Breaking the Links: Natural Resource Booms and Intergenerational Mobility*

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Abstract

Do large economic shocks break the links between generations through the creation of new economic opportunities or increase intergenerational persistence by reinforcing the ties between generations? We demonstrate that a large oil shock increases intergenerational earnings mobility among men entering the labor market at the start of the boom in oil-affected regions, mostly through increased bottom-up mobility. Preexisting local differences in mobility or shifts in the earnings distributions do not drive these findings. Instead, changes in relative earnings paid to workers with different skills offer the best explanation. For women, there are no oil-related regional differences in mobility. We document that mobility is significantly higher across three generations in oil boom regions and that the oil boom broke the earnings link between first- and third-generation men.

1 Introduction

What economic factors can alter social mobility and thereby break the link between parents and their children's economic status? While the literature documents differences in intergenerational mobility across regions within countries and changes in intergenerational mobility over time (Corak, Lindquist, and Mazumder, 2014; Chetty, Hendren, Kline, Saez, and Turner, 2014; Nybom and Stuhler, 2013; Pekkarinen, Salvanes, and Sarvimäki, 2017), the factors that determine changes and regional differences in intergenerational mobility are not yet well understood. In particular, how major economic shocks or turbulences affect intergenerational

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mobility and whether these changes persist across generations remain open questions. From a theoretical perspective, the direction of the effect of an economic shock on intergenerational mobility is unclear. On the one hand, if new industries with new job opportunities demanding new skills are established, this may decouple the ties between parents and their children's outcomes. Consequently, parental income and existing social networks become less accurate predictors of children's economic outcomes. On the other hand, poorer families may be less able to benefit from new opportunities, leading to lower social mobility. Moreover, different types of economic shocks, including economic downturns or upturns, natural resource booms, and technological changes, may well reinforce or break the transmission of economic status, and the resulting changes may persist for one or more generations.

In this paper, we focus on the effect of a specific major and long-lasting resource boom on social mobility. In particular, we exploit the geographic variation across local labor markets in the impact of the Norwegian oil boom, which transformed the Norwegian economy from being one largely based on shipping, logging, fishing, and food production into a globally successful resource-based economy. Previous literature has shown that resource booms substantially increase local economic activity and average wages despite substantial population migration (Black, McKinnish, and Sanders, 2005a; Allcott and Keniston, 2018; Basso, 2016). We therefore believe the Norwegian oil boom of the 1970s presents an ideal natural experiment for considering the effects of a natural resource shock on intergenerational mobility for three main reasons. First, most indications suggest that oil has been a blessing for Norway, judging by Norway's resultant high per capita GDP, relatively low unemployment rate, and sizeable government pension fund. Since oil production commenced in 1971, the expansion of oil activities has had far-reaching effects on both Norwegian workers and firms. By 2014, the Norwegian oil sector (including oil-related suppliers) provided about 60 percent of Norway's exports and directly or indirectly provided some 9 percent of total employment. Accordingly, if natural resource shocks do alter the transmission of economic status, the Norwegian oil boom should be large enough for us to measure any possible impact. Second, Norwegian registry data permit us to directly link the earnings and education of Norwegian parents to those of their children. While we can observe parental earnings prior to the discovery of oil, the passage of time also allows us to observe the earnings of their children exposed to the oil shock as adults, and likewise the educational outcomes and early career earnings of their grandchildren. Finally, there are significant differences across Norwegian local labor markets in the importance of the oil sector, which creates geographic variation. This enables us to compare the transmission of economic status across local labor markets affected unevenly by the oil boom.

To analyze the impact of the resource shock on intergenerational income mobility, we use rank–rank regression models (Chetty, Hendren, Kline, and Saez, 2014). In addition, we measure upward rank mobility using transition matrices to detect nonlinearities and to analyze nonlinear patterns in intergenerational mobility, and this enables us to understand whether individuals growing up in poor or moderately well off families benefited most from the natural resource shock. We examine the effect of this natural resource boom on intergenerational mobility using a local labor market strategy, which exploits variation across local labor markets in their exposure to the resource shock. New employment opportunities in petroleum-relevant occupations may have increased earnings for some individuals entering oil boom-affected labor markets in the 1970s (Brunstad and Dyrstad, 1997), and changed the intergenerational earnings persistence.

In our main analysis, we therefore focus on cohorts (and the parents of these cohorts) that entered the labor market during the 1970s, which marks the first decade of oil extraction in Norway. To evaluate whether our result is likely causal and not driven by preexisting differences in intergenerational mobility across local labor markets, we also consider the intergenerational mobility of placebo cohorts (and their parents) that were about 40 years of age at the beginning of the oil boom, and thereby less affected in their career decisions by the growing oil sector. In particular, we examine cohorts born in the 1930s and their parents born around the turn of the century, and measure their income before the commencement of oil production in 1972.

