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Educational policy and inter-generational income mobility:
evidence from the Finnish comprehensive school reform

Tuomas Pekkarinen
Sari Pekkala
Roope Uusitalo

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Postal address: P.O. Box 513, 751 20 Uppsala
Visiting address: Kyrkogårdsgatan 6, Uppsala
Phone: +46 18 471 70 70
Fax: +46 18 471 70 71
ifau@ifau.uu.se
www.ifau.se

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Tuomas Pekkarinen, Sari Pekkala and Roope Uusitalo

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Abstract

This paper estimates the effect of a major education reform on the intergenerational income mobility in Finland. The Finnish comprehensive school reform of 1972-1977 replaced the old two-track school system with a uniform nine-year comprehensive school and significantly reduced the degree of heterogeneity in the Finnish primary and secondary education. We estimate the effect of this reform on the intergenerational income elasticity using a representative sample of males born during 1960-1966. The identification strategy relies on a difference-in-differences approach and exploits the fact that the reform was implemented gradually across country during a six-year period. The results indicate that the reform reduced the intergenerational income elasticity by about seven percentage points.

Keywords: Intergenerational mobility, education, comprehensive school reform
JEL-codes: D32, J62, I20

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1 Introduction

One of the key questions in the study of economic inequality is the degree to which the economic status is transferred within families. It is often argued that high cross-sectional inequality is socially more sustainable if it is accompanied with high intergenerational mobility. In a highly mobile society, each incoming cohort is faced with equal opportunities to climb up the income distribution and neither wealth nor poverty is necessarily inherited from the parents.

The most common approach to study intergenerational income mobility in economics is to estimate correlations of lifetime earnings of fathers and their sons. More than two decades of research has shown that there are large differences in mobility across countries. Income mobility is low and inter-generational income correlation high (around 0.4) in the United States and the United Kingdom. Mobility is much higher and intergenerational income correlation lower (around 0.2) in Canada, Finland, and Sweden.[1] Recent research also indicates that these correlations have been increasing in the United States and the United Kingdom over the last two decades. In Finland, on the other hand, intergenerational income correlation has followed a steady downward trend over last thirty years.[2]

Apart from these facts, however, little is known about the mechanisms underlying the intergenerational persistence in income or about the reasons behind the cross-country differences. Also, even though recent research has started to document changes in social mobility, there is little hard evidence on the causes of the observed changes. Perhaps most importantly, there is no evidence on the effects of feasible policy instruments that could affect income

[1] See Solon (1992) and Zimmerman (1992) on US; Dearden, Machin, and Reed (1997) on UK; Corak and Heisz (1999) on Canada; Björklund and Jäntti (1997) on Sweden; and Österbacka (2001) on Finland.

[2] See Aaronson and Mazumder (2005) on the trends in the US; Blanden, Goodman, Gregg, and Machin (2004) on the trends in the UK, and Pekkala and Lucas (2006) on the trends in Finland. Interestingly, Pekkala and Lucas also demonstrate that the decrease in intergenerational correlation in Finland is mainly due to a decrease in the returns to education and to the lessening impact of family income on educational attainment.

mobility. It would be interesting to know whether programs that aim to alleviate the adverse effects of poor family background actually succeed in equalizing economic opportunities.

In this paper, we estimate the effects of one such policy by examining the impacts of the Finnish comprehensive school reform implemented between 1972 and 1977. The Finnish school reform is a good example of the educational reforms that were implemented in Europe after the Second World War. Very similar reforms took place in Sweden in the 1950s and in Norway in the 1960s.[3] These reforms were seen as an integral part in the building of modern welfare state and one of the main motivations for their implementation was precisely to enhance the equality of opportunity.

The Finnish reform replaced old two track school system with a nine year comprehensive school and imposed a uniform academic curriculum on the entire cohort until age 16. This kind of reform should have an impact on the intergenerational income mobility for a number of reasons. First, the reform increased the length of compulsory schooling from eight to nine years. If the returns to increased years of schooling are positive and if those with low income parents are more likely to quit school after compulsory schooling, the reform will have the largest effect on the students from low-income families. Second, the reform significantly reduced the heterogeneity in the quality of primary and secondary education. Third, the reform postponed the age when the students are tracked to academic and vocational schooling from eleven to sixteen. If family background has a larger impact on early education choices postponing the tracking age lessens the effect of family background on educational attainment. Finally, keeping the entire cohort together in the same schools increases the heterogeneity of the peer groups which may also reduce the effect of family background. Holmlund (2006), for example, shows that more diverse peer groups decreased the degree of assortative mating after a similar reform in Sweden and that the reduction of assortative mating amplifies the effects of comprehensive school on the intergenerational income correlation.

[3] See Lechinsky and Mayer (1990) for an overview of the comprehensive school reforms in post-war Europe.

The effects of this kind of reform are also interesting because educational policies play a key role in the theoretical literature on intergenerational income mobility, starting from the work by Becker and Tomes (1979, 1986) and developed by Solon (2004). More recently, Restuccia and Urrutia (2004) have presented a model that distinguishes between early and late education and argue that the intergenerational income persistence is driven by parental investment in the primary and secondary education of their children. This model is in line with the growing literature on the technology of the skill formation surveyed by Carneiro and Heckman (2003) as well as Cunha, Heckman, Lochner, and Masterov (2006). According to these authors, the production of human capital is characterized by strong complementarity of skills that are acquired early and investment in later education. Hence, policy interventions that target early education of individuals from a disadvantaged background will increase the returns to both private and public investment in post-secondary education, and are likely to lead to increased income mobility.

Finally, there is some evidence that suggests that the aspects of the educational systems such as tracking and the heterogeneity in the quality of early education affect intergenerational income mobility. Dustmann (2004) argues that high intergenerational income correlation in Germany is at least partly due to the German educational system where pupils are tracked to academic and vocational schools already at the age of 10. In line with this argument, Meghir and Palme (2005) show that the comprehensive school reform in Sweden had a particularly strong effect on the education and income of high ability pupils with less educated parents.

