

# Family income and children's education: Using the Norwegian oil boom as a natural experiment.

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## Abstract

Parental income is positively correlated with children's educational attainment. This paper addresses the causality of this observed link. We have a unique data set for Norwegians born in the period 1967-1969, with a measure of permanent family income in the children's adolescence. This enables us to examine the long-term effect of family income on children's educational attainment. The Norwegian oil shock in the 1970s is used as an instrument, because this- in some regions but not in others- implied a general increase in income unrelated to parents' abilities. This variation in income is used to estimate the causal effect of family income on children's educational attainment. We find no such causal relationship. This result is robust with respect to different specification tests.

**JEL Classification:** I2, J13, J62

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# 1 Introduction

Family income is positively correlated with children's educational attainment. This is observed in data from countries all over the world. Using a large and representative dataset, we find that the raw correlation in Norway is almost as high as in the US.<sup>1</sup> The main question researchers ask themselves is whether the observed correlation is due to nature, nurture or a combination of these two factors. Is the link between parental income and children's educational attainment casual, or is the observed link mostly a story of selection into education? One mechanism could be that greater investment in children during adolescence<sup>2</sup> improves their cognitive and noncognitive skills and hence their long-term outcomes. Another plausible mechanism may be that educational attainment is costly in terms of tuition fees (for example in the US and UK), living expenses, the opportunity cost of lost labor market income and experience, and that it carries a possible risk of failing in planned courses of study. Parents' income can serve as a source of income for students taking higher education but also as a safety net if effort in higher education turns out to be unsuccessful. This means that children from high-income families would choose more education because it is both less costly in monetary terms and less risky.

Earlier literature has not reached a consensus on whether or not the income-education link is causal. Shea (2000) analyzes the effects that family income has on children's educational attainment and finds that parents' money is not directly relevant to children's educational attainment. Some newer papers (Blanden and Gregg, 2004; Oreopoulos, Page and Stevens, 2005) on the other hand, find that there exists a small causal effect. These different results stem from different sources of data and different methods used to investigate the problem of causality. We need to study more countries and apply new methods to get a more general idea of the impact of family income on children's educational attainment. Furthermore, the conclusions may differ from papers using positive (Shea, 2000) and negative (Oreopoulos, Page and Stevens, 2005) income shocks. It might be that people react

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<sup>1</sup>We find an impact of family income on children's educational attainment (not controlling for family characteristics) of almost the same size as Shea (2000).

<sup>2</sup>For example, investment in time and material goods.

differently to increased and decreased family income. This is based on the idea that it is relative and not absolute income that affects people's behavior.

In this paper, we investigate the link between family income and children's educational attainment controlling for different observable parental and child characteristics. Increased wages involve both substitution and income effects possibly affecting time allocated within households. We will focus on the total effect of increasing family income on children's educational attainment. Many income policies, like tax policies, will involve both a substitution and an income effect, so the total effect of increasing family income will be important in order to evaluate such policies on children's outcomes. An important variable that we cannot observe is parental abilities. There might be differences in parents' abilities to generate income<sup>3</sup> that are transferred to their children and generate the observed correlation between family income and children's education. Because we do not have a good proxy variable for ability in the dataset, the instrumental variable approach is used to identify the possible link between family income and children's educational attainment. As an instrument, we use the oil shock in Norway in the 1970s. We argue that in those counties that experienced sharp income increases in the early oil boom, these increases were unrelated to parental abilities. We compare two counties in Norway: Rogaland, which was strongly affected by the shock, and Sør-Trøndelag, which did not experience any observed early effects.<sup>4</sup> Sør-Trøndelag was chosen as a reference county because the sizes of the two counties' main cities, Stavanger and Trondheim, are approximately the same, and because Sør-Trøndelag is so far from Rogaland that an increase in labor demand in Rogaland has very little initial impact on the Sør-Trøndelag labor market. The oil shock increased the income of families living in Rogaland significantly compared with families living in Sør-Trøndelag. The increased income was independent of ability because it was due to an economic shock whose effects depended on geography, not on skills and abilities, at least in the early years. We explore the timing of the oil boom by comparing children born between

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<sup>3</sup>These differences can be due to, for example, unobserved heterogeneity in skills, tastes and preferences.

<sup>4</sup>See Figure 1 for the location of these counties.

1967-1969. The educational choice of these children took place two decades later, in the 1980s and 1990s, after the oil boom was already fully incorporated in the economy, while their parents had already completed their education by 1970. This enable us to separate the effect of the oil boom on family income from possible other effects the oil boom had on the market for education

The main results show that family income does not matter directly for children's educational attainment. Even though the OLS results show clear effects, the instrumental variable results are mostly negative, close to zero and insignificant. This suggests that the positive link between family income and children's educational attainment in Norway is mainly due to selection into education and not causation. This selection process can come from hereditary factors, cultural factors, or from other family background factors linked to parental education levels.

This paper contributes to the existing literature on the causal effect of family resources on children's education by studying a new country, Norway. The main contribution is the application of an oil shock as an instrumental variable for family resources. Other papers have used supply-side shocks to study the effect of such shocks on labor markets (Carrington, 1996; Black et al., 2002; Black et al.; 2005) and civil conflicts (Miguel et al., 2004; Angrist et al., 2005), but to my knowledge, there have been no studies that examine the effect of an oil shock as a source of variations in parents' resources and use this variation to study intergenerational effects.

The paper is organized as follows. Section 2 presents an overview of the relevant income and education literature. Section 3 describes the data and gives information about the variables we use in the empirical analysis. Section 4 describes the instrument in more detail, while Section 5 presents the identification strategy used in this paper. Section 6 presents the results of the estimations, and Section 7 incorporates different specification tests to verify the results. Finally Section 8 presents conclusions and a discussion of why family income does not matter for children's educational attainment.

## 2 Previous Literature

Running an OLS regression on children’s educational attainment with respect to parental income and education confirms the observable high correlation between these variables. This has led many researchers to conclude that there exists a causal relationship and that we observe transmission of income and education over generations. However, the observed high correlations give no evidence of causal relationships. As Solon (1999) concludes in his chapter on intergenerational mobility in the labor market, “[u]nfortunately, we remain fairly ignorant about the causal processes underlying the intergenerational transmission of earnings. . . does parental income matter so much as it does because high-income parents are able to invest more in their children’s human capital, or because the genetic or cultural traits that contributed to the parents’ high earnings are passed on to the children?” These questions regarding intergenerational transmission of income and education, and the direct effect of family income on children’s educational attainment, are pressing ones.

What can be the implied mechanisms behind the observed effect between family income and children’s educational attainment? Investment in young children may affect their later educational attainment. This may be, for example, investment in material goods that benefit children’s cognitive and noncognitive skills when they are in adolescence. In many countries, higher education requires not only certain skills but also substantial tuition fees. In countries like the US and UK, this means that parents from higher-income families may have a better chance of paying for their children to receive higher education. Even though this seems like a plausible explanation for the observed effect of family income on children’s educational attainment, Carneiro and Heckman (2002) find that in the US, credit constraints are much lower than those implied by the observed correlation. Another mechanism that may be in play is that family income can serve as a fallback opportunity for children. Children from high-income families may be more likely to enter higher education because they know that their family provides a safety net. In countries like Norway, there are no tuition fees at public universities, but this does not mean that education

is free. Students have to take up loans to cover their cost of living, and there is also an opportunity cost in the form of lost labor market income and experience. This implies that children from low-income families that are not able to bear the risk of failing their higher education may choose to undertake less education.

There is an extensive literature on intergenerational transmission with regard to both income and education<sup>5</sup>. The received literature on the direct effect of family income on children's educational attainment is more limited. This is an important research area because while parental education is normally already determined when the children grow up, income can change drastically during their adolescence. Independently of parental educational attainment and abilities, family income may increase because of shocks to the economy, luck in the labor market or other transitory income shocks. How these income changes then affect the children's educational attainment can have important policy relevance. To aid policy, we need to know the effects such policies will have on children's education and income.