Several mechanisms may explain why resource booms alter intergenerational earnings persistence. First, a resource shock may alter educational attainment, the relative earnings paid to workers with different skills, or resources devoted to educational investments. In particular, the existing literature has shown that resource booms change the opportunity costs of attending high school or college, as more high-paying low-skill jobs become available (Black, McKinnish, and Sanders, 2005b; Cascio and Narayan, 2015; Morissette, Chan, and Lu, 2015). Second, resource boom-related wage increases in low-skill jobs may reflect compensation for greater health risk. Our data allow us to distinguish between these different mechanisms. In addition, we analyze whether the changes in the intergenerational transmission of economic status persist over multiple generations. Generally, periods of structural change may reduce the transmission of social status in the generation most directly affected. However, this decrease in intergenerational earnings persistence does not necessarily remain in place for the next generation, because family ties may again tighten and the society could enter a new steady state with lower intergenerational mobility (Nybom and Stuhler, 2013).

Overall, we find that the Norwegian oil boom increased intergenerational earnings mobility for men: men born in local labor markets that benefited the most from the oil boom of the 1970s experiencing more intergenerational earnings mobility than elsewhere. In particular, the intergenerational persistence in earnings rank was roughly 9 percent lower in oil-affected local labor markets. In addition, we find that men born to poor families in oil-affected regions were significantly less likely to remain poor, and much more likely to move all the way to the top of their cohort in terms of earnings. Through examining the placebo cohorts, we find that preexisting location differences in intergenerational earnings mobility did not drive these effects. In addition, region-specific shifts in the earnings distributions can only explain a small part of the increase in mobility. For women, we document no oil-related regional differences in mobility. Turning to the underpinning mechanisms, we find that changes in relative earnings paid to male workers with different skills offer the best explanation for the geographic differences in intergenerational mobility among men following the oil boom. In particular, the returns to academic versus vocational education dropped significantly in the high-oil regions. School resources and educational attainment (by socioeconomic background) do not differ by region. Moreover, we show that the increase in mobility is unlikely to arise from a risk premium due to dangerous work environments in the oil industry.

In addition, we find that intergenerational mobility is significantly higher in oil-affected labor markets across three generations. In particular, the earnings rank of the second generation was less predictive of the earnings rank of third-generation men in high-oil regions. In addition, the oil boom broke the earnings link between first- and third-generation men in high-oil regions. For third-generation women, the ranks of both the first and second generations of men was predictive of their earnings rank. There was, however, only regional variation in the relationship between the second and third generations. Increases in educational attainment were no channel for the increased intergenerational mobility in the oil-region, rather are children of bottom-to-top movers in the high-oil regions less educated and their middle school grades are lower than in low-oil regions. This indicates that bottom-to-top movers in the high-oil regions are likely investing less into their children's human capital development. Whereas these lower educational investments could be explained by a lower return to education in the high-oil region for third-generation men, there are no regional differences in the returns to education for third-generation women. Overall, the results were not sensitive to selective migration, to the definition of high- and low-oil regions, or the age at which first- or third-generation earnings were measured.

Our findings contribute greatly to the scarce literature establishing a link between macroeconomic conditions and the transmission of economic status. Feigenbaum (2015) shows that a very different type of economic turbulence in the form of the Great Depression lowered intergenerational mobility in the US for sons growing up in the cities hardest hit by the economic downturn. Unlike Feigenbaum (2015), we consider a boom not a bust, followed by an extended period of economic growth, which began in the early 1970s and lasted for more than four decades. In addition, we contribute to the literature on the dynamics of intergenerational mobility across cohorts (Nybom and Stuhler, 2013), along with the growing literature documenting the substantial geographic variation in intergenerational mobility (Chetty, Hendren, Kline, and Saez, 2014; Chetty and Hendren, 2018; Connolly, Corak, and Haeck, 2017).

The remainder of the paper is structured as follows. Section 2 provides some historical background on the Norwegian oil boom. Section 3 outlines the empirical strategy and Section 4 discusses the data and provides descriptive statistics. Section 5 details the results and Section 6 provides empirical evidence on the underlying mechanisms. Section 7 discusses the persistence across multiple generations, Section 8 provides robustness tests, and Section 9 discusses the external validity of the main results. Section 10 concludes.