We estimate the effect of the reform on the elasticity of son's earnings in 2000 with respect to father's average earnings during 1970-1990 using a representative sample of males born between 1960 and 1966. The identification strategy relies on a differences-in-differences approach and exploits the fact that the reform was implemented gradually during a six-year period. The overall intergenerational income elasticity in this sample is 0.28. The reform decreased the intergenerational income elasticity by approximately seven percentage points from the pre-reform elasticity of 0.30 or by approximately 20 percent.

The paper is organized as follows. In the following section, we describe the Finnish comprehensive school reform in detail and argue why it provides a good natural experiment to study the effects of educational policies on intergenerational income correlation. Our identification strategy is described in

more detail in section 3. We then present the sample from the Finnish Longitudinal Census Data Files that we use in our analysis and in the fifth section we present the results. The sixth section concludes.

2 The Finnish comprehensive school reform 1972-1977

Finland followed the example of her Nordic neighbours and introduced a thorough comprehensive school reform in the 1970's. Similar reforms had taken place earlier in Sweden and Norway. These reforms are described in detail in Meghir and Palme (2004) and Aalvik, Salvanes and Vaage (2003). The main motivation for the reform was to provide equal educational opportunities to all students irrespective of place of residence or social background. Rapid re-structuring of the Finnish economy probably also played a role. The demand for low-skill labor in small farms and forestry had decreased rapidly. The growing industrial sector increased the demand for skilled workers.

Prior to the comprehensive school reform, Finland had a two-track school system. In this system, cohorts attended uniform education only for four years after which they were divided into two tracks that differed both in the content of education, as well as, in the eligibility that they provided for further education.

The pre-reform system is described schematically in the left-hand panel of Figure 1. All students entered primary school (kansakoulu) at age seven. After four years in the primary school, at age 11, the students were faced with the choice of applying to general secondary school (oppikoulu) or continuing in the primary school. Admissions to the general secondary school were based on an entrance examination, a teacher assessment and primary school grades. Those who were admitted continued their schooling in the junior secondary schools for five years and often went on to the upper secondary school for three additional years. At the end of the upper secondary school the students took the matriculation examination that provided eligibility to university-level studies.

Those who were not admitted or who did not apply to the general secondary school continued in primary school for two more years, and spent in total six years in the primary school. By the beginning of 1970s most primary schools had continuation classes (civic schools) that kept almost the whole age cohort

at school up to the 8th (and in many municipalities 9th) grade. This education did not provide eligibility for senior secondary school or for university studies. After civic school most students continued into vocational education or finished their schooling.

In 1970, most secondary schools were private. About 55 percent of all general secondary school students attended these private schools. The private schools collected student fees but received most of their funding as state aid and contributions from local municipalities. The fraction of students in the state schools was about 30 percent. The remaining 15 percent attended municipality-run secondary schools, mostly founded during the 1960s.

The curriculum in general secondary schools was very different from the more practical civic schools. For example, foreign languages were compulsory only in the general secondary school. These schools also taught more advanced mathematics and science whereas the focus in civic schools was on practical skills required in low-skill occupations.

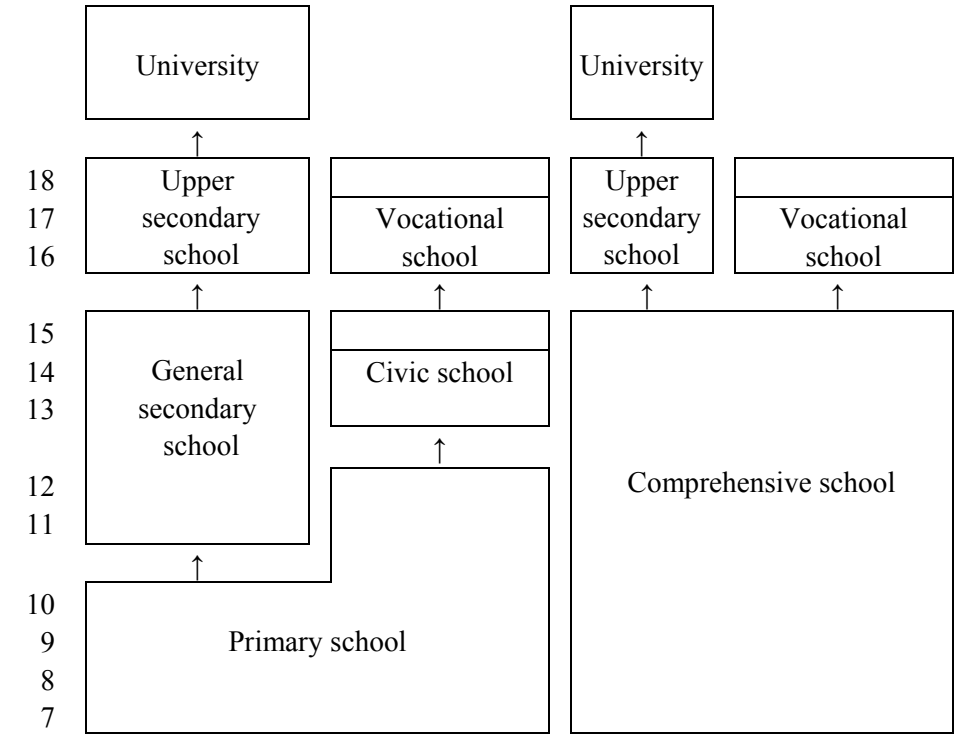

Figure 1 Finnish school systems before and after the comprehensive school reform

2.1 Content of the comprehensive school reform

The school system was reformed in the 1970s. The post-reform system is described in the right-hand panel of Figure 1. Previous primary school, civic school and junior secondary school were replaced by a nine-year comprehensive school. At the same time upper secondary school was separated from the junior secondary school to form a distinct institution. After the reform, all the pupils followed the same curriculum in the same establishments (comprehensive schools) up to age 16. After this, the students chose between applying to upper secondary school or to vocational schools. Admission to both tracks was based solely on comprehensive school grades.