Shea (2000) finds negligible effects of parental income on children's skills. By using father's union status, industry and job loss, he seeks exogenous effects that are correlated with parental income but uncorrelated with ability. He concludes that parental income has a negligible impact on children's human capital for most families. Maurin (2002) claims that the IV effects reported in Shea often are very poorly estimated, because there are too few observations and weak instruments. Most of the confidence intervals for his IV results may also include the OLS results. Carneiro and Heckman (2002) criticize Shea for interpreting his estimates as evidence against credit constraints in schooling because his measure of permanent family income is over a period of 20 years and not divided into smaller income streams. Blanden and Gregg (2004) review different approaches to estimating the effect of family income on children's educational attainment for Britain. They find some effect of family income, but the effects are rather small. However, they show that small income effects can also generate large educational inequalities when income inequalities are wide. Among the models they investigate, they use the sibling fixed-effect estimator, as-

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<sup>5</sup>See Solon (1999) for a review of the income literature and Black et al. (2005) for a review of the education literature.

suming that ability levels are the same for all siblings. This assumption is debatable, because siblings differ in their educational attainment and ability levels (see Ermisch and Francesconi (2001) for a discussion of the problems of using sibling estimators). Another interesting approach is presented by Oreopoulos, Page and Stevens (2005). They look at how worker displacements lead to a long-lasting decline in family income and find a small but significant effect of income on children's outcomes. The estimates are driven by the families at the bottom of the income distribution. They control for income before the displacement took place, but there might be other crucial differences between the families exposed to worker displacements and other families that they do not account for. Chevalier, Harmon, O'Sullivan and Walker (2005) use two different instruments, one for explaining parental education and one for family income. They use fathers' union membership as an instrument for father's income, and the British School Reform in the 1960s for parental education. They are then able to investigate the intergenerational transmission of education with respect to both parental education and income. They find that parental education becomes insignificant and that permanent income matters much more than when using OLS estimation. One of the problems of using school reform as an instrument is that it is only relevant for the lower distribution of educational attainment. This eliminates a large part of the population from the empirical analysis. Chevalier et al. suffer the same problems as Shea (2000), using fathers' union membership as an instrument.

There is a small literature using different shocks in the US to identify participation in labor market programs (Carrington, 1996; Black et al., 2002; Black et al.; 2005b) and long-term consequences for adult earnings (Michaels, 2006). The paper closest to our study is Black et al. (2005a) using evidence from the coal boom in the US in the 1970s to study the effect on the demand for education. They find that the coal boom significantly decreased demand for education in the short run, but when the boom subsided the earnings of high school dropouts declined relative to graduates and the effects evaporated. Unlike our study they do not use these first stage results on adults to study intergenerational effects on the children.

In the empirical analysis of the causal effects of parental income on children's education, we include in the analysis a much larger proportion of the population

when using the oil shock in Norway as an instrument to explain parental income. Furthermore, our instrument for family income, the Norwegian oil shock in the 1970s, is highly correlated with family income and independent of parental education and abilities. We have a unique opportunity to contribute to the existing literature on causality and selection into education.

### **3 Data**

We have a dataset comprising the entire population of Norwegians. We follow the cohorts from birth until 2002. The dataset contains both administrative data collected from Statistics Norway and data collected from the censuses in 1960, 1970 and 1980. The analysis will focus on individuals' years of education and how this is related to different family factors such as parental education and income. We have a unique dataset with information about parental income from 1967 to 2000, both parents' and children's education history, marital status of parents, number and order of siblings, parents' employment status and age, and the county and municipality in which the children grew up. All the data are linked by personal identity codes. We have deleted around 20% of the observations because of missing data, mainly as a result of missing parental identification numbers and too few observations for families with non-Norwegian citizenship.

My main variables were family income, education variables, number of siblings, parents' age, marital status and municipality information. Table 1 gives an overview of the variables used in the regressions.

The educational attainment for both parents and children in 2002 was taken from Statistics Norway. These data were reported by the educational institutions directly to Statistics Norway, which means that there is very little measurement error in the data. The number of individuals in the family, municipality of residence, marital status and age were all taken from the administrative database and were linked to the censuses in 1960, 1970 and 1980. This should ensure accurate information, because these sources are reliable and do not involve individual self-reporting. There are data for both fathers' and mothers' income streams from 1967 to 2000. We

added mothers' and fathers' income to create one variable, family income.<sup>6</sup> We took the logarithm of family income after having calculated the average income streams in order to be able to compare education and family income more easily in the empirical analysis. The data were from the pension register taken from the public social security program in Norway starting in 1967. Income includes wages and income from business activity before tax, including taxable income such as unemployment benefits, disability benefits and sickness benefits. We deflated the income to real 1999 income by using the average yearly consumer price index taken from Statistics Norway.<sup>7</sup> We included dummies for whether the mother was single, married or divorced, and also whether the mother was in the labor market in 1970 or not.

It is important to work with large samples when using the instrumental variable approach, because the instrumental variable is consistent though not necessarily unbiased. Selecting the segment of the 1967-1969 cohorts born in Rogaland and Sør-Trøndelag yields 33547 observations. We used children that were born in Rogaland and Sør-Trøndelag in the years before the oil shock. They were hence exposed to the oil shock in their early years of life. When they chose their educational attainment 20 years later, the oil shock was entirely incorporated into the economy, so the only effect of the oil shock on children's educational attainment came through exposure to family income in the children adolescence.

Table 2 provides descriptive statistics for the children born between 1967 and 1969 for the families living in Rogaland and Sør-Trøndelag. These two counties are fairly equal with a tendency for both parents and children to have more education in Sør-Trøndelag than in Rogaland. The most striking difference is the difference in

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<sup>6</sup>At least one of the parents is the biological parent. We matched children with mothers and fathers using a household ID. This means that we measured family income as the total resources of the household that the child lived in.

<sup>7</sup>Ideally, we would have preferred local consumer price indexes, however they are not available for the 1970s. As our results will show the real growth in wages are much larger in Rogaland than in Sør-Trøndelag, so even though prices might have risen slightly more in Rogaland the effects of the oil boom on wages will still be substantially larger than in Sør-Trøndelag.

average family income between 1970 and 1980 of about 30.000NOK.<sup>8</sup>

## 4 The Instrument: The Norwegian Oil Boom

The ability variable was omitted from my regression analysis. We have no data on the children's or parents' abilities. There exists an upward bias because of the positive correlation between parents' abilities and the family characteristics if parents' observable skills are not included. The reason for this is that there is a positive correlation between family income and abilities that are transmitted across generations. Thus we need an instrument that is highly correlated with family income but uncorrelated with the omitted variable, ability. The oil shock in Norway in the 1970s serves as an instrument to explain parental income. This oil shock can be seen as a unique natural experiment<sup>9</sup> in which the families in Rogaland experienced increased overall family income compared with families in Sør-Trøndelag. This shock was exogenous to ability and parents' educational attainment, although it increased family incomes significantly.

At the end of 1969, there was a major oil discovery in the North Sea, and on June 1 1970, the public was informed of this find. The Norwegian oil adventure had begun. The oil shock provided a huge boost to the entire Norwegian economy, but Rogaland was the first and most strongly influenced, because the main oil production in the relevant period was located off the coast there. Before Norway discovered the huge oil supply in the North Sea, Rogaland was a normal Norwegian county whose main economic activity centered around fish and agriculture. When oil was discovered, Norwegian authorities decided to make Stavanger, the largest city in Rogaland, the country's principal oil base. Statoil and the Norwegian Petroleum Directorate were located there in 1972. Soon other oil companies followed. The shock influenced both low- and high-income families in Rogaland. Often individuals with less education

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<sup>8</sup>Income is measured in 1999 NOK. \$1=5.52NOK (02.09.08). 30000NOK is approximately \$5400.

<sup>9</sup>See Maurin and McNally (2005) for an interesting natural experiment using the French student revolution in 1968 as an instrument for parental education.

were hired to do basic work in oil production in the North Sea, while more educated individuals, often engineers, worked in the oil companies located in and around Stavanger.

