for the Economics of Education, London School of Economics, 91 Discussion Paper, November.

Holmlund, H., Lindahl, M. and Plug, E. (2008) 'The Causal Effect of Parent's Schooling on Children's Schooling: A Comparison of Estimation Methods' *IZA Discussion Papers* 3630.

Holter, H. (2011) 'Accounting for Cross-Country Differences in Intergenerational Earnings Persistence: The Impact of Taxation and Public Education Expenditure' Working Paper, December.

Hoxby, C. (2003) 'School Choice and School Competition: Evidence from the United States' *Swedish Economic Policy Review 10*.

Hoxby, C. (1996) 'Are Efficiency and Equity in School Finance Substitutes or Complements?' *Journal of Economic Perspectives*, 10 (4), Fall, pp. 51-72.

Hoxby, C. (1994) 'Do Private Schools Provide Competition for Public Schools? National Bureau of Economic Research' Working Paper, December.

Hsieh, C. and Urquiola, M. (2006) 'The effects of Generalized School Choice on Achievement and Stratification: Evidence from Chile's Voucher Program' Journal of Public Economics 90, pp.1477-1503.

Hussain, M., Bonke, J. and Munk, M. (2011) Intergenerational Income Mobility: Top Incomes and Assortative Mating in Denmark. Working Papers Center for Mobility Research, Aalborg University.

Hyson (2003) 'Differences in Intergenerational Mobility across the Earnings Distribution' *Bureau of Labor Statistics Working Papers* 364.

Ichino, A., Karabarbounis, L. and Moretti, E. (2010) 'The Political Economy of Intergenerational Income' *National Bureau of Economic Research Working Paper Series* 15946 April, Cambridge Massachusetts.

Ichino, A., Moretti, E., Karabarbounis, L. and Salvanes, K. (2008) 'Optimal Intergenerational Mobility of Income and the Allocation of Talent Working Paper, June.

Inoue A. and G. Solon (2010) Two-Sample Instrumental Variables Estimators. Review of Economics and Statistics, 92(3), 557-561.

Jantti, M., Bratsberg, B., Roed, K., Raam, O., Naylor, R., Osterbacka, E., Bjorklund, A. and Eriksson, T. (2006) 'American Exceptionalism in a New Light: A Comparison of Intergenerational Earnings Mobility in the Nordic Countries, the United Kingdom and the United States' IZA Discussion Paper 1938, January.

JUNAEB (2005) SINAE Sistema Nacional de Asignación con Equidad para Becas JUNAEB: Una nueva visión en la construcción de igualdad de oportunidades en la infancia, Chilean Goverment.

Kalmijn, M. (1998) 'Intermarriage and Homogamy: Causes, Patterns,Trends' *Annu. Rev. Sociol* 24, pp. 395-421.

Kalmijn, M. and Flap, H. (2001) 'Assortative Meeting and Mating: Unintended Consequences of Organized Settings for Partner Choices' *Social Forces* 79(4), pp. 1289-1312, June.

Koenker, R. and Hallock, K. (2001) 'Quantile *Regression' The Journal of Economic Perspectives* 15(4), pp. 143-156.

Koenker, R. And Bassett, G. Jr (1978) 'Regression Quantiles' *Econometrica* 46(1) January, pp. 33-50.

Kubal, M. (2006) 'Contradictions and Constrains in Chile's Health Care and Education Decentralization' *Latin American Politics and Society* 48(4), Winter, pp.105-135.

Ladd, H. and Fiske, E. (2003) 'Does Competition Improve Teaching and Learning? Evidence from New Zeland' *Educational Evaluation and Policy Analysis* 25 (1) Spring, pp. 97-112.

Lam, D. and Schoeni, R. (1993) 'Effects of Family Background on Earnings and Returns to Schooling: Evidence from Brazil' *Journal of Political Economy* 101 (4), pp.710-740, August.

Lannelli, C. and Paterson, L. (2005) Does Education Promote Social Mobility?

Laumann, E., J. Gagon, R. Michael and S. Michaels (1994). The Social Organization of Sexuality: Sexual Practices in the US. Chicago: University of Chicago Press.

Lee, S. (2008) Preferences and Choice Constraints in Marital Sorting: Evidence From Korea. Department of Economics, Stanford University, November.

Lefranc, A. and Trannoy, A. (2005) 'Intergenerational Earnings Mobility in France: Is France more Mobile than the US?' Annales d'Economie et Statistique 78.

Le Grand, J. (1990) 'Equity Versus Efficiency: The Elusive Trade-Off' Ethics 100 (3), pp. 554-568, April.

Lehmann, C. and Hinzpeter, X. (1997) Opinicion Publica y Educacion en Chile: Preferencias y Disposiciones, Centro de Estuidios Publicos, 183, Julio.