2 Norwegian Oil Exploration and Industry

In the late 1950s, few believed that the Norwegian continental shelf concealed rich oil and gas deposits. Fifty years later, the oil and gas industry is now the country's most important industry in terms of both treasury revenue and investment (Ekeland, 2015). While early geological opinions were largely negative concerning the presence of oil and gas deposits in the Norwegian parts of the North Sea, the discovery of gas at Groningen in the Netherlands in 1959 revised expectations (Cooper and Gaskell, 1976). In 1963, the Norwegian government proclaimed sovereignty over the Norwegian continental shelf and began issuing licenses to oil companies to carry out preparatory exploration and to perform seismic surveys. But drilling only commenced in 1965 following an agreement on how to divide the continental shelf between Norway, Denmark, and the United Kingdom (see, e.g., Noreng, 1980).

In 1965, the Norwegian state issued 22 production licenses for 78 blocks around the southwestern tip of

Norway (see, e.g., Helle, 1984). These production licenses provided exclusive rights for exploring, drilling, and production in the license area (see Figure A1). However, as Norway lacked essential knowledge of platform construction in the 1960s, the first oil rig was towed from New Orleans to Norway in 1966 to drill the first well, about 180 kilometers southwest of the Norwegian city of Stavanger. The first few attempts failed to find any trace of oil or gas. The discovery of Ekofisk, one of the largest offshore oil fields ever found, on December 23, 1969, was the first of a number of major discoveries on the Norwegian continental shelf (for the location of the Ekofisk field, see Figure A2). Production from Ekofisk commenced in 1971 (see, e.g., Helle, 1984).

In 1972, the Norwegian parliament voted to increase regulations for oil exploration and to develop new knowledge and industries based on petroleum (Finansdepartementet, 1974). Statoil, a state-owned oil company, was funded to look after the government's commercial interests and to pursue appropriate collaborations with domestic and foreign oil interests. In addition, the newly established Norwegian Petroleum Directorate was made responsible for recommending which licenses the government should award and ensuring that companies complied with safety regulations for offshore drilling and production. Hence, the year 1972 marks a turning point in Norway's petroleum industry: before 1972, the industry was dominated by foreign oil companies, but the government declared its interest in building up domestic oil expertise in that same year (see, e.g., Noreng, 1980). As there were no large refineries or other high-capacity infrastructure to land oil on the Norwegian shore, oil was initially landed abroad. However, the government decided that petroleum from the Norwegian continental shelf must only be landed in Norway (NOU, 1972).[1]

These new laws and the establishment of Statoil's headquarters in Stavanger in 1972 transformed what was once a small canning industry town to the 'oil capital' of Norway. Figure A2 shows that Stavanger was the closest to the oil fields among the three main Norwegian cities in the south of Norway (Oslo, Bergen, and Stavanger). Moreover, international oil companies had already constructed supply bases close to Stavanger in both Tananger and Dusavik before the enactment of the new laws. As one outcome, individuals residing in southwestern Norway around Stavanger were more affected by the growing oil industry in the 1970s (see, e.g., Løken, 2010). As the oil boom created a substantial labor demand shock, mostly for skilled and semiskilled craftsmen (Brunstad and Dyrstad, 1997), labor markets with large ship- or machine-building industries also benefited from the oil boom in the 1970s.

Following a series of large oil and gas discoveries on the Norwegian continental shelf in the North Sea (southwest of Norway), new oil and gas fields were discovered in the Norwegian Sea (off mid-Norway) in 1981 and the Barents Sea (northern Norway) in 1984 (see, e.g., Lerøen, 1990). Figure A2 displays all oil discoveries up until 2015. Given the steady increase in new discoveries, the oil shock in Norway was not short lived. It entailed a semi-permanent income shock, as it lasted for more than four decades, until the most recent decline in oil prices in 2014. Further, while the initial boom was mainly concentrated in southwestern Norway, today many areas along the western and northern coasts of Norway also benefit from nearby oil and gas deposits. Consequently,

[1]Several of the early offshore oil fields were only marginally closer to Norway than to the United Kingdom, whose oil fields had been discovered in 1964 and whose refineries and transport hubs had been established before the first Norwegian oil discoveries. For example, the Ekofisk field is 320 km southwest of Stavanger in Norway but only 350 km northeast of the refinery in Teesside in the UK.

the strong geographic differences in oil-related economic growth were most pronounced in the 1970s.

3 Empirical Strategy

In this paper, we analyze how a large resource shock affects intergenerational mobility. Intergenerational mobility is the relationship between the outcomes, such as the earnings or level of education, of one generation and the outcomes of the offspring generation. In this section, we first describe our empirical strategy to measure intergenerational mobility. We then detail how we identify the effect of the oil boom on intergenerational mobility.