We compare two counties in Norway: Rogaland, which was strongly affected by the shock, and Sør-Trøndelag, which did not experience any observed early effects.<sup>10</sup> Sør-Trøndelag was chosen as a reference county because the sizes of the two counties' main cities, Stavanger and Trondheim, are approximately the same, and because Sør-Trøndelag is so far from Rogaland that an increase in labor demand in Rogaland has very little initial impact on the Sør-Trøndelag labor market. The data for families living in Rogaland and Sør-Trøndelag should be as similar as possible in all the explanatory variables so that we can rule out other differences between Rogaland and Sør-Trøndelag that influence the results. The main control for potential differences not related to the oil boom is the inclusion of cohorts that were born after the oil boom (1975-1977). Because the shock was more or less incorporated in the economy in the 1980s, we control for possible differences between Rogaland and Sør-Trøndelag not related to family income by including cohorts born from 1975-1977.<sup>11</sup> When these children were older, the shock had begun to fade, and there was no significant difference in family income between Rogaland and Sør-Trøndelag for these children. We also used these children to perform a placebo test.<sup>12</sup>

The selection criteria are as follows: We studied children born to parents in Rogaland and Sør-Trøndelag between 1967 and 1969. These were the years prior to the oil boom. As these children grew, parents in Rogaland were exposed to the oil boom to a much greater extent than those in Sør-Trøndelag. This led to a boom in family income for all families in Rogaland, which was uncorrelated with unobservable parental abilities<sup>13</sup>. The reason for this boom in incomes was that the large increase

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<sup>10</sup>See Figure 1 for the location of these counties.

<sup>11</sup>Because there is no educational history after 2002, we could not include later-born cohorts because they had not completed their higher education in 2002. Also, cohorts born between 1970 and 1974 were not included because they were born in the years of the oil boom, and hence they were not directly affected from the year they were born, but partly affected because the shock was still not incorporated in the economy in those years.

<sup>12</sup>See Section on results.

<sup>13</sup>Parental education was already determined in the 1970s. We only studied families in which

in labor demand from the oil industry spilled over into higher wages for all kinds of jobs. When the children were old enough to start their higher education<sup>14</sup>, the oil boom was incorporated into the economy. Potential differences between Rogaland and the rest of Norway in returns to education no longer existed. The oil industry stabilized and required both high- and low-educated workers.<sup>15</sup> The timing of cohorts are therefore very important for this analysis. By studying the children born right before the oil boom we can use the oil boom as an exogenous source of variation in income not linked directly to children's educational choice that took place two decades later.

A good instrument must satisfy certain criteria. There are three main assumptions that have to be fulfilled. Firstly, the instrument has to be as good as randomly assigned. Secondly, the exclusion restriction has to hold, the instrument should only effect the explanatory variable and not effect the outcome directly. Thirdly, we need an existence of a strong first stage relationship. The first and third assumption is closed to satisfied. The oil shock is uncorrelated with parental abilities because the effects of the shock depended on geography and not necessarily on skills and abilities, at least in the early years. There is also a clear correlation between family income and living in Rogaland in the 1970s. This can be seen in Figure 2a and Figure 2b, which illustrates the real growth in income in Rogaland compared to Sør-Trøndelag for the birth cohorts 1967-1969. We see that for the years 1970-1976 the real growth in family income is yearly 1-2 % higher than in Sør-Trøndelag.<sup>16</sup> To test for differences in the income distribution we have separated the population into 

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the parents were at least 26 in 1970. This ensures that it was not the oil boom that was the source of parental education choices.

<sup>14</sup>The first child in our sample, born in 1967, would normally have started higher education after finishing high school in 1986.

<sup>15</sup>This we test in Section 6 by differentiating between girls and boys. Because it is mostly men that work in the oil industry, they will be the only ones potentially affected by differences in returns to education related to the oil boom.

<sup>16</sup>We also compare Rogaland to all other counties in Norway and the same pattern emerges everywhere. Families in Rogaland experience a higher real growth in earnings in the beginning of the 1970s. We focus on the children born in 1967-1969, but we verify that family income did increase for families of all birth cohorts from 1955 to 1980.

four income quantiles. Figure 3a present results for the top quartile and Figure 3b for the bottom quartile of the income distribution. We see that the real growth in family income between 1970 and 1976 is significantly higher in Rogaland compared to Sør-Trøndelag for both groups. This demonstrates that most families in Rogaland did experience effects of the oil shock. Hence the instrument should work for the whole income distribution of the families in Rogaland.

The second assumption needs to be discussed in detail to understand implications of the results. There should be little correlation between the oil shock and the children's educational attainment after controlling for family income. The oil boom may have affected the returns to education both positively and negatively. We argue that the setup of our empirical specification is crucial in order to satisfy the exclusion restriction. One source of difference between Rogaland and Sør-Trøndelag that could be related to the oil boom and could affect children's educational attainment is increased local government spending on schooling in Rogaland. This is not likely because all public oil revenues went directly to the central government and were redistributed to the counties independently of proximity to the offshore oil fields.<sup>17</sup> A potential source of negative returns to education is the boom in availability of jobs discouraging higher education, but the shock was more or less incorporated in the economy when the children started their higher education. We see from Figure 4 that the yearly growth in years of educational attainment is very similar for Rogaland and Sør-Trøndelag and similar to Norway in general for all birth cohorts from 1947 to 1980. There are no clear evidence that the oil boom lowered the returns to education in Rogaland compared to Sør-Trøndelag. Furthermore, because men dominate the oil and gas sector<sup>18</sup>, men were more likely to be affected by the oil

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<sup>17</sup>The main local source of income for municipalities in Norway in the 1970s were taxes on income and companies. By itself this would improve the economy of Rogaland compared to other parts of Norway. However, the central Government used a redistribution policy favoring the municipalities with low income. Hence, the spillovers from the oil boom affected all municipalities in Norway. Also, in the 1970s, revenue from the oil industry was reinvested in the oil fields. See Statistics Norway (2007) for a historical survey on municipalities and income policy.

<sup>18</sup>According to Statistics Norway only 19% of workers in the oil and gas sector in Norway in

boom. By separating the sample into boys and girls, we can exclude potential differences in returns to education by giving evidence supporting equal effects of income on children’s education for both sexes.<sup>19</sup>

In sum, the oil shock in Norway in the 1970s seems to satisfy all the criteria for a good instrumental variable. The oil boom did not have an independent effect on children’s education in Rogaland compared with Sør-Trøndelag except through the family income variable.

## 5 Identification Strategy

In order to identify the causal effects of family income on children’s educational attainment, we needed to find variations in family income that are exogenous to both the parents’ and children’s skills. By using the oil shock in Norway in the 1970s that boosted the income of the families living in Rogaland, compared with families in Sør-Trøndelag, we sought results that could show this link.

The model is given by the following equations.

$$E_{i,child} = \beta_0 + \beta_1 I_{70-80} + \beta_2 X + \varepsilon_i \quad (1)$$

$$I_{70-80} = \delta_0 + \delta_1 ROG_{67-69} + \delta_2 X + \nu_i \quad (2)$$

$I_{70-80}$  is the average logarithmic family income between 1970 and 1980, when the children in the sample were between 1 and 13 years old.<sup>20</sup>  $X$  is all family characteristics that may affect children’s educational attainment including the education of the parents, marital status of the parents, log income prior to the oil boom (1967-1969), a dummy for whether the mother was working in 1970, parental age, number and order of siblings and sex. We used the instrumental variable method (IV) to estimate

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2004 were women.

<sup>19</sup>These results are reported in Tables 4 and 5, and are discussed at the end of Section 6.

<sup>20</sup>We could have included income for more of the children’s adolescence, but the effect of the oil boom was strongest in the 1970s. Furthermore, the OLS effect of family income on children’s educational attainment is almost the same even though we included a longer income span.

this model. Equation 2 was the first stage where  $ROG_{67-69}$  served as an instrumental variable for permanent family income.  $ROG_{67-69}$  is equal to the family income between 1970 and 1980 to the children born in Rogaland between 1967 and 1969. The control group was children born in Sør-Trøndelag in 1967-1969 and children born in both counties between 1975 and 1977 when the oil boom was incorporated into the economy. To control for potential differences between the cohorts because of differences in age when exposed to the shock, we included dummies for cohort effects and controls for the age of the child in 2002. Because we mainly performed these regressions for the families living in Rogaland and Sør-Trøndelag, we did not control for county-specific effects.