The reform also introduced a new curriculum and changed the structure of primary and secondary education. The new curriculum increased the academic content of education compared to the old primary school curriculum by increasing the share of mathematics and sciences. In addition, one foreign language became compulsory for all students. Thus, the new comprehensive school curriculum resembled the old general secondary school curriculum and exposed the pupils who, in the absence of the reform, would have stayed in the primary school to a significantly more academic education.

Hence, the main changes that followed the reform were the postponement of tracking from the age 11 to 16 and the increase in the academic content of the curriculum. In addition to these fundamental changes, the reform also imposed a centralized control on schools at the national level and almost abolished the extensive network of private schools that had run general secondary school system by placing them under municipal ownership.

2.2 The implementation of the comprehensive school reform

The implementation of the reform was preceded by a process of planning that lasted for two decades. Government working groups had proposed creating comprehensive school as early as in 1948. The first experimental comprehensive schools started their operation in 1967. Finally, in 1968 the parliament approved School Systems Act (467/1968) according to which the two track school system would be gradually replaced with a nine-year comprehensive school. The adoption of the new school system was to take place between 1972 and 1977 and the order in which the municipalities adopted the reform was to be determined by geography starting from the Northern

Finland where access to education was most limited. A regional implementation plan divided the country into six implementation regions and dictated when each region would adopt the comprehensive school system. Regional school boards were created to oversee the transition process.

In each region, the five lowest primary school grades were to start in the comprehensive school immediately in the fall term of the year stated in the regional implementation plan. After this, each incoming cohort would start their schooling in the comprehensive school. The pupils that were already above the fifth grade in the year that the region started the reform would complete their schooling according to the pre-reform system. Thus, in each region it took approximately four years to complete the reform so that all the pupils in the grades 1-9 were in the comprehensive school.

Figure 2 illustrates how the reform spread through Finland during 1972-1977. The first municipalities that adopted the reform in 1972 were predominantly situated in the northernmost province of Lapland. In 1973 the reform was mostly adopted in the north-eastern regions. From thereon, the reform spread so that it was adopted in 1974 in the northwest, in 1975 in south-east, in 1976 in the south-west, and finally, in 1977 in the capital region of Helsinki.

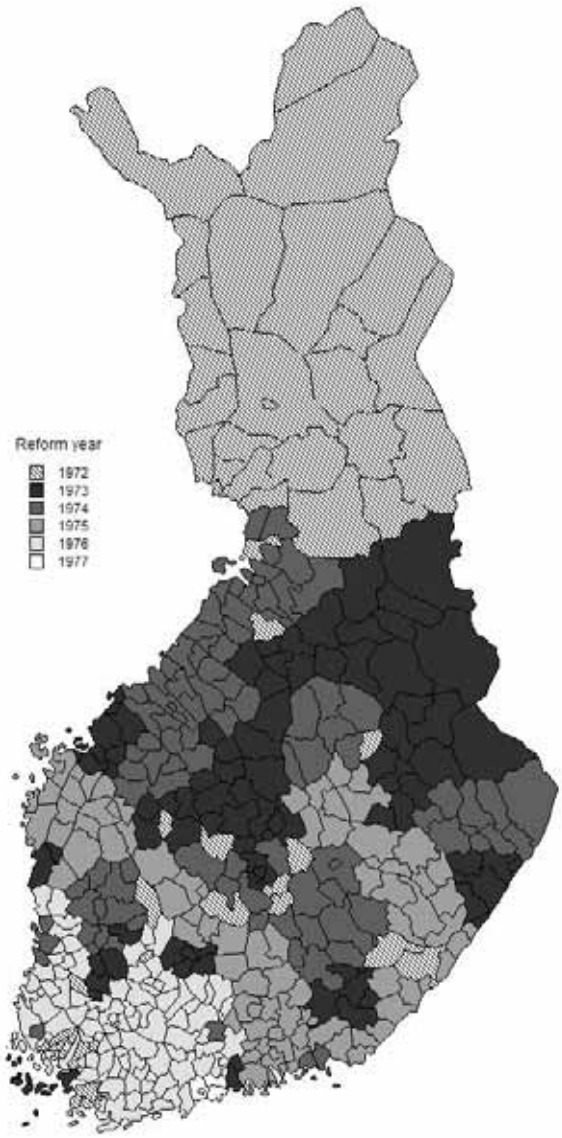

Figure 2 Implementation of the comprehensive school reform across regions 1972-1977

Figure 3 illustrates the effect of the reform by displaying the number of students relative to the relevant age cohort by school type and grade level in 1970, before the nation-wide implementation of the reform, and in 1980 when most municipalities had already completed the reform. The figure shows clearly how in 1970, the cohort was divided almost evenly into primary school and general secondary school tracks after the fourth grade. In 1980, practically the whole age cohort stayed in the comprehensive school up to the ninth grade. The few remaining general secondary school students in 1980 are from the last pre-reform cohort in the capital region where the reform took place in 1977.

There are two additional observations that can be made from Figure 3. First, approximately ten percent of the students attended (experimental) comprehensive schools already before the reform. These schools were scattered across the country, but unfortunately cannot be identified in our micro-level data. Second, the general level of education was clearly rising during the 1970's. The fraction of cohort at school on the ninth grade increased from about 70 percent in 1970 to practically the entire cohort in 1980. Also the fraction of students enrolled in the upper secondary school in 1980 exceeds the number of students in the last three grades in the general secondary school in 1970 by almost twenty percent. The increase in the fraction at school at the ninth grade is mainly due to the comprehensive school reform but the increase in the upper secondary school participation rate also reflects the general increase in the demand for education. Such changes might have an independent effect on the intergenerational income elasticity so that identifying the effect of school reform on intergenerational income elasticity by simple before-after comparisons could be misleading.