3.1 Measuring Intergenerational Mobility

The most commonly used measure of intergenerational mobility is intergenerational elasticity. This measure computes the percentage change in the income of a son given a 1 percent change in the income of the father, and is estimated by regressing the log earnings of the son s on the log earnings of the father f:

$$log(earnings_i^s) = \alpha + \beta \cdot log(earnings_i^f) + \epsilon_i. \tag{1}$$

The slope coefficient β is the intergenerational persistence parameter, with larger values of β indicating a stronger link between fathers and their sons and thus less mobility. In a society with no intergenerational mobility, we would observe a persistence parameter of $\beta = 1$; in a society with no relationship between the father's and the son's earnings, we would observe a persistence parameter of $\beta = 0$. Intergenerational mobility is measured by $1 - \beta$, which represents a measure of regression to the mean in percentage terms. Importantly, if this elasticity is constant across generations, it is a measure of how many generations it takes for a family living in poverty to attain the average level of income.

However, intergenerational earnings elasticity is not well-suited for a comparison between subgroups (Mazumder, 2016). In our case, by computing the intergenerational elasticity at the labor market level, we would compute the regression to the mean within each labor market region. This does not necessarily allow for meaningful comparisons. Suppose that we aim to compare intergenerational mobility in two labor market regions A and B. Now suppose that the log of the income distribution of the parents' generation is the same in the two regions, while the log of the income distribution of children in labor market B shifts to the right, such that all individuals in B are better off. In this case, it is possible that the regression to the mean is identical in both labor market regions A and B, even though the offspring generation in labor market region B is much better off.

Furthermore, the slope coefficient β may differ across regions not only if the correlation in income between generations differs, but also if there is a difference in the ratio of the standard deviation of the income distribution of fathers to the standard deviation of the income distribution of sons (Solon, 1999).[2]

[2] This is because the coefficient β can be rewritten as

$$\beta = \frac{Cov(earnings_i^s, earnings_i^f)}{Var(earnings_i^f)} = \frac{Cov(earnings_i^s, earnings_i^f)}{\sigma_f \sigma_s} \frac{\sigma_s}{\sigma_f} = Corr(earnings_i^s, earnings_i^f) \frac{\sigma_s}{\sigma_f},$$

where σ_f is the standard deviation of the fathers' log earnings distribution and σ_s is the standard deviation of the sons' log

Estimates of the intergenerational elasticity do not distinguish between these two effects. As a result, intergenerational earnings elasticity is not a good measure for comparisons between regions when earnings distributions differ by regions, and therefore it is not useful for our purpose.

To compute a measure of intergenerational mobility that allows for a better comparison across labor markets, we need to standardize the earnings distribution at the national level. A possible solution is to use the rank of individuals in the national income distribution (Mazumder, 2016). We employ two different measures of intergenerational mobility: rank persistence and upward rank mobility. These two related measures provide answers to different questions. Rank persistence measures the average difference in outcomes between children from higher versus lower socioeconomic backgrounds. Upward rank mobility shows the outcomes of children from a specific (fixed) family background.

To measure rank persistence, we regress the rank of a son in his own earnings distribution on the rank of the father in his own earnings distribution:

$$rank_i^s = \omega + \delta \cdot rank_i^f + \epsilon_i. \tag{2}$$

Assuming that the rank–rank relationship is linear, the estimated parameter δ represents the intergenerational persistence of the rank in the earnings distribution. More precisely, δ is a measure of the relationship between the positions of sons and their fathers in the national earnings distributions of their respective cohorts. A major advantage of measuring intergenerational mobility using rank–rank regression is that the measure is not sensitive to zero incomes and is less sensitive to the ages at which the incomes of both fathers and sons are measured (Chetty, Hendren, Kline, and Saez, 2014; Nybom and Stuhler, 2017). The intercept ω measures the expected rank of sons whose fathers were at the bottom of the income distribution.

Measures of upward rank mobility indicate the outcomes of sons from a specific family background. The most commonly used measure of upward rank mobility is the 'transition matrix,' which maps the probabilities of a son being in each quintile of the earnings distribution, given his father is in a specific quintile. For example, this measure yields the likelihood that a son who grew up in a household in the lowest earnings quintile will reach the top earnings quintile in his generation. In particular, it allows us to investigate specifically whether mobility is nonlinear and differs across the income distribution; that is, whether more children of poorer families are able to move to higher earnings quintiles, or more children from middle-income families are able to move to the top of the income distribution.