We performed Hausman tests to for the null hypothesis that the OLS results and the IV results were similar and we performed Wald tests to test the linearity assumption. We rejected the hypothesis that our specifications are not linear in all the different specifications.

## 6 Results

The first-stage results for the families with children born in 1967-1969 are given in Table 3a, and the OLS results and IV results are given in Table 3b. We observe from the first-stage results that living in Rogaland affected the permanent family income positively and significantly.<sup>21</sup> Living in Rogaland increased the permanent family income by 11%-12% compared with living in Sør-Trøndelag. As discussed in Section 4, most of this can be related to the oil shock in the 1970s. From Table 3b, it can be observed that the OLS results for the whole sample provide a clear and positive effect of family income on children’s educational attainment. The estimates suggest that increasing family income by 10% increases children’s levels of education by approximately 0.1%. This is not a huge effect, but if the effect is causal, it can be the crucial difference between taking and not taking higher education for some of

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<sup>21</sup>The first stage is highly significant with t-statistics of between 20 and 30 in the different specifications.

the children at the margin.<sup>22</sup> The most interesting results are the IV results in Table 3b. The results show that permanent family income is statistically insignificant. We control for parental education in all specifications due to the importance of parental education as a determinant of children's education.<sup>23</sup> Including all other control variables listed in Section 5 increase the precision slightly however the point estimate is almost the same. The standard errors are larger than for the OLS results, but this finding suggests that family income means much less for children's education than the OLS results imply. We confirmed this by performing a Hausman test, rejecting the null hypothesis that the OLS results and the IV results were similar. The difference between OLS and IV is statistically significant at the 1% level, suggesting that permanent family income matters very little for children's level of education. Children mostly inherit their skills and abilities through genes or culture or from other family factors, such as parental education. This corresponds to Shea's (2000) results.

We controlled for differences in family income prior to the oil shock by including average family income from 1967 to 1969. Hence we controlled for potential differences in family income between Rogaland and Sør-Trøndelag unrelated to the oil boom.

Parental education was treated as an exogenous variable. Because parental education is positively correlated with parental abilities, we might worry that the dummy for college biases our results upwards. Since we do not have the data to account for the endogeneity of parental education, we must accept the results in Black et al. (2005a), who present evidence against a causal relationship between parental and child educational attainment. Also, parental education is determined prior to the oil boom, hence it is not correlated with the oil boom. We regressed the instrument on parental education and found no significant differences between Rogaland and Sør-Trøndelag

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<sup>22</sup>See Blanden and Gregg (2004) for an illustration of the impact of small income changes on educational inequalities.

<sup>23</sup>We remember that parents education is determined before the oil boom. Parental education is therefore not correlated with the instrument.

It may be a concern that an oil boom that made some families wealthier than others affected family planning decisions. In such a case, number of siblings may be correlated with the oil boom. We first excluded number and order of siblings from the analysis. This did not alter the results that family income does not matter for children's educational attainment. We also regressed the instrument on number of siblings and found that there were no significant differences between Rogaland and Sør-Trøndelag, indicating that number of siblings is not correlated with the oil boom.

All the regressions were performed for the pooled sample, but it might be that family income affects girls and boys differently. As mentioned in Section 4, this test may be important for contradicting possible differences in returns to education between Rogaland and Sør-Trøndelag related to the oil boom. Because it is predominantly men that work in the oil and gas sector, men are more likely to be affected by the oil boom when it comes to potential differences in returns to education. If we believe that the returns to education between Rogaland and Sør-Trøndelag changed because of the oil boom, we should study the effects for girls rather than for boys. Evidence that the effect of family income on children's education is the same for both sexes, indicates that there were no potential differences in returns to education between Rogaland and Sør-Trøndelag because of the oil boom. This would also support the intuition that the oil boom should have been incorporated into the economy by the time the children began their higher education. We estimated Equations 1 and 2 separately for girls and boys. The results are given in Table 4a and 4b for girls and Table 5a and 5b for boys. The effect of family income on children's educational attainment is insignificant for both sexes. The IV estimate is lower for girls than for boys, but the difference between OLS and IV is significant at 1% for both.

To verify our results, we performed a placebo test. We examined the data for children born between 1975 and 1977, which we had earlier used as a control group. We then tested the effect of family income between 1980 and 1990 on their educational attainment. Table 6b shows that the OLS results for these children are as expected and similar to the earlier results. When we performed the Instrumental Variable Estimation, we observed that the first-stage result in Table 6a is not sig-

nificantly different from zero. The IV is not longer applicable because there is no significant difference in family income between Rogaland and Sør-Trøndelag.

## 7 Specification Tests

We performed different specification tests in order to verify the results presented in this paper.

### 7.1 Sample selection

A potential problem is that families in Rogaland and Sør-Trøndelag could be different from other families in Norway. Is it plausible to generalize the results to the entire population?

We compared families in Rogaland with families in Sør-Trøndelag because the first-stage results were much more precise when comparing Rogaland to a county that is as far away as Sør-Trøndelag<sup>24</sup>, but in which families have many of the same characteristics as those in Rogaland. This allows us to isolate better the effect of the oil shock. We also compare Rogaland with all other Norwegian counties and observe a general pattern. We observe that Rogaland, compared with most counties, had a significantly higher family income in the 1970s; the only exceptions were Oslo and Akershus<sup>25</sup>. This was expected because Oslo is the city that should also have experienced effects of the oil shock. Because Oslo is also Norway's capital, income levels may be greater there than in other counties. Even though family income increased because of the oil shock in Rogaland, other factors might have contributed to an even larger increase in family income in and around Oslo. One important such "other factor" could be the ongoing urbanization process in Oslo.

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<sup>24</sup>The distance between Rogaland and Sør-Trøndelag is approximately 580 km, and communications between the two counties are poor. Car travel would take a couple of days.

<sup>25</sup>Akershus is the county surrounding the Norwegian capital, Oslo.

### 7.1.1 Control group: Counties

We verified the earlier results by performing the same regressions as before with more counties as reference counties. The only criterion is that the county must not be a close neighbor to Rogaland or too close to Oslo. We also excluded the three northeast counties because few people live there, and hence they are very different from Rogaland. Eleven counties survived this criterion: Sør-Trøndelag, Hedmark, Vestfold, Aust-Agder, Oppland, Telemark, Sogn og Fjordane, Møre og Romsdal, Nord-Trøndelag and Buskerud. The OLS and IV results are presented in Table 7a and 7b. We have confirmed our previous results, and again the difference between OLS and IV is statistically significant at the 1% level. We see that the results are even more precise than before reflecting a larger sample than before.

### 7.1.2 Treatment and Control group: Cohorts

We wished to check whether the results are sensitive to the use of the 1975-1977 cohorts as a control group. Excluding this group, there remains an insignificant effect of family income on children's educational attainment. The effects are more strongly negative than before with a higher standard error.<sup>26</sup> This confirms that the IV result is significantly lower than the OLS result. The reason for obtaining a more negative result may be that we captured some differences between Rogaland and Sør-Trøndelag prior to the oil boom that affected children's education. By including cohorts from both counties that were not affected directly by the oil boom, we removed these potential differences. The results are robust if we use only the 1975-1977 cohorts separately rather than aggregating them.

Our findings are not typical of the income and education literature.<sup>27</sup> Often the IVs are significantly larger than in the OLS results. For the impact of family income on children's educational attainment, this has been interpreted as a credit constraint on higher education, meaning that education level is higher for the marginal child than for the average child in the sample. Because we used family income for the

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<sup>26</sup>The effect is -0.67 with a standard error of 0.34.

<sup>27</sup>See Carneiro and Heckman (2002) for a discussion on IV estimations and credit constraints.

whole childhood period, we had to be careful to interpret the results as evidence against credit constraints. However, we use this timing issue to perform the same regressions for earlier cohorts. We have argued that the timing of our study is crucial in order to satisfy the exclusion restriction for our instrument. Cohorts born in the 1950s and early 1960s made their educational choice closer to the oil boom. Their choice might then have been effected by a lower return to education in Rogaland compared to Sør-Trøndelag. As Figure 4 showed us, there are no clear evidence to support this. We therefore performed the same analysis as before with cohorts born from 1958-1969. We see from Table 8 that the results are the same for all cohorts. The increased family income in Rogaland in the 1970s did not effect any of the birth cohorts' educational attainment.