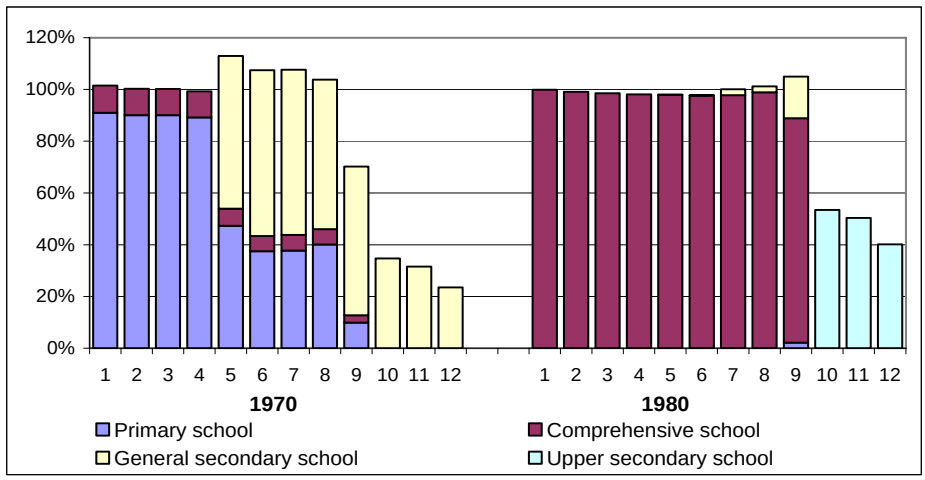

Figure 3 Number of students by grade level (as a percentage of the relevant age cohort)

Source: Number of students by grade level and school type are reported in the Statistical Yearbook of Finland 67, 1971; Statistical Bulletin 1980:16 and Statistical Bulletin 1981:2 all by Central Statistical Office, Helsinki, Finland. Population by age group are reported in Population Census 1970, and in Population Census 1980, Part 1 Population structure and population changes, Central Statistical Office, Helsinki, Finland.
Note: The number of students at some grade levels is larger than the relevant birth cohort. This is mainly due to grade repetition in the general secondary school. According to the Statistical Yearbook, passing rates in the general secondary school were in most grade levels below 90 percent. Another reason is that some students entered general secondary school only after 5th or 6th grade in the primary school. Hence, though most students enter the first grade in the general secondary school in the year when they turn eleven there are also older students in the same grade level.

2.3 The comprehensive school reform as a quasi-experiment

The Finnish comprehensive school reform is in many ways an ideal experiment for evaluating the effects of early versus late tracking on the intergenerational income elasticity. The regional implementation plan dictated when each municipality moved into comprehensive school system. Using a fixed-effects approach we can control for other simultaneous time trends and regional

differences and purge the estimate of school system from these confounding factors.

Yet, as in any real world reform there are some caveats to the approach. First of all, as is clear from Figure 2, the geographical implementation plan assigned some municipalities to early implementation groups even though most surrounding municipalities implemented the reform much later. The choice of municipalities to these early implementation groups was probably not entirely random. The comprehensive school reform also faced intensive resistance. Most common arguments against the reform were that abolishing tracking would reduce the quality of education. As a compromise, ability tracking was partially retained within the comprehensive school. Even after the reform the students were divided into ability groups in foreign language and math classes, but studied all other subjects in their regular (not tracked) classes. This ability grouping was eventually abolished in 1985.

The socialization of private schools under municipal ownership was also opposed especially in Helsinki where some of these schools had a distinguished reputation. After an intensive debate, it was agreed that several private schools would be allowed to survive as private alternatives to the comprehensive schools in the Helsinki region even after the reform. Many of these still exist as private senior secondary schools. Another important point to note is that in several municipalities municipality-run experimental comprehensive schools already took in almost the whole age cohort a few years before the reform. In these municipalities the founding of these schools probably had a larger effect than the subsequent transformation to a comprehensive school.

What is common to these factors is that they imply that the implementation of the reform in practice did not necessarily follow the implementation plan. One would expect these factors to attenuate the effects of the reform on intergenerational income mobility, but the size of the bias is difficult to assess. As a rough check on how contaminated the implementation of the reform actually was, we examined data from the Finnish Adult Education Surveys in 1990, 1995 and 2000. We linked the municipality where the respondents lived in 1975 to the survey data and classified these municipalities into regions according to the year when the comprehensive school reform took place in these municipalities. Then we calculated the fraction of respondents whose highest education was primary school by regions and birth cohorts. The main lesson from these calculations was that the reform clearly had an impact. Very few respondents report primary school as highest education after the reform

and these can easily be explained by regional mobility. Also timing of the reform matches the timing of the reduction of the share with primary school as the highest education, though in most regions the fraction with only compulsory school decreases already one to two years before the reform.[4]

3 Estimation methods

Our goal is to estimate the changes in the intergenerational income elasticity due to the comprehensive school reform. The identification strategy relies on a difference-in-differences approach and exploits the fact that the reform was implemented gradually during a six-year period.

We start with the standard specification relating the lifetime earnings of the son y_s to the lifetime earnings of his father y_f.

$$\log(y_s) = a + b_{jt}\log(y_f) + e \qquad (1)$$

The regression coefficient b provides an estimate of the intergenerational income elasticity. In order to examine how the reform affected this elasticity, we allow this regression coefficient to vary across cohorts, regions, and the reform status:

$$b_{jt} = b_0 + \delta R_{jt} + \Omega D_j + \Psi D_t + u_{jt} \qquad (2)$$

where j indexes region of residence, and t the birth cohort. R_{jt} is a dummy variable equal to 1 if the reform had taken place in the municipality by the time when the son was in the relevant age, D_j is the full set of region fixed effects, and D_t a full set of cohort dummies. Including a full set of cohort and region fixed-effects allows the intergenerational income elasticity to change over time and to vary across regions. Including cohort dummies also accounts for the fact that later cohorts are observed at a younger age and their earnings may be worse proxies of lifetime income. The only identifying assumption we impose is that the changes in intergenerational income elasticity are not systematically

[4] Details on these calculations can be found from an appendix available upon request.

different in the different regions. The parameter δ identifies the effect of the reform on the intergenerational income elasticity.