Levin, H. (1991) 'The Economics of Educational Choice' *Economics of Education Review* 10(2) pp.137-158.

Lewis, S. and Oppenheimer, V. (2000) 'Educational Assortative Mating across Marriage Markets: Non-Hispanic Whites in the UnitedStates' *Demography* 37(1), pp. 29-40, February.

Li, I. (2011) Intergenerational Income Mobility in Taiwan, Institute of EconomicsAcademia Sinica, September.

Lindley, J. and McIntosh, S. (2009) 'A Panel Data Analysis of the Incidence and Impact of Over-Education' The University of Sheffield Economics Research Paper Series 2008009.

Lochner, L., Moretti, E. (2001) The effect of Education on Crime: Evidence from Prison Inmates, Arrests and Self-Reports, Working Paper 8605, National Bureau of Economic Research.

Lubienski, C. (2005) 'Public Schools in Marketized Enviroments: Shifting Incentives and Unintended Consequences of Competition-Based Educational Reforms' *Journal of Education* 111(4), August.

Lyigun, M. (1999) 'Public Education and Intergenerational Economic Mobility' *International Economic Review* 40(3).

Machin, S. (2004) Education Systems and Intergenerational Mobility.Draft Paper Prepared for CESifo/PEPG Conference, Munich, July.

MacLeod, B. and Urquiola, M. (2009) Anti-Lemons: School Reputation and Educational Quality, National Bureau of Economic Research Working Paper 15112.

Magee, L., Burbidge, J. and Robb, L. (2000) The Correlation Between Husband's and Wife's Education: Canada, 1971-1996.Department of Economics, McMaster University. Hamilton, Ontario, Canada, June.

Mare, R. (2008) Educational Assortative Mating in Two Generations, University of California – Los Angeles, August.

Mare, R. (2000) Assortative Mating, Intergenerational Mobility, and Educational Inequality, California Center for Population Research On-Line Working Paper Series, November

Mare, R. (1991) 'Five Decades of Educational Assortative Mating' *American Sociological Review* 56(1), pp. 15-32, February.

McConnell, B., Burgess, S., Propper, C. and Wilson, D. (2004) 'Sorting and Choice in English Secondary Schools' *CMPO University of Bristol Working Paper 111.*

McEwan, P. (2004) 'The Potential Impact of Vouchers' *Peabody Journal of Education* 79(3), pp.57-80.

McEwan, P., Urquiola, M. and Vegas, E. (2008) 'School Choice, Stratification, and Information on School Performance: Lessons from Chile' Economia, Spring.

McEwan, P. and Carnoy, M. (2000) 'The effectiveness and Efficiency private Schools in Chile's Voucher System' *Educational Evaluation and Policy Analysis* 22(3), Autumn, pp.213-239.

McGinn, N. and Street, S. (1986) 'Educational Decentralization: Weak State or Strong State?' *Comparative Education Review* 30(4) November, pp.471-490.

Medrano, P. and Contreras, D. (2009) Evidence of Neighbourhood Effects on Educational Performance in the Chilean School Voucher System, Working Paper, Noviembre.

Mickelson, R.A., Bottia, M., Southworth, S. (2008). *School Choice and Segregation by Race, Class, and Achievement*.Boulder, CO: National Education Policy Center.

Ministerio de Planificacion (2010) 'La Encuesta de Caracterizacion Socioeconomica: Nuevas cifras de Distribucion del Ingreso' [WWW] Gobierno de Chile. Available from: http://www.ministeriodesarrollosocial.gob.cl/casen2009/ingreso.php [Accessed 11/05/2012].

Ministry of Education (2008) Indicadores de la Educación en Chile (Años 2007 – 2008), Gobierno de Chile.

Mizala, A. and Urquiola, M. (2009) 'School Markets: The impact of Information Approximating Schools's Effectiveness' Documentos de Trabajo, Serie Economia 239. July

Mizala, A. and Romaguera, P. (1998) 'Desempeño Escolar y Elección de Colegio: La Experiencia Chilena' *Centro de Economia Aplicada*, Universidad de Chile.

Mocetti, S. (2007) 'Intergenerational Earnings Mobility in Italy' *The B.E. Journal of Economic Analysis and Policy*, Berkeley Electronic Press 7(2).

Mooney, C. (1996) 'Bootstrap Statistical Inference: Examples and Evaluations for Political Science' *American Journal of Political Science* 40(2) May, pp. 570-602.

Mulligan, C. (1997) Parental Priorities and Economic Inequality, University of Chicago Press.

Nakosteen, R and Zimmer, M. (2001) 'Spoose selection and Earnings: Evidence of Marital Sorting' *Economic Inquiry* 39(2), pp. 201-213, April.