## 7.2 Migration

Could it be a problem that people migrated to Rogaland in the 1970s to take advantage of the oil boom? It might be that families did this in order to invest in their children's educational attainment. We checked for this by examining how many families moved from Rogaland to Sør-Trøndelag and vice versa. Of the children born between 1967 and 1969, only 5.9% had moved from Rogaland by 1980. Of these families, only 3.4% had moved to Sør-Trøndelag, which implies that only 0.2% of families moved between the two counties. Most of these families moved to nearby counties like Hordaland and Vest-Agder (approximately 50%) and the Oslo area (~25%). The most interesting cases are the converse. How many families might have moved to Rogaland to take advantage of the oil boom? 11% of the families that had children between 1967 and 1969 had moved from Sør-Trøndelag by 1980. Of these families, only 3.6% moved to Rogaland. Also, here most families moved to nearby counties like Nord-Trøndelag and Hedmark (~60%) and the Oslo area (~20%). Examining the whole sample, approximately 8% of families living in Rogaland in 1970 had moved away by 1980, and 9% that did not live in Rogaland in 1970 lived there in 1980. We also performed a test in which we included all families that moved to Rogaland in the 1970s, and these families did not affect the results.

Migration to Rogaland due to the oil boom is therefore not a cause for concern.

### **7.3 Nonlinear effects**

We tested the linear assumption in our specification and could not reject the hypothesis that the specifications are correct. Even so, we confirmed our results by estimating the same regressions as above using a non-parametric Wald estimator. We take the difference in average educational attainment for the children born in Rogaland in 1967-1969 and the children born in Sør-Trøndelag in 1967-1969 and divide by the difference in log of family income for the same groups over the whole distribution of incomes. This allows a more flexible form of how family income may affect children's educational attainment. We see from Table 9 that the coefficients are of the same size and significance level as before.

It is also possible that families from the lower end of the income distribution still experienced a significant impact of family income on children's educational attainment but that the effect disappeared when aggregated with all the families in the sample. Because family income is our variable of interest, we chose to divide the sample into four groups according to fathers' and mothers' educational attainment: the parent's with nine years or less of education and those with ten years or more. This confirms the earlier results, the effect of family income on children's educational attainment is close to zero and insignificant. We used the same reference counties as in Section 7.1.1. Table 10 reports the coefficients for the instrumental variable result.

## **8 Conclusion**

This paper has sought to provide new evidence on the causal link between family income and children's education by using a unique Norwegian data set. The OLS results show a clear, positive relationship between permanent family income and children's education after controlling for observable family background variables. This corresponds to earlier research on family income and children's education. The

main question is whether family income is a causal factor for children's educational attainment. The oil shock in Norway in the 1970s constitutes a good instrumental variable for family income, because it is highly correlated with family income for families living in Rogaland, but uncorrelated with ability and parents' educational attainment. This variation in income is used to estimate the causal effect of family income on children's education.

The results indicate no such causal relationship. These results are robust across our control groups, the families living in Sør-Trøndelag and other representative counties in Norway. Also different specification tests including different cohorts, nonlinear effects and migration support the results. This indicates that family income does not matter for children's educational attainment. This is in line with the results in Shea (2000), while some other studies (see Chevalier et al., 2005; Oreopoulos et al., 2005) have come to the opposite conclusion.<sup>28</sup>

The question that follows is why family income matters so little for children's education in Norway. One reason could be that we have perfect capital markets in Norway so that families can borrow against their children's educational attainment. This may be the case for high-income families but is unlikely for low-income families. Another reason could be that Norway has very high public investment in children. All students in higher education are eligible for grants and subsidies from the Government to finance their education. This makes it easier to undertake higher education in Norway than in many other countries. It is possible that family income would have an impact on children's educational attainment if all of these Government interventions were removed.<sup>29</sup>

Both the argument for capital markets and public investment in children can provide some reasons why parents' income has a small observable effect on children's educational attainment. However, because some correlation between family income and children's educational attainment is still observed, other mechanisms or channels may be equally important. As discussed in the introduction, there is a

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<sup>28</sup>Even though these studies conclude that income matters for children's education, the effects are rather small, and in Oreopoulos they are driven by low-income families.

<sup>29</sup>We do not have access to data before these Government interventions began in the 1950s

risk involved in obtaining higher education. Family income can serve as a fallback option for children. Because the oil boom substantially improved the financial situations of many families in Rogaland compared with Sør-Trøndelag, we would expect the children from Rogaland to undertake further education, but the results suggest that they obtained the same educational attainment regardless of increases in their parents' earnings. Instead, the observed correlation between parental income and children's education may be genetic or related to cultural factors. Children inherit parents' skills; thus, a child from a high-income family has a higher probability of higher educational attainment than a child from a low-income family. This is what we refer to as the selection process into higher education. Of course, parental education may also affect children's education. If parental education is a causal factor, the observed correlation between family income and children's educational attainment may work through this channel, because more highly educated people also have higher average incomes. As previously mentioned, we have no observations to account for the endogeneity of parental education, but Black et al. (2005) have found evidence that parental education also affects children's education mainly through hereditary and cultural factors.

We argued earlier that our estimation of the total effect of family income on children's educational attainment may work through two channels, the direct income effect and the substitution effect. Our results show that increased family income does not effect children's education. This might be because income in itself does not matter or because the income effect is offset by changes in intrahousehold allocation. Although we are not able to pin down the direct channels through which the oil boom effected wages and intrahousehold allocation many policies targeted to income will involve income and substitution effects. To measure the intergenerational effect on education will be important in order to evaluate the effect of these policies.

From this study, we have been able to isolate one of the family background factors that have been offered as a causal interpretation of children's educational attainment in many previous studies. By ruling out family income as a causal factor for children's education, we have come closer to understanding the intergenerational transfer of family background. Studies in North America (Shea, 2000; Oreopoulos

et al., 2005) and the UK (Blanden et al., 2004) also provide evidence that family income matters much less than the observed correlation between the variables. Furthermore, newer studies using Scandinavian data (Black et al., 2005; Björklund, Ginther and Sundström, 2004) rule out other family background factors, such as parental education and marital status, as causal factors. We observe a wave of studies moving away from causality of family background factors towards those that view more long-term family background and selection effects as important determinants of education. This may have new implications for policies that base their programs on causal interpretations of family income, parental education and marital status.