3.2 The Resource Shock and Intergenerational Mobility

Most consider the discovery of oil to have been a blessing for Norway, and the expansion of oil activities has had far-reaching effects on both Norwegian workers and firms. However, did this resource shock break the economic link between fathers and their sons and increase the intergenerational mobility in labor markets most affected by the oil discovery? Alternatively, did the oil discovery reinforce earnings differences for children in different parts of the income distribution, thereby increasing intergenerational persistence? To determine the effect of the oil boom on intergenerational mobility, we regress the rank of the son on the

earnings distribution.

rank of the father, along with an interaction term between the rank of the father and a dummy variable indicating whether the son was born in a local labor market affected by the oil boom:

$$rank_i^s = \theta_0 + \theta_1 \cdot rank_i^f + \theta_2 \cdot rank_i^f \times Oil_{llm} + X_i'\theta_3 + \gamma_{llm} + \epsilon_i, \tag{3}$$

where $rank_i^s$ is the son's rank in his cohort's income distribution and $rank_i^f$ is the father's rank in the income distribution of fathers. Oil_{llm} is an indicator of whether the son was born in a local labor market affected by the oil boom. γ_{llm} are local labor market fixed effects. X_i is a set of individual characteristics, including the father's age at childbirth and fixed effects for the son's birth cohort. We cluster standard errors at the municipality of the son's birth to control for common municipality-level shocks. Therefore, θ_1 is the persistence parameter in local labor markets little affected by the oil boom. However, the key variable of interest is θ_2, which measures the increase or decrease in intergenerational persistence in local labor markets affected by the oil boom.

3.3 Treated and Control Cohorts

To assess the effects of the Norwegian oil boom on intergenerational mobility, we require variation in the importance of the oil sector across local labor markets. Local labor markets are aggregations of municipalities (the lowest administrative level in Norway) based on commuting patterns, but they are still typically smaller than counties (the middle administrative level in Norway). The 46 local labor markets in Norway cover the entire country, including urban and rural areas, and include the area in which people mostly live and work (Bhuller, 2009). A local labor market consists on average of nine municipalities and has an average population of 68,000 individuals.

To measure the local importance of the oil boom, we specify the share of employment in the oil and oil supply industries in each local labor market using 1980 census data. To identify the oil supply industries, we follow Brunstad and Dyrstad (1997), who show using recruiting survey data from 1975, 1977, and 1980 that supply industries such as the manufacturing of metal products, machinery and equipment, and construction should be included in the definition of oil-related industries. This is because these industries are important suppliers to the oil industry and likewise experienced a large demand shock due to the oil boom in the 1970s. Using three-digit industry codes, we define oil sector employment as comprising jobs in crude petroleum and natural gas production, petroleum refining, the manufacturing of petroleum and coal products, the manufacturing of machinery (including oil and gas well machinery and tools), the manufacturing of transport equipment (including ships and boats), and construction other than building construction (including oil well drilling).[3]

Figure A3 plots the proportion of workers employed in the oil industry in 1980 in each labor market. Generally, the areas with most employment in the oil sector are in southwestern Norway, which is closest to the first oil field discovered in 1969 (see Section 2). We classified local labor markets into one of three regional groups. We defined a local labor market as a low-oil region if employment in the oil industry accounted for less than 7.5 percent of total employment, which corresponds to the median oil employment level across all local labor markets. We defined local labor markets with more than 10 percent of employment

[3]Our definition of oil sector employment is similar to the definition suggested by Allcott and Keniston (2018), who used four-digit industry codes.

in the oil industry (the top quartile of oil employment) as high-oil regions. Among the high-oil regions, the average share of oil employment was 14 percent and the highest share was 26 percent. Consequently, the oil boom clearly affected these regions, whereas the low-oil regions were hardly affected. We therefore focus on comparing low- and high-oil regions in our main analysis. In some of the robustness tests, we include middle-oil regions with between 7.5 and 10 percent of employment in the oil industry.

In our main analysis, we focus on the cohorts of sons that entered the labor market during the first decades of oil extraction in Norway. For this reason, we consider the six cohorts born in the 1950s (birth cohorts 1952–1957). These cohorts (hereafter called the 'main cohorts') entered the labor market in the 1970s. Therefore, they were the first cohorts with the potential to benefit from the expansion of the oil industry in Norway throughout their entire working lives. In addition, these cohorts were largely finished with high school education (or at least made the decision whether to enrolled in vocational or academic high school education) when oil extraction began. Therefore, we can abstract from the influence of the effect of the oil shock on human capital investment.[4] This is also supported by Figure A4, which shows that the proportion of individuals born in the 1950s who finished academic or vocational high school was stable and similar in both high- and low-oil regions.