Inserting expression (2) back into the regression equation (1) and adding the main effects of the region and time, as well as, the main effect of the reform produces

$$\log(y_{s,jt}) = a + b_0\log(y_f) + \delta(\log y_f * R_{jt}) + \Omega(\log y_f * D_j) + \Psi(\log y_f * D_t) + \log y_f * u_{jt} + \Phi D_t + \Pi D_j + \Gamma R_{jt} + e_{ijt} \qquad (3)$$

Estimating the effect of the comprehensive school reform on intergenerational income elasticity, therefore, reduces to a model where the son's log lifetime earnings are regressed on the father's log lifetime earnings interacted with the reform dummy, and a full set of interactions between region and the cohort dummies and the father's lifetime earnings.[5] The effect of the reform is identified from second level interactions i.e. from the changes in the effect of father's income occurring at the time of the reform.

4 Data

The data that we use in this paper come from the Finnish Longitudinal Census Data Files (FLCD) by Statistics Finland.[6] Information is based on population census conducted every fifth year between 1970 and 2000. Currently the Finnish census is entirely register-based and uses personal identity codes to merge information from various administrative registers. Up to 1980 census contained also a questionnaire mailed to every household, but even in 1970s variables such as annual earnings were based on tax registers.

[5]It should be noted that equation (3) is actually a random coefficient model with a heteroskedastic error term, which needs to be accounted when calculating standard errors for the estimates.

[6]Data used in the analysis contain confidential information based on tax registers. All datasets used in the paper and their English language descriptions are available from the authors for replication purposes but data access requires a prior approval by Statistics Finland. Details on data access policy and application procedure can be found from the Statistics Finland website at http://www.stat.fi/meta/tietosuoja/kayttolupa_en.html. The authors are willing to assist in any way in gaining access to the data.

Data contain information on all the 6.3 million individuals who had legal residence in Finland in at least one census year. As these data are based on administrative registers, the only reasons for the individual not to appear in the data are death and emigration. Hence, these data do not have the attrition problems that are common in the intergenerational studies. Census files also allow matching individuals across census years and matching family members to each other.

Our data is a 10 percent random sample from the cohorts born between 1960 and 1966. We chose to restrict the analysis to these cohorts to have two cohorts, 1960 and 1966, with individuals only in the pre- and in the post-reform school systems and five cohorts, 1961-1965, with individuals in both systems. We can track these individuals in all census years from 1970 to 2000. To be comparable with most of the earlier literature we focus on fathers and their sons. With our data similar analysis could also be performed for mothers and daughters.

We measured sons' earnings as log taxable earnings in 2000. The measure includes both employment and self-employment earnings, as well as, all taxable benefits (e.g. unemployment benefits). In 2000, the youngest cohort in our sample was 34 and the oldest 40 years old As noted above, we account for age of measurement by allowing the effect of father's earnings to depend on son's age. In some robustness checks we also use earnings from 1995 and take the average from these two years. The main problem in using earlier years is that Finnish students graduate relatively late. In 1995 the youngest cohorts are only 29 years of age and many have just finished school or are still studying at a university. We also experimented with trimming the data in various ways to reduce the effects of extreme observations on sons' earnings but this had only a minor effect on our estimates.

To calculate fathers lifetime earnings we took the average log taxable earnings from 1970, 1975, 1980, 1985, and 1990 all deflated to the 2000 prices. We calculated the average log earnings including all years with positive earnings. Using five years of data over a time span of twenty years reduces the bias caused by measurement error in fathers' earnings. To further reduce the effect of measurement errors, we top-coded the highest 1 percent of father's earnings by replacing them with 99th percentile of the fathers' earnings distribution and similarly bottom-coded the lowest one percent of fathers' earnings replacing them with the 1st percentile. We have no information on

fathers' age so we cannot make further adjustments that would account for observing fathers at different ages.

The original data does contain information on the municipality of residence but this information is not released to users so that individuals could not be identified. From our request the Statistics Finland classified the municipalities of residence in 1970, 1975, and 1980 to six groups according to the year when the comprehensive school reform was implemented in each municipality. We used this information together with information on the birth dates to determine whether individual was affected by the comprehensive school reform. We classified all individuals who were on the fifth grade or below when the municipality adopted the reform to the treatment (comprehensive school) group.

As some of the effect of the reform may be due to the effect on schooling, a good measure of years of education would be useful. Data contains information on the highest degree completed that can be coded to years of education in a relatively straightforward way. Unfortunately, only information on post-compulsory education is in the data. Our education measure does not distinguish between primary and comprehensive schooling nor between completing 7, 8 or 9 years of primary schooling and hence does not capture the most relevant changes in the length of education after the reform.

The original 10% sample of the males born during 1960-1966 contains information on 27 109 individuals. Altogether 1 909 of these individuals either died or moved out of the country before year 2000. For 2 494 individuals the treatment status could not be identified because they moved between regions during their school years and 1 622 had no father present. Finally, in most of our specifications we also drop the 260 individuals who had no positive earnings in 2000. Our final analysis sample thus contains information on 20 824 individuals. Out of these, 9 695 (47 %) fall into the treatment group.

In, Table 1 we report some summary statistics on the age and annual earnings of our sample of individuals and their fathers. Sons' mean earnings are considerably higher than fathers' mean earnings reflecting the increase in real wages across the generations. Also the standard deviation for sons' earnings is higher, mainly because fathers' earnings are averaged across five years but sons' earnings measured based on a single year.

Table 1 Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Son's age in 2000	37.03	1.98	34	40
Son's earnings in 2000	29 778	110 544	100	14 916 700
Father's average earnings during 1970-1990	18 687	11 832	800	69 041

Note: Summary statistics for 20 786 individuals in our sample and their fathers. Earnings refer to all taxable income in 2000 prices converted to euros.