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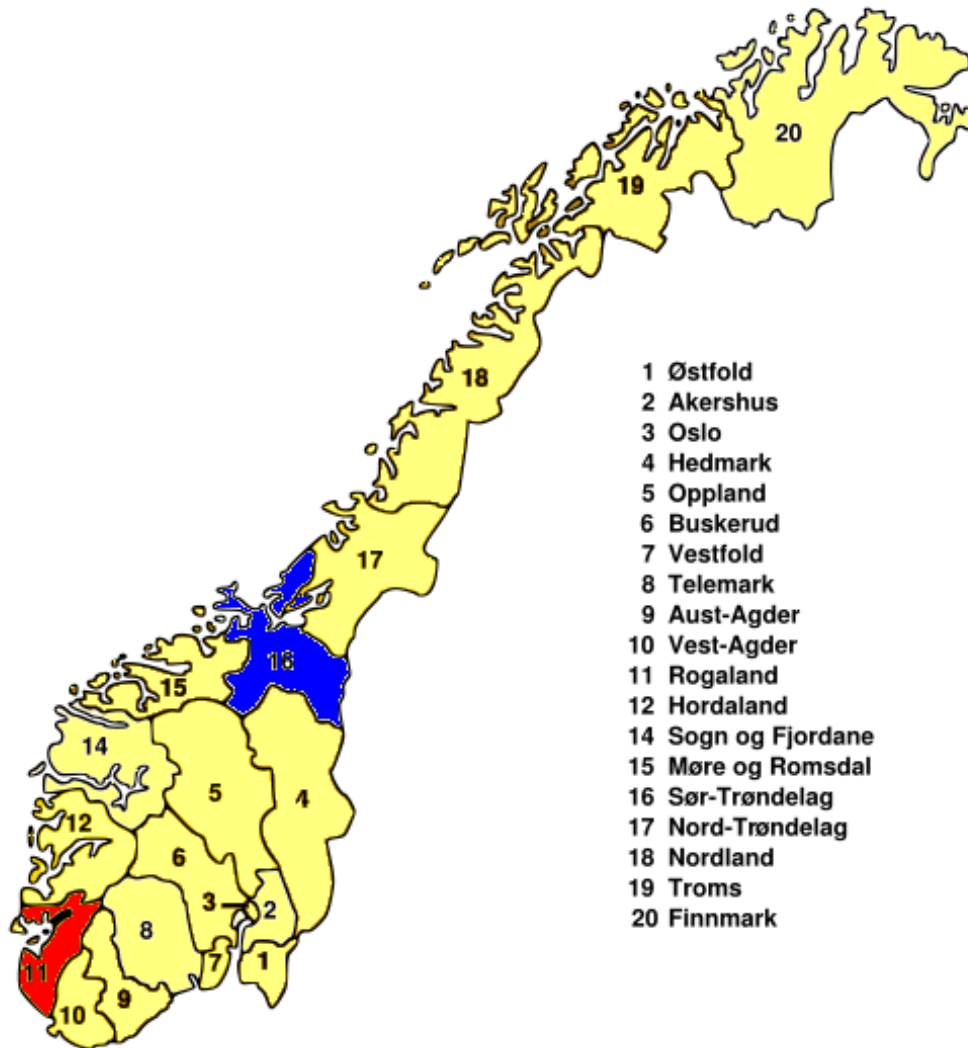
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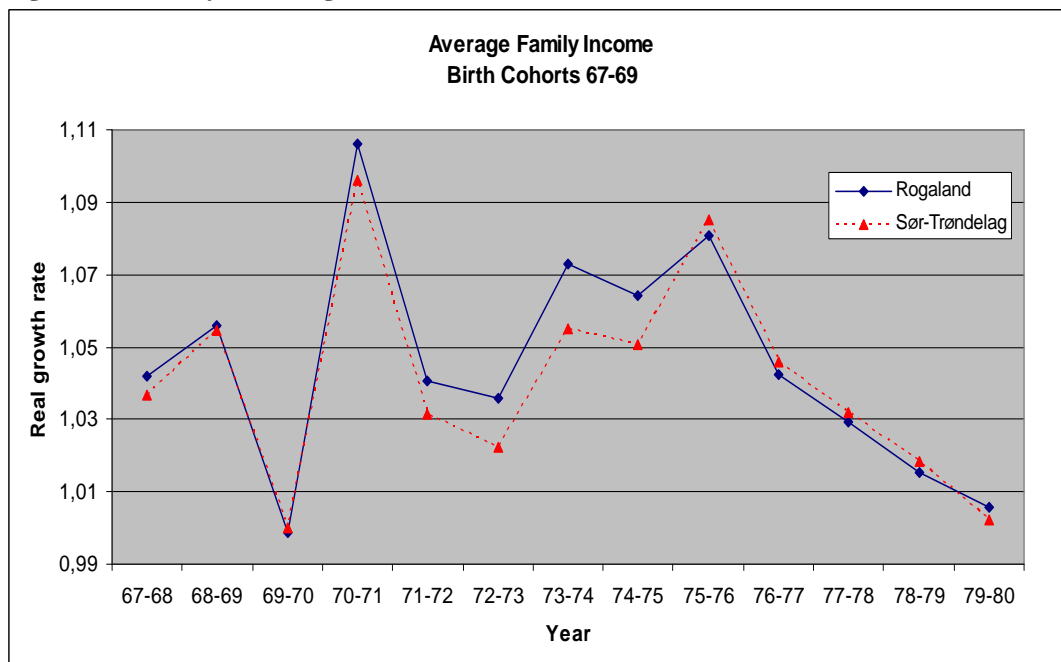
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## Appendix

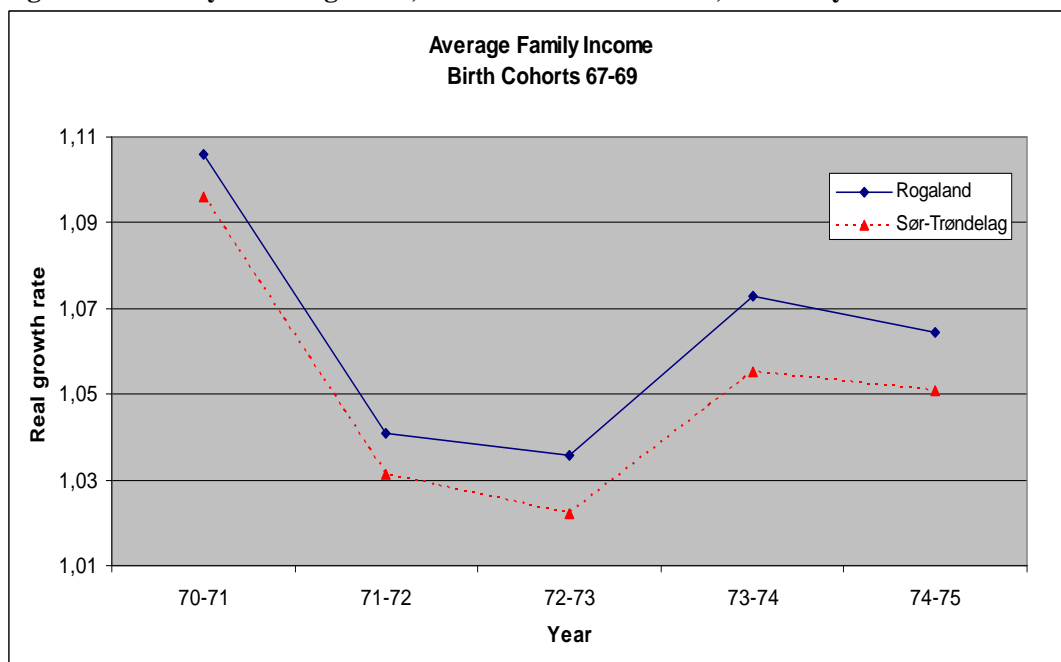
Figure 1: Map of Norway. County 11 is Rogaland, while county 16 is Sør-Trøndelag.



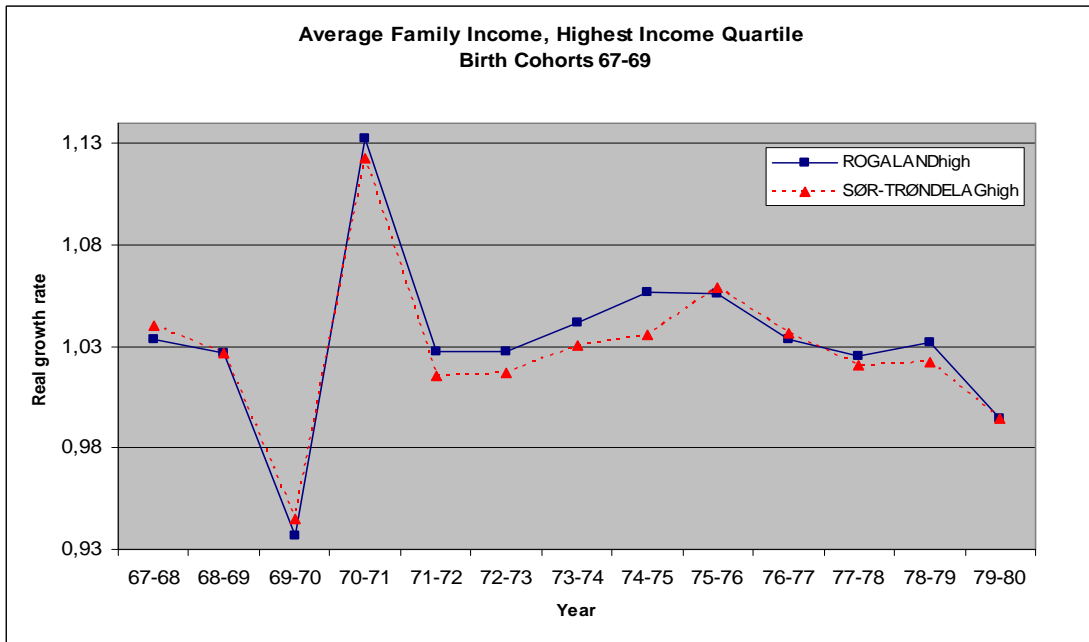
**Figure 2a: Family income growth, birth cohorts 1967-1969**