To argue that θ_2 represents the effect of the oil boom on the intergenerational links between fathers and sons, we need to establish that intergenerational mobility and exposure to the oil boom by local labor market were unrelated in those generations prior to the oil shock. There is much randomness in whether one actually makes an oil discovery, and the exact location of the oil and gas deposits and the timing of their discovery are exogenous (Cust and Harding, forthcoming). Although the decisions about where to land the offshore oil and where to locate the headquarters of the Norwegian oil company Statoil were political, and therefore nonrandom, the trends in income per capita in the low- and high-oil regions were nearly parallel from 1950 to 1970 (see Figure A5). Per capita income in the high- and low-oil regions began to diverge only after the first oil discoveries in 1970.[5]

Nevertheless, the increase in oil-related employment was larger in areas with preexisting machine and shipping industries that could potentially supply products to the nascent oil industry. Therefore, we turn to two additional placebo cohorts born in the 1930s to show that the exposure to the oil boom did not predict intergenerational mobility for the generation entering the labor market long before the oil journey began in Norway (hereafter called the 'placebo cohorts'). Of course, while individuals born in the early 1930s would eventually benefit from the oil boom, by measuring their earnings before the discovery of oil we can reveal any geographic variation in intergenerational mobility unrelated to the resource shock. If the intergenerational mobility of sons born in the 1930s was significantly related to the oil shocks, it would suggest that θ_2 does not actually reveal the effect of the oil boom on intergenerational mobility, but rather reflects existing geographic differences in intergenerational mobility. However, if there were no geographic

[4] As existing research shows that men tend to drop out of high school in areas affected by resource booms, this distinction is important (Black, McKinnish, and Sanders, 2005b; Cascio and Narayan, 2015; Morissette, Chan, and Lu, 2015).

[5] Note that coastal areas were not more economically developed prior to the discovery of oil. There are also large industrial areas in central Norway among the low-oil regions.

differences in intergenerational mobility for sons born in the 1930s, θ_2 likely identifies our effect of interest.

Ideally we would also like to present evidence that the trends in intergenerational mobility for cohorts born before the 1930s are parallel across regions. Our data do not allow linking parents to children born prior to the 1930s. However, there is both a conceptual and empirical link between intergenerational mobility and inequality and we therefore present trends for different measures of inequality in high- and low-oil regions as a proxy. We use data from three different sources: in 1930 and 1948, inequality is measured based on digitalized tax records and we use tax register data for 1967–1969. Figure A6 shows that the trends in the Gini coefficient and the 75-25-decile dispersion ratio in the two different regions develop parallel prior to the oil shock in the 1970s. Although this evidence is only suggestive for intergenerational mobility, it indicates that there were no deviating regional pre-trends in inequality prior to the oil boom.

4 Data

We compile the data from several sources. Our primary source is Norwegian Registry Data, a linked administrative dataset that covers the whole population resident in Norway up to 2014. These data combine different administrative registers, including the central population register, the education register, and the tax and earnings register. These data follow individuals over time in a longitudinal design and provide information about place of birth, place of residence, educational attainment, labor market status, occupations, earnings, and a set of additional demographic variables. Information on employment, earnings, and place of residence is collected for each individual for every year. In addition, a multigenerational register matches Norwegian children to their parents. As a result, we can link earnings and education data over several generations. In what follows, we briefly summarize the sample definitions and describe the variables and summary statistics for our sample.

As discussed in Section 3.3, our analysis focuses on different groups of cohorts and their fathers. Individuals born from 1952 to 1957, who entered the labor market during the first decades of oil extraction in Norway, constitute the cohorts of primary interest. The sample of their fathers includes individuals born from 1917 to 1935.[6] This sample consists of 85,927 father–son pairs and 82,243 father–daughter pairs in either low- or high-oil regions for whom we have data on lifetime earnings (including zero earnings). Note that we do not consider father–son or father–daughter pairs in 'middle-oil' regions in our main analysis. The total sample across all three types of regions consists of 107,854 father–son pairs and 102,894 father–daughter pairs for whom we have data on earnings. In addition, we analyzed intergenerational mobility across a third generation. That is, we studied the children of the 1952 to 1957 male cohorts. The third generation was born from 1968 to 2009 and consisted of 116,994 father–son and 111,175 father–daughter pairs in low- and high-oil regions. In addition, we studied Norwegian-born sons born between 1932 and 1933 (placebo cohorts). This sample consists of 6,894 father–son pairs in which the fathers were born around the turn of the century.[7]

The central population register records the municipality of birth, which we used to assign an individual

[6] About 21 percent of men born between 1952 and 1957 had fathers born before 1917, for whom we lack data on earnings over their working lives.

[7] As discussed below, we are able to link the two cohorts born in the 1930s to their fathers using data from the two years of military service they completed, which are not available for other cohorts born before 1950.

to a local labor market. The cohorts we analyzed were born before the first oil discoveries. Assigning oil boom affectedness by place of birth allows us to abstract from the influence of any parental moving decisions, possibly also affected by oil-related employment opportunities. In a robustness analysis, we also assigned individuals to a local labor market based on their place of residence at an age of 36 years. The only cohorts born during the oil boom were the children of the 1952 to 1957 cohorts. We assigned these individuals to a local labor market based on the municipality of birth of their fathers.