Table 2 further describes how the sample is divided into different cohorts and across the reform regions. There are no large differences in the cohort size in these age groups. The most intense reform years were 1974, -75 and -76. The table also shows how the treatment status depends on birth year and timing of the reform in the municipality of residence. The 1960 cohort was not affected by the reform in any region. Members of the next cohort (born 1961) were affected if they lived in a municipality that adopted the reform in 1972 when they entered the fifth grade. The shaded area in the table indicates the affected groups in the younger cohorts. The table already indicates that there are a number of potential difference-in-differences estimates that can be calculated to evaluate the effect of the reform.

Table 2 The timing of the reform by cohorts and regions

	Reform year						
Birth cohort	1972	1973	1974	1975	1976	1977	Total
1960	6th grade	7th grade	8th grade	9th grade	-	-	
	N = 280	N = 437	N = 609	N = 646	N = 642	N = 348	N = 2,962
1961	5th grade	6th grade	7th grade	8th grade	9th grade	-	
	N = 279	N = 466	N = 624	N = 598	N = 674	N = 358	N = 2,999
1962	4th grade	5th grade	6th grade	7th grade	8th grade	9th grade	
	N = 311	N = 414	N = 605	N = 599	N = 649	N = 355	N = 2,933
1963	3rd grade	4th grade	5th grade	6th grade	7th grade	8th grade	
	N = 318	N = 440	N = 650	N = 648	N = 719	N = 379	N = 3,154
1964	2nd grade	3rd grade	4th grade	5th grade	6th grade	7th grade	
	N = 266	N = 414	N = 651	N = 630	N = 703	N = 407	N = 3,071
1965	1st grade	2nd grade	3rd grade	4th grade	5th grade	6th grade	
	N = 251	N = 411	N = 598	N = 623	N = 630	N = 383	N = 2,896
1966	-	1st grade	2nd grade	3rd grade	4th grade	5th grade	
	N = 260	N = 331	N = 586	N = 579	N = 665	N = 388	N = 2,809
Total	N = 1,965	N = 2,913	N = 4,323	N = 4,323	N = 4,682	N = 2,618	N = 20,824

Note: The shaded areas indicate cells that adopted the post-reform educational system. N refers to the sample size in each cell in the data that are used in the analysis.

5 Results

In Table 3 we first report our estimates of the intergenerational elasticity of earnings separately by reform regions and birth cohorts. The first column of the upper panel displays estimates by birth cohort. There is some indication of downward trend. The elasticity falls from 0.30 for the 1960 birth cohort to 0.26 for the 1966 cohort. In addition to the effect of school reform, this drop may reflect other differences between cohorts, or the fact that the earlier cohorts are older when we observe their earnings and intergenerational earnings elasticity tends to increase with the age when sons' earnings are measured. In the second and third columns we calculate these within cohort elasticities separately in the regions where the reform had not taken place by the time when the cohort turned eleven and in regions where the system was already reformed. The rightmost column reports the within-cohort difference between these regions. In all the birth cohorts, apart from cohort born in 1961 and 1964, the estimated intergenerational earnings elasticity is lower in the regions where reform had already taken place. These differences, however, are hardly ever significant.

The bottom panel of Table 3 repeats these calculations now examining changes over time within regions. Looking down in the first column one can note that there are substantial differences across regions. In the second and third column the elasticities are calculated separately for the pre- and post-reform cohorts. In all regions except the 1977 reform region, elasticity is lower among post-reform cohorts.

Table 3 Intergenerational income correlations across birth cohorts and reform regions

a) Birth cohorts

Birth cohort	Average	Pre-reform	Post-reform	Difference
1960	0.303	0.303		
	(0.021)	(0.021)		
1961	0.301	0.296	0.359	0.063
	(0.021)	(0.022)	(0.064)	(0.069)
1962	0.294	0.295	0.271	-0.024
	(0.021)	(0.025)	(0.041)	(0.048)
1963	0.244	0.313	0.141	-0.172
	(0.022)	(0.030)	(0.034)	(0.045)
1964	0.267	0.240	0.261	0.021
	(0.022)	(0.039)	(0.028)	(0.049)
1965	0.276	0.393	0.245	-0.147
	(0.023)	(0.070)	(0.025)	(0.072)
1966	0.262		0.262	
	(0.023)		(0.023)	

b) Reform regions

Region	Average	Pre-reform	Post-reform	Difference
1972	0.285	0.385	0.265	-0.119
	(0.026)	(0.068)	(0.028)	(0.071)
1973	0.234	0.293	0.211	-0.082
	(0.021)	(0.036)	(0.027)	(0.045)
1974	0.256	0.289	0.230	-0.058
	(0.018)	(0.027)	(0.025)	(0.037)
1975	0.257	0.273	0.242	-0.031
	(0.019)	(0.025)	(0.031)	(0.039)
1976	0.258	0.273	0.214	-0.060
	(0.019)	(0.021)	(0.038)	(0.044)
1977	0.322	0.314	0.391	0.077
	(0.028)	(0.030)	(0.085)	(0.086)

Note: Numbers in the cells are coefficients of the father's earnings in the regressions where son's earnings are regressed on father's earnings alone. Standard errors are reported in parentheses.

Table 4 presents the main regression results. In column 1, we report the results of regressing the son's log earnings in 2000 on the father's average log earnings during 1970-1990 without any control variables. The resulting coefficient is 0.277 which is somewhat higher than the earlier Finnish estimates. This is probably due to the fact that we measure sons' earnings at a later age and use five-year averages of fathers' earnings. Jäntti and Österbacka (1996) obtain an estimate of 0.22 using data for cohorts born between 1950 and 1960 with earnings measured in 1990. Österbacka (2001) obtains a much lower elasticity estimate of 0.13 using data for the same cohorts. Both of these papers use only two-year averages of fathers' earnings. Österbacka (2001) also includes sons' earnings from 1985 when the youngest sons are only 25 years old and many are still in school. Also Lucas and Pekkala (2005) report a lower estimate of 0.19 for cohorts born between 1960 and 1964 with earnings measured at age 30.