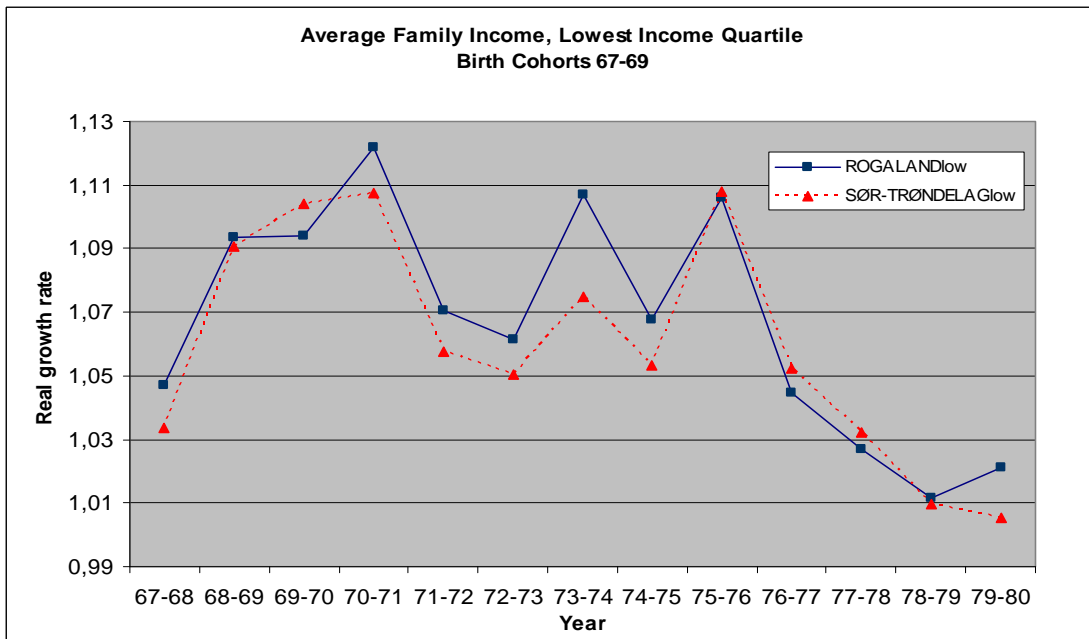
**Figure 2b: Family income growth, birth cohorts 1967-1969, selected years**



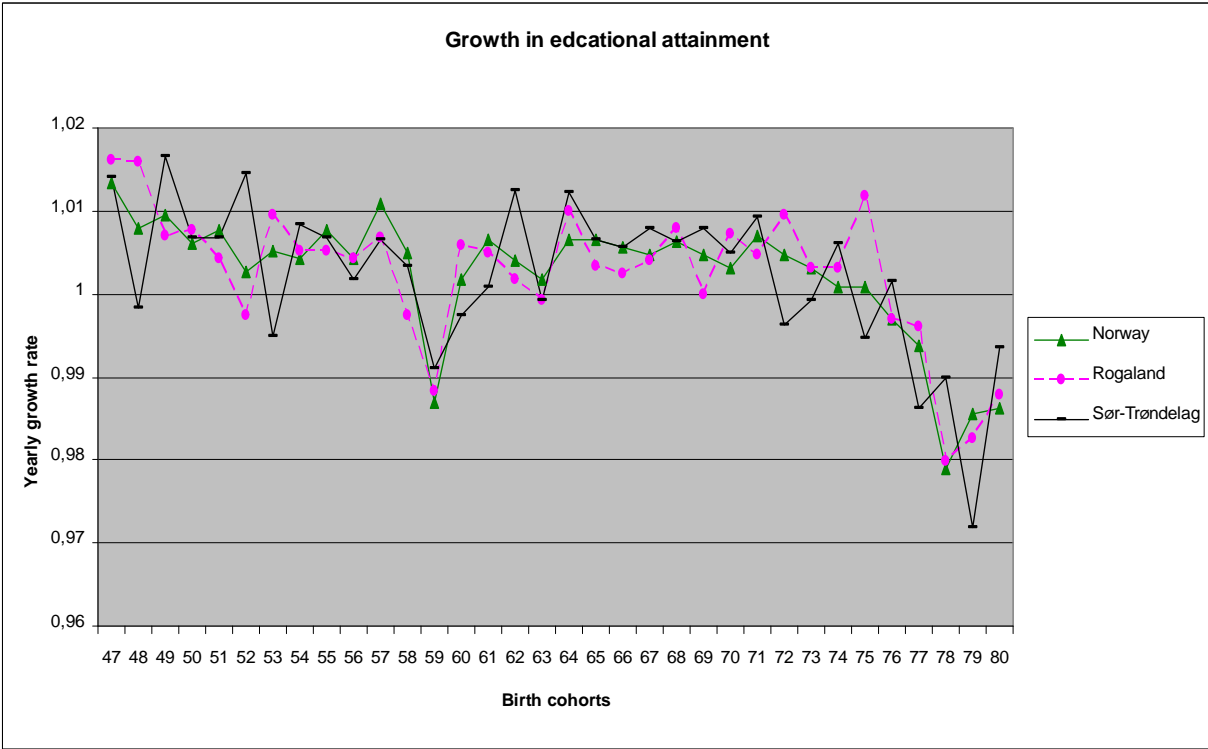
**Figure 3a: Family income growth, birth cohorts 1967-1969, highest income quartile**



**Figure 3a: Family income growth, birth cohorts 1967-1969, lowest income quartile**



**Figure 4: Growth rate in years of education, different birth cohorts**



**Table 1: Variable description**

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<b>Children's education</b>	= measured in years of obtained higher education
<b>Family income (70-80)</b>	= average family between 1970 and 1980
<b>Family income (67-69)</b>	= average family income prior to the oil boom
<b>College mother</b>	= 1 if mother has gone to college, 0 otherwise
<b>College father</b>	= 1 if father has gone to college, 0 otherwise
<b>Married</b>	= 1 if mother was married in 1980, 0 otherwise
<b>Age father</b>	= Age of father in 1970
<b>Age mother</b>	= Age of mother in 1970
<b>Mother not working</b>	= 1 if mother is not working in 1970
<b>0 sibling</b>	= 1 if individual has 0 sibling, 0 otherwise
<b>1 sibling</b>	= 1 if individual has 1 sibling, 0 otherwise
<b>2 siblings</b>	= 1 if individual has 2 siblings, 0 otherwise
<b>3 siblings</b>	= 1 if individual has 3 siblings, 0 otherwise
<b>4 siblings</b>	= 1 if individual has 4 siblings or more, 0 otherwise
<b>Cohort67</b>	= 1 if child was born in 1967
<b>Cohort68</b>	= 1 if child was born in 1968
<b>Cohort69</b>	= 1 if child was born in 1969
<b>Cohort75</b>	= 1 if child was born in 1975
<b>Cohort76</b>	= 1 if child was born in 1976
<b>Cohort77</b>	= 1 if child was born in 1977
<b>Rogaland (67-69)</b>	= 1 if the child is born in Rogaland between 1967 and 1969, 0 if born in Sør-Trøndelag or between 1975 and 1977.