Narodowski, M. and Nores, M. (2002) 'Segregation with (without) Competitive Education Policies. A Cpmparative Analysis of Argentina and Chile' Comparative Education, 38 (4), pp. 429-451, Special Number (26): Latin America and Educational Transfer November.

Neal, D. (2002) 'How Vouchers Could Change the Market for Education' *Journal of Economic Perspectives* 16(4), pp.25-44, Autumn.

Nielsen, H. and Svarer, M. (2006) 'Educational Homogamy: Preferences or Opportunities?' Centre for Applied, Microeconometrics, Department of Economics University of Copenhagen, December.

Nores, M. and Narodowski, M. (2002) 'Socio-Economic Segregation with (without) Competitive Education Policies: A Comparative Analysus of Argentina and Chile' Comparative Education 38(4) Special Number (26) Latin America and Educational Transfer .November, pp.429-451.

Nunn, A. (2011) 'Draft on Fostering Social Mobility as a Contribution to Social Cohesion' *The European Committee of Social Cohesion.*

Núñez, J. and Miranda, L. (2011) 'Intergenerational Income and Educational Mobility in Urban Chile: Movilidad Intergeneracional del Ingreso y la

Educación en Zonas Urbanas de Chile' *Departamento de Economia, Universidad de Chile, Estudios de Economia* 38(1), Junio, pp. 195-221.

Núñez, J. and Tartakowsky, A. (2009) 'The Relationship between Inequality of Incomes and Inequality of Opportunities in a High-Inequality Country: The Case of Chile' *Departamento e Economia Universidad de Chile Working Papers* 292.

Núñez, J. and Riesco, C. (2004) 'Movilidad Intergeneracional del Ingreso en un Pais en Desarrollo: El Caso de Chile' *Economics Department, Universidad de Chile, Chile Working Papers* 210, December.

Núñez, J. and Gutiérrez, R. (2004) Classism, Discrimination and Meritocracy in the Labour Market: The Case of Chile. Working Paper 208, Departamento de Economía Facultad de Ciencias Económicas y Administrativas, Universidad de Chile

OECD (2014) OECDEconomic Outlook, Chile Economic Forescast Summary.

OECD (2012) OECD StatExtracts, Complete Databases available via OECD's iLibrary.

OECD (2011) OECD Employment Outlook 2011, Directorate for Employment, Labour and Social Affaire.

OECD (2005) 'A Family Affair: Intergenerational Social Mobility across OECD Countries' *Economic Policy Reforms Going for Growth Chapter 5.*

OECD (2004) Revisión de Políticas Nacionales de Educación, Chile. OECD, Paris.

OECD (2003) Human Capital Policy. OECD, Paris.

Parrado, S. and Salvador, M. (2011) 'Institutionalisation of Meritocratic Recruitment in Latin American Regulatory Agencies' International Review of Administrative Sciences 77 (4), pp. 687-712, December.

Parry-Rounds, T. (1997) 'Decentralization and Privatization: Education Policy in Chile' *Journal of Public Policy* 17(1) pp. 107-133.

Patrinos, H. and Sakellariou, C. (2008) 'Quality of Schooling, Returns to Schooling and the 1981 Voucher Reform in Chile' *The World Bank Human Development Network, Education Team, May Policy Research Working Paper 4617.*

Perry, E. and Francis, B. (2010) 'The Social Class Gap for Educational Achievement: A Review of the Literature' RSA Project, December.

Piopiunik, M. (2011) 'Intergenerational Transmission of Education and Mediating Channels: Evidence from Compulsory Schooling Reforms in Germany' *Institute for Economic Research at The University of Munich Working Paper* 107.

Pronzato, C. (2009) 'An Examination of Parental and Maternal Intergenerational Transmission of Schooling' *Centre for Household, Income, Labour and Demographic Economics Working Paper* 20, August.

Psacharopoulos, G. and Chu Ng, Y. (1992) 'Earnings and Education in Latin America: Assessing Priorities for Schooling Investments' Technical Department, Latin America and the Caribbean Region, The World Bank, Working Paper Series 1056, December.

Raaum, O., Bratsberg, B. , Osterbacka, E., Eriksson, T. Jantti, M. and Naylor, R. (2007) 'Marital Sorting, Household Labor Supply and Intergenerational Earnings Mobility Across Countries' IZA Discussion paper 3037, Institute for the Study of Labor.

Restuccia, D. and Urrutia, C. (2002) 'Intergenerational Persistence of Earnings: The Role of Early and College Education' *American Economic Review*94(5), December, pp. 1354-1378.

Roemer, J. (2004) 'Equal Opportunity and Intergenerational Mobility: Going beyond Intergenerational Income Transition Matrices' In: Corak, M. *Generational Income Mobility in North America and Europe*. Cambridge, University Press, pp. 48-57.

Russell, B. (1988) Education and the Social Order, Routledge Classics Ed.