In column 2, we add the reform dummy and the interaction between the reform dummy and father's earnings. The interaction term is -0.063 indicating that the intergenerational earnings elasticity is lower after the reform. However, it would be premature to interpret this difference as the effect of the reform. As is clear from Table 3, there are systematic differences in the intergenerational income elasticity across both regions and cohorts and the result in column 2 may simply reflect the general downward trend in intergenerational earnings elasticity or differences in the effect of father's earnings between the regions that adopted the reform early and those where the reform occurred later.

In column 3 we account for both of these factors by adding a full set of cohort and region dummies and interacting these dummies with father's earnings as described in section 3. We normalize fathers' earnings, as well as, cohort and region dummies by subtracting the sample mean. This has no effect on our estimate on the effect of the reform on intergenerational income elasticity (which is an interaction of cohort, region and fathers' earnings) but makes the other coefficients easier to interpret. For example, the main effect of fathers' earnings now refers to the average effect in the sample before the reform and not to the effect in some specific region or in a specific cohort. The main effect of father's earnings on son's earnings in Column 3 is 0.298 which is close to our baseline estimate in Column 1 and almost identical to the estimated pre-reform elasticity reported in Column 2. The effect of the reform on the intergenerational earnings elasticity i.e. the coefficient of the interaction between father's earnings and the comprehensive school reform is -0.069,

indicating that the comprehensive school reform reduced intergenerational earnings elasticity by almost seven percentage points. This implies approximately 20% decrease in the elasticity from the pre-reform average of 0.30. The estimate is statistically significant with a t-value of 3.11.

Interacting father's earnings with cohort and region dummies in column 3 accounts for any general trends and regional differences in intergenerational income elasticity. It is still possible that the changes in the intergenerational elasticity differ across regions for reasons that are unrelated to the comprehensive school reform. In column 4 we account for this by adding region-specific linear trends in intergenerational income elasticity. For completeness, we also include all interactions between the cohort and region dummies to allow for any differences in the growth rates of regional income. After adding these interactions, the main effect of the reform on the son's earnings is no longer identified. However, the effect of the reform on intergenerational income elasticity is still identified. The estimate is now -0.066 very close to that in the previous column and indicating that at least the simplest regional trends cannot explain our findings.

Table 4 Regression results

	(1)	(2)	(3)	(4)
Father's earnings	0.277	0.297	0.298	0.296
	(0.014)	(0.011)	(0.010)	(0.014)
Reform		-0.063	-0.019	…
		(0.012)	(0.021)	
Father's earnings x Reform		-0.055	-0.069	-0.066
		(0.009)	(0.022)	(0.031)
Cohort dummies			√	√
Father's earnings * Cohort dummies			√	√
Region dummies			√	√
Father's earnings * Region dummies			√	√
Cohort * Region dummies				√
Region-specific trends				√
Observations	20824	20824	20824	20824
R-squared	0.05	0.05	0.05	0.06

Note: The dependent variable is son's log earnings in 2000. Father's earnings are measured with average log earnings during 1970-1990. Reform refers to the comprehensive school reform dummy. Cohort dummies refer to 7 birth cohort dummies that are included in the regression in columns (3) and (4). Father's earnings * cohort dummies refers to the interaction of father's earnings and 7 cohort dummies. Region dummies refer to 6 reform region dummies that are included in the regression in columns (3) and (4). Father's earnings * region dummies refers to the interactions of father's earnings and 6 region dummies. Cohort * region dummies refer to full set of interactions of these dummies included in the regression in column (4). Region-specific trends refer to region specific linear trends of the intergenerational income elasticity. Standard errors, reported within parentheses, are robust to clustering at the regional level.

We implemented a number of robustness checks to the results reported in Table 4. These are reported in Table 5. First, in column 1 we removed from the data all municipalities that implemented the reform before the other municipalities in the same province. In column 2 we removed observations from Helsinki region where the reform faced most intense resistance. These attempts to control for potential endogeneity in the timing of the reform had no major effects on the results. The estimates are slightly higher than the baseline estimates in Table 4, but not significantly different.

In column 3 we replaced son's earnings in 2000 with average log earnings from 1995 and 2000. This yields somewhat lower estimate (-0.047). Also the main effect of fathers' earnings decreases and is now close to earlier Finnish estimates. These results suggest that measuring sons' earnings at a younger age decreases the effects of family background perhaps because those with better educated parents tend to stay in school longer and their earnings at younger age do not yet measure lifetime earnings very precisely. Finally, in columns 4, 5, and 6 we remove top-coding, bottom-coding and both of these from fathers' earnings. This has virtually no effect on the results.

Table 5 Regression results – robustness checks

	(1) Without early reformers	(2) Without Helsinki	(3) 1995-2000 earnings	(4) No top-coding	(5) No bottom-coding	(6) No top- or bottom coding
Father's earnings	0.311	0.302	0.251	0.327	0.340	0.325
	(0.022)	(0.012)	(0.009)	(0.020)	(0.024)	(0.020)
Father's earnings x Reform	-0.092	-0.074	-0.047	-0.070	-0.070	-0.070
	(0.039)	(0.022)	(0.018)	(0.021)	(0.024)	(0.022)
Reform	-0.004	-0.008	-0.024	-0.018	-0.019	-0.018
	(0.025)	(0.026)	(0.019)	(0.021)	(0.021)	(0.021)
Constant	10.002	10.009	9.903	10.020	10.021	10.021
	(0.014)	(0.014)	(0.009)	(0.010)	(0.010)	(0.010)
Observations	12040	18206	20824	20824	20824	20824
R-squared	0.05	0.05	0.06	0.05	0.06	0.05

Note: The dependent variable is son's log earnings in 2000 and father's earnings are measured with average log earnings during 1970-1990. In column (1), municipalities that deviate from the regional implementation plan are dropped from the sample. These are municipalities that implement the reform earlier or later than the mode of municipalities in the province. In column (2), Helsinki region that implemented the reform in 1977 is dropped from the sample. In column (3), the dependent variable is the mean of son's 1995 and 2000 earnings. In column (4), top coding at 99th percentile is removed. In column (5), bottom coding at 1st percentile is removed. In column (6), all coding is removed. All regressions control for a full set of regional and cohort dummies as well as their interactions with father's earnings. Reform refers to the comprehensive school reform dummy. Standard errors, reported within parentheses, are robust to clustering at the regional level.