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**Table 2: Descriptive statistics, treatment group: Rogaland (67-69) and control group: Sør-Trøndelag (67-69)**

	- treatment -	- control -	Difference
Variable	Mean	Mean	
<b>Age in 2002</b>	33.99 (.0094)	33.99 (.0110)	.0085 (.0145)
<b>Years of education</b>	12.5815 (.0266)	12.6450 (.0333)	-.0635** (.0271)
<b>Father, college degree</b>	.1034 (.0035)	.1179 (.0050)	-.0145** (.0059)
<b>Mother, college degree</b>	.0586 (.0027)	.0785 (.0037)	-.0199*** (.0046)
<b>Age, Father</b>	35.38	35.52	.1459
<b>Age, Mother</b>	32.18	32.31	.127
<b>Family Income 1968-1970</b>	211107 (868)	208091 (1205)	3015** (1446)
<b>Family Income 1973-1988</b>	298963 (1063)	266019 (1461)	32945*** (1762)

Note: family income is measured in 1999 NOK (1USD= 5.52 NOK (02.09.08))

**Table 3a: First-stage results, (Rogaland (67-69), control group: Sør-Trøndelag (67-69) and Rogaland and Sør-Trøndelag (75-77)).**

<b>Family Income (70-80)</b>	<b>Coefficient (std. error)</b>	<b>Coefficient (std. error)</b>
<b>Rogaland</b>	.1155*** (.0047)	.1239*** (.0046)
<b>t-statistics</b>	24.73	26.66
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	33547	33547

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parents education, parents age and marital status and working status of mother.

**Table 3b: OLS and IV results, (Rogaland (67-69), control group: Sør-Trøndelag (67-69), and Rogaland and Sør-Trøndelag (75-77)).**

<b>Children's education in years</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>
<b>Family Income (70-80)</b>	.7222*** (.0251)	-.0889 (.1858)	.7442*** (.0252)	-.0478 (.1502)
<b>t-statistics</b>	28.73	-.48	29.56	-.32
<b>Mother college degree</b>	.5699*** (.0433)	.7031*** (.0533)	.5024*** (.0430)	.5628*** (.0663)
<b>Father college degree</b>	1.236*** (.0337)	1.370*** (.0457)	1.192*** (.0333)	1.236*** (.0503)
<b>Control variables</b>	no	no	yes	yes
<b>Observations (N)</b>	33547	33547	33547	33547

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 4a: First-stage results, (girls)**

<b>Family Income (70-80)</b>	<b>Coefficient (std. error)</b>	<b>Coefficient (std. error)</b>
<b>Rogaland</b>	.1081*** (.0066)	.1482*** (.0069)
<b>t-statistics</b>	16.31	21.48
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	16265	16265

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parents education, parents age and marital status and working status of mother.

**Table 4b: OLS and IV results, (girls)**

<b>Children's education in years</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>
<b>Family Income (70-80)</b>	.7412*** (.0381)	-.1542 (.2980)	.6756*** (.0396)	-.2081 (.2374)
<b>t-statistics</b>	19.47	-.52	17.05	-.88
<b>Mother college degree</b>	.5764*** (.0638)	.7302*** (.0824)	.4429*** (.0897)	.5881*** (.0988)
<b>Father college degree</b>	1.2401*** (.0508)	1.3865*** (.0707)	1.1130*** (.0675)	1.2459*** (.0771)
<b>Control variables</b>	no	no	yes	yes
<b>Observations (N)</b>	16265	16265	16265	16265

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 5a: First-stage results, (boys)**

<b>Family Income (70-80)</b>	<b>Coefficient (std. error)</b>	<b>Coefficient (std. error)</b>
<b>Rogaland</b>	.1226*** (.0066)	.1609*** (.0069)
<b>t-statistics</b>	18.62	23.33
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	17282	17282

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parents education, parents age and marital status and working status of mother.

**Table 5b: OLS and IV results, (boys)**

<b>Children's education in years</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>
<b>Family Income (70-80)</b>	.7053*** (.0329)	-.0208 (.2303)	.6575*** (.0340)	.0823 (.1898)
<b>t-statistics</b>	21.43	-.09	19.36	.43
<b>Mother college degree</b>	.5432*** (.0582)	.6570*** (.0689)	.4529*** (.0332)	.5449*** (.0892)
<b>Father college degree</b>	1.2427*** (.0443)	1.3627*** (.0586)	1.1470*** (.0590)	1.2321*** (.0656)
<b>Control variables</b>	no	no	yes	yes
<b>Observations (N)</b>	17282	17282	17282	17282

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 6a: First-stage results, placebo-test, cohorts 1975-1977**

<b>Family Income (80-90)</b>	<b>Coefficient (std. error)</b>	<b>Coefficient (std. error)</b>
<b>Rogaland</b>	.0051 (.0068)	.0007 (.0072)
<b>t-statistics</b>	.76	.10
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	20595	20595

Note: \*\*\*-significant at 1 % level. Control variables include family income (77-79), cohort dummies, sex, siblings, parents education, parents age and marital status and working status of mother.

**Table 6b: OLS and IV results, placebo-test**

<b>Children's education in years</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>
<b>Family Income (80-90)</b>	.4587*** (.0230)	-4.0977 (7.6216)	.4116*** (.0230)	-51.797 (523.463)
<b>t-statistics</b>	19.97	-.54	17.88	-.10
<b>Mother college degree</b>	.4568*** (.0485)	.5708 (.2734)	.3267*** (.0688)	3.8056*** (35.0638)
<b>Father college degree</b>	.8449*** (.0385)	2.2054 (2.3035)	.7323*** (.0499)	17.774*** (170.885)
<b>Control variables</b>	no	no	yes	yes
<b>Observations (N)</b>	20595	20595	20595	20595

Note: \*\*\*-significant at 1 % level. Control variables include family income (77-79), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 7a: First-stage results, including all counties described in Section 7.1.**

<b>Family Income (70-80)</b>	<b>Coefficient (std. error)</b>	<b>Coefficient (std. error)</b>
<b>Rogaland</b>	.1054*** (.0033)	.1331*** (.0034)
<b>t-statistics</b>	31.66	38.72
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	112516	112516

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parents education, parents age and marital status and working status of mother.

**Table 7b: OLS and IV results, including all counties described in Section 7.1.**

<b>Children's education in years</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>	<b>Coefficient (std. error) OLS</b>	<b>Coefficient (std. error) IV</b>
<b>Family Income (70-80)</b>	.7306*** (.0138)	-.0691 (.1391)	.6573*** (.0142)	-.0546 (.1257)
<b>t-statistics</b>	52.86	-.50	46.29	-.43
<b>Mother college degree</b>	.6610*** (.0239)	.7833*** (.0388)	.5711*** (.0278)	.7985*** (.0339)
<b>Father college degree</b>	1.1415*** (.0197)	1.2496*** (.0317)	1.0715*** (.0211)	1.2081*** (.0293)
<b>Control variables</b>	no	no	yes	yes
<b>Observations (N)</b>	112516	112516	112516	112516

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 8: IV results for different cohorts, including all control counties described in Section 7.1.**

<b>Children's education in years</b>	<b>Coefficient (std. error) IV</b>	<b>N</b>
<b>Family Income (70-80)</b> Cohort: 58-60	.1403 (.1304)	137861
<b>Family Income (70-80)</b> Cohort: 61-63	.0626 (.1237)	129620
<b>Family Income (70-80)</b> Cohort: 64-66	-.1442 (.1231)	116500
<b>Family Income (70-80)</b> Cohort: 67-69	-.0546 (.1257)	112516

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother

**Table 9: Non-parametric IV estimates, (Rogaland (67-69), control group: Sør-Trøndelag (67-69))**

Children's education in years	Coefficient (std. error) OLS	Coefficient (std. error) IV
<b>Family Income (80-90)</b>	-.0444 (.1246)	-.0429 (.1229)
<b>Control variables</b>	no	yes
<b>Observations (N)</b>	12952	12952

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother.

**Table 10: IV results for different education groups, including all control counties described in Section 7.1.**

Children's education in years	Coefficient (std. error) IV	N
<b>Family Income (70-80)</b> Father less than 10 years of education	-.2618 (.1657)	52994
<b>Family Income (70-80)</b> Father more or equal to 10 years of education	-.0633 (.2520)	59522
<b>Family Income (70-80)</b> Mother less than 10 years of education	-.0127 (.1400)	59845
<b>Family Income (70-80)</b> Mother more or equal to 10 years of education	.0307 (.2690)	52671

Note: \*\*\*-significant at 1 % level. Control variables include family income (67-69), cohort dummies, sex, siblings, parent's age and marital status and working status of mother