Schoen, R. and Weinick, R. (1993) 'Partner Choice in Marriages and Cohabitations Reviewed' *Journal of Marriage and Family* 55(2), pp. 408-414, May.

Schwartz, C. and Mare, R. (2005) 'Trends in Educational Assortative Marriage from 1940 to 2003' Demography 42(4), pp. 621-646, August.

Smits, J., Ultee, W. and Lammers, J. (1998) 'Educational Homogamy in 65 Countries: An Explanation of Differences in Openness Using Country-Level Explanatory Variables' *American Sociological Review* 63(2), pp. 264-285, April.

Solon, G. (2004) 'A Model of Intergenerational Mobility Variation over Time and Place' In. Corak, M. *Generational Income Mobility in North America and Europe*. Cambridge, University Press, pp. 38-47.

Solon, G. (2002) 'Cross-Country Differences in Intergenerational Earnings Mobility' *The Journal of Economic Perspectives* 16(3), pp. 59-66.

Solon, G. (1999) 'Intergenerational Mobility in the Labour Market'. In: Ashenfelter, O. and Card, D. *Handbook of Labour Economics* Vol. 3A.

Solon, G. (1992) 'Intergenerational Income Mobility in the United States' *The American Economic Review*82(3) June, pp. 393-408.

Solon, G. (1989) 'Biases in the estimation of intergenerational earnings correlations' *The Review of Economics and Statistics* 71 (1) February, pp. 172-174.

Thomas, D. (1999) 'Gender Differences in Household Resource Allocations' *Living Standards Measurement Study Working Paper* 79.

Tokman, A. (2002) 'Is Private Education Better? Evidence from Chile' *Central Bank of Chile Working Papers* 146, February.

Topor, D., Keane, S., Shelton, T. and Calkinsb, S. (2010) ‘Parent involvement and student academic performance: A multiple mediational analysis’ J Prev Interv Community 38(3), pp. 183–197.

Torche, F. (2010) ‘Educational Assortative Mating and Economic Inequality: A Comparative analysis of Three Latin American Countries’ *Demography* 47(2) May, pp. 481-502

Torche, F. (2005a) Unequal but Fluid: Social Mobility in Chile in Comparative Perspective American Sociological Review 70 (3) pp. 422-450.

Torche, F. (2005b) ‘Privatization Reform and Inequality of Educational Opportunity: The Case of Chile’ Sociology of Education 78(4), Octubre, pp.316-343.

Ultee, W. and Luijkx, R. (1990) 'Educational Heterogamy and Father-to-Son Occupational Mobility in 23 Industrial Nations: General Societal Openness or Compensatory Strategies of Reproduction?', *European Sociological Review* 6(2): 125–149.

Vaillant, N. and Wolff, F. (2011) ‘Positive and Negative Preferences in Human Mate Selection’ *Rev Econ Household* 9, pp. 273–291.

Vogel, T. (2006) ‘Reassessing Intergenerational Mobility in Germany and the United States: The Impact of Differences in Lifecycle Earnings Patterns’ *School of Business and Economics, Humboldt University Berlin, Germany* 649, pp. 2006-2055.

Weil, D. (2005) 'Income Inequality and Economic Development'. In: *Economic Growth*. Chapter 13, pp. 364-399 Pearson Education, Publishing as Addison-Wesley.

West, E. (1996) Education Vouchers in Practice and Principle: A World Survey, February.

West, E. (1991) 'Public Schools and Excess Burdens' *Economics of Education Review* 10(2) pp.159-169.

Wierzchos, J., Ascaso, C. and McKay, C. (2006) 'Endolithic Cyanobacteria in Halite Rocks from the Hyperarid Core of the Atacama Desert' Astrobiology 6(3) pp. 415-422, June.

Winkler, D. and Rounds, T. (1996) 'Municipal and Private Sector Response to Desecentralization and School Choice' *Economics of Education Review* 15(4) pp. 365-376.

Wößmann, L. and Schütz, G. (2006) Efficiency and Equity in European Education and Training Systems: Analytical Report for the European Commission, European Expert Network on Economics of Education (EENEE), Communication and Staff Working Paper by the European Commission, April.

Wooldrige (2002) Econometrics Analysis of Cross-Section and Panel Data.The MIT Press

Zamora, G. (2011) 'Movilidad Escolar en Chile: Analisis de las Implicancias para la Calidad y Equidad de la Educacion' *Estudios Pedagocios* 37(1), pp. 53-69.

Zanzig, B. (1997) 'Measuring the Impact of Competition in Local Government Education Markets on the Cognitive Achievement of Students' *Economics of Education Review* 16 (4), pp. 431-441.

Zimmerman, D. (1992) 'Regression toward Mediocrity in Economic Stature' *The American Economic Review* 82 (3) June, pp. 409-429.