In Table 6, we estimate the effects of the reform using all available pairwise comparisons between cohorts and regions. For example, the first entry in the top panel uses data only from cohorts born in 1960 and 1961 and reports the difference-in-differences estimate based on the fact that only those born in 1961 who lived in the nothernmost part of the country were exposed to the reform. The next estimate compares cohorts born in 1960 to those born in 1962 and so on. Altogether there are 21 possible pairwise comparisons, 14 of which produce a negative point estimate. Also the distribution of the estimates does not indicate that the overall estimates would be driven by some particular cohorts but rather points to there being a general tendency of decreasing effect of family background after the reform. The lower panel repeats the same exercise using fifteen possible pairwise comparisons between regions. Twelve of these point estimates turn out to be negative. Again there is no indication of the effect being due to particular regions.

Table 6 Regression results – pair wise comparisons

a) By cohorts

	1960	1961	1962	1963	1964	1965
1960						
1961	-0.031					
	(0.098)					
1962	-0.101	0.007				
	(0.069)	(0.085)				
1963	-0.195	-0.162	-0.151			
	(0.063)	(0.065)	(0.076)			
1964	0.029	0.036	-0.007	0.020		
	(0.068)	(0.062)	(0.063)	(0.080)		
1965	-0.086	-0.111	-0.006	-0.162	-0.145	
	(0.101)	(0.072)	(0.063)	(0.066)	(0.085)	
1966	-0.041	0.002	-0.067	-0.183	0.079	0.002
	(0.032)	(0.105)	(0.074)	(0.066)	(0.071)	(0.105)

Note: Numbers are the coefficients of the interaction of the reform dummy and father's earnings in differences-in-differences regressions that are conducted pairwise by cohorts. Standard errors are reported within parentheses.

b) By regions

	1972	1973	1974	1975	1976
1972					
1973	0.070				
	(0.091)				
1974	-0.016	-0.037			
	(0.068)	(0.081)			
1975	-0.039	-0.112	-0.162		
	(0.065)	(0.065)	(0.075)		
1976	-0.098	-0.072	-0.169	0.017	
	(0.064)	(0.057)	(0.058)	(0.077)	
1977	-0.017	-0.067	-0.019	0.102	-0.178
	(0.087)	(0.071)	(0.066)	(0.073)	(0.097)

Note: Numbers are the coefficients of the interaction of the reform dummy and father's earnings in differences-in-differences regressions that are conducted pairwise by regions. Standard errors are reported within parentheses.

In Table 7 we examine the effects of the reform by estimating the reform effect separately in quintiles defined according to the fathers' earnings. Each

column presents the results from a separate regression where sons' earnings are explained by the comprehensive school reform, and dummy variables for the cohort and the region (Coefficients of the dummy variables are not reported in the table). No cross-equation restriction on the size of the cohort or region effects are imposed, so the estimates for the reform effects are essentially nonlinear version of those reported in Table 4. The pattern of the results is striking. The effect of the reform decreases monotonously from a positive effect of 0.036 in the lowest quintile to a negative effect of -0.080 for the highest quintile. We also repeated these calculations splitting the data according to father's education with very similar results. The negative point estimates in the highest quintiles also suggest that the comprehensive school reform may have had negative effects on some sub-groups. This could be due to a decrease in quality of education in the comprehensive school compared to the general secondary school before the reform, perhaps due to a more heterogenous and, on average, poorer family background. However we would hesitate to make strong conclusions given large standard errors on these estimates.

Table 7 The effect of the reform on son's earnings by father's income quintiles

	(1)	(2)	(3)	(4)	(5)
	1st quintile of father's earnings	2nd quintile of father's earnings	3rd quintile of father's earnings	4th quintile of father's earnings	5th quintile of father's earnings
Reform	0.036	0.038	-0.037	-0.051	-0.080
	(0.045)	(0.040)	(0.038)	(0.041)	(0.048)
Constant	9.770	9.918	10.037	10.096	10.294
	(0.025)	(0.022)	(0.021)	(0.022)	(0.026)
Observations	4165	4165	4165	4165	4164
R-squared	0.00	0.00	0.01	0.00	0.01

Note: Coefficients of the reform dummy in regressions where son's log earnings are regressed on the reform, cohort, and regional dummies and the data are split by the quintiles of the fathers' earnings distribution. Standard errors are reported in parentheses.

6 Conclusions

Even though the knowledge about intergenerational earnings correlations and their differences across countries has quickly accumulated over the last ten years, understanding about the mechanisms underlying these correlations is still incomplete. Many authors have emphasized the potential role of educational institutions in shaping the intergenerational earnings mobility. Especially the role of heterogeneity in the quality early education has received attention. Yet, there is little direct evidence on the effect of educational institutions on intergenerational earnings mobility.

In this paper we estimate the effect of a major educational reform on the intergenerational earnings elasticity. The Finnish comprehensive school reform completely transformed the structure and the content of the secondary education in Finland. As a result of this reform, tracking to academic and vocational secondary education was postponed from the age 11 to 16 and a uniform academic curriculum was imposed on entire cohorts up to the ninth grade. The reform was adopted gradually by municipalities, which allows us to treat this reform as a quasi-experiment.

We find that the comprehensive school reform reduced the effect of fathers' earnings on the sons' earnings by seven percentage points. This amounts to a 20 percent drop in the intergenerational earnings correlation. These results suggest that policies that expand the access to academic secondary education may significantly enhance intergenerational earnings mobility.

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