The earnings measure is not top-coded and includes labor earnings expressed in constant 1998 Norwegian Kroners (i.e., adjusted for inflation), taxable sickness benefits, unemployment benefits, parental leave payments, and pensions since 1967. As lifetime earnings are less affected by transitory fluctuations than earnings in a single year, we proxied the fathers' lifetime earnings by averaging their earnings between the ages of 50 and 55 years. Therefore, the age of a son or a daughter when his father's earnings were measured differs by cohort. As in Chetty and Hendren (2018), we aimed to measure the economic resources of parents while the children were growing up. However, as our yearly earnings data only start in 1967, the oldest cohorts in our sample were 15 years old when parental earnings were measured. We defined the lifetime earnings of sons and daughters similarly. However, we measured children's earnings at ages 36 to 41 years.[8] Earnings between ages 35 and 40 years should provide us with a reasonable proxy for lifetime earnings (Bhuller, Mogstad, and Salvanes, 2016). By this age, most individuals had completed their education, entered the labor market, and gained some labor market experience. The children of the main cohorts are born between 1968 and 2011. As we have data on earnings until 2014, we focus on children born before 1984 and measured the earnings of the children of the main cohorts at age 30 years. This allows us to measure earnings for 46 percent of the children of the main cohorts.

The lifetime earnings of sons born in 1932 and 1933 were also measured at ages 36 to 41 years. That is, the earnings measures were from 1968 to 1974—largely prior to the oil boom. As we only have data on earnings in 1967 and after, the share of sons born in 1932 and 1933 for whom we have data on their fathers' earnings in the registry is small. Therefore, we follow Pekkarinen, Salvanes, and Sarvimäki (2017) and construct an alternative measure of fathers' earnings using military conscription records. In Norway, military enlistment was mandatory for all men. For this reason, our enlistment data include all males born in 1932 and 1933, and we can link these data to the population registry using a personal identification number. In addition, the military recorded information on the occupation and municipality of residence of the fathers of each conscript for both these cohorts. We used the information on fathers' occupations and municipalities of residence to impute earnings for fathers based on average salaries by occupation in 735 Norwegian municipalities from the 1948 tax records. This allowed us to construct imputed earnings for almost 80 percent of the fathers of men born in 1932 and 1933.[9]

Educational attainment data are from the educational database provided by Statistics Norway. Since

[8] As pointed out by (Solon, 1999; Haider and Solon, 2006), individuals with higher lifetime earnings may have steeper earnings profiles at younger ages. Problematically, measuring the earnings of the sons when young may understate the intergenerational earnings persistence estimates. Chetty, Hendren, Kline, and Saez (2014) and Nybom and Stuhler (2017) show that such a lifecycle bias is small for rank–rank correlations if we measure the sons' earnings after age 30 years.

[9] Note that military records for birth cohorts 1932 and 1933 are the only data for cohorts born in the 1920s, 1930s, and 1940s that we can link to the register data using a personal identifier.

1974, educational institutions have reported educational attainment annually directly to Statistics Norway, thereby minimizing any measurement error. For individuals who had completed their education before 1974, we used self-reported information from the 1970 census, which is considered to be very accurate (see, e.g., Black, Devereux, and Salvanes, 2005). On average, the 1952 to 1957 cohort men had 12.4 and women 12 years of education, while the fathers' cohorts had 10.3 years. We have data on educational outcomes for 83 percent of the third generation. On average, 61 and 38 percent of sons and 75 and 25 percent of daughters born before 1991 completed a three-year academic or a two- or three-year vocational high school program, respectively.

We can link individuals to their spouses using couple-identifiers in the population registry. Time and cause of death by 2010 is complied from the Cause of Death Register. The Social Security Administration reports disability pension data. These data include information on the date when disability insurance benefits began and the level of benefits received. We defined an individual as enrolled in a disability insurance program if he or she had received benefits at least once between 1991 and 2008. For the third-generation sons, we employed IQ measures reported by the military. The IQ score is reported in stanine (Standard Nine) units, a method of standardizing raw scores into a nine-point standard scale, which has a discrete approximation to a normal distribution, a mean of five, and a standard deviation of two (Sundet, Barlaug, and Torjussen, 2004). For the third generation sons and daughters we also used information on their final grade at completion of middle school. These data are available for cohorts born between 1986 and 2000.

Although we consider also women born between 1952 and 1957, we mainly focus our analysis on father–son pairs for three main reasons. First, we can only link male recruits in the 1930s to their fathers. Second, only 1.2 percent of the individuals working in the oil sector in our sample were women. Third, women in the main cohorts of interest (1952–1957) were much less attached to the labor market than men. However, in the third generation we focus equally on both genders.

Table A1 provides summary statistics of our sample's demographic and socioeconomic characteristics for the different local labor markets. Altogether, the data we gathered provide a unique opportunity to examine how natural resource booms affect intergenerational mobility.

5 Empirical Results

5.1 Rank Persistence

We focus first on the six cohorts that entered the labor market at the beginning of the Norwegian oil boom (1952–1957) and begin by measuring intergenerational mobility using the rank–rank specification (see Chetty, Hendren, Kline, and Saez, 2014). We rank each child based on his earnings aged 36 to 41 years relative to others in his birth cohort, and rank fathers using their earnings aged 50 to 55 years relative to other men with children born in the same cohort.

First, we analyze men born between 1952 and 1957. Panel (a) of Figure 1 presents the binned scatterplot of the mean percentile ranks of sons against their fathers' percentile ranks in the high- and low-oil regions. Note that these binned scatterplots present the raw earnings data, without controlling for local labor market fixed effects. The conditional expectation of a son's rank given his father's rank is nearly linear in the lowest four quintiles of the fathers' earnings distribution. In the top quintile of the fathers' earnings distribution, the relationship increases sharply. Comparing high- and low-oil regions, the figure shows that the relationship between a father's rank and the son's rank is less steep in high-oil regions. A less-steep curve implies a weaker link between ranks and thus less intergenerational persistence. That is, the sons that grew up in the local labor markets that benefited most from the oil boom experienced greater intergenerational mobility. Moreover, the estimated intercept for the high-oil regions is larger. That is, the expected rank for sons of fathers at the bottom of the earnings distribution is higher in high-oil regions. This suggests that in the high-oil regions the sons' earnings distribution is shifted to the right. Section 5.4 provides a detailed discussion of the earnings distributions.

To appraise whether the effect of the oil boom on intergenerational mobility was driven by preexisting local-level differences, we plot the mean percentile ranks of the placebo cohorts (1932–1933) versus their fathers' percentile ranks in Panel (b) of Figure 1. Other than the top and bottom of the fathers' earnings distribution, the conditional expectation of a son's rank given his father's rank is nearly linear. Unlike Panel (a), the two plots of the rank–rank relationships are overlapping and equally steep in the low- and high-oil regions. Thus, there were no obvious preexisting differences in intergenerational mobility between the two types of regions.

Next we focus on women born between 1952 and 1957 and plot the mean percentile ranks of daughters against their fathers' percentile ranks in the high- and low-oil regions in Panel (c) of Figure 1.[10] Comparing high- and low-oil regions, the plot suggests that the relationship between a father's rank and the daughter's rank is about equally steep in high- and low-oil regions. The estimated intercept, however, is higher in the low-oil regions. That is, the expected rank for daughters of fathers at the bottom of the earnings distribution is higher in low-oil regions.[11] These findings suggests that daughters that grew up in the high-oil regions did not experience a similar increase in intergenerational mobility as their male peers did. This result is consistent with the small share of female oil sector workers and previous research showing that women are less affected by resource shocks (see, e.g., Cascio and Narayan, 2015).

The graphical results in Figure 1 are only illustrative and do not control for local labor market fixed effects. Table 1 presents the regression results for Equation 3 and thereby the effect of the oil boom on intergenerational mobility after controlling for local labor market fixed effects, the age of the fathers at childbirth, and fixed effects for the child's birth year.[12,13] The estimated rank–rank correlation for father–son pairs is 0.234 for the placebo cohorts born in 1932 and 1933 (Column (i)) and 0.235 for the main cohorts born in 1952–1957 (Column (ii)).[14] For the placebo cohorts, the coefficient of the interaction term is negative, but not significant

[10]Note that we do not have a placebo cohort of women to ensure that these findings are not driven by preexisting local-level differences in intergenerational mobility as we do not have military session data for women born in the 1930s.

[11]Note that women in the high-oil regions are less likely to participate in the labor force. When adjusting the labor force employment rate to be the same across regions, the intercept in the low- and high-oil regions are the same. Results are available on request.

[12]Note that we estimate a linear rank–rank regression, although Panel (a) in Figure 1 and the literature suggests that there is some nonlinearity in the relationship between fathers' earnings ranks and children's earnings ranks in the top part of the fathers' earnings distribution in Norway (see, e.g., Bratberg, Davis, Mazumder, Nybom, Schnitzlein, and Vaage, 2017; Pekkarinen, Salvanes, and Sarvimäki, 2017). In Section 5.2, we analyze upward rank mobility and discuss nonlinearities in the relationship between fathers' earnings ranks and children's earnings ranks in detail.

[13]Table A2 shows that our main cohorts of interest (1952–1957) are not an especially selected sample. In fact, the table shows that the estimated intergenerational persistence is similar to that of the other groups of cohorts born in the 1950s and early 1960s.

[14]Note that the imputed earnings for the fathers of the cohorts born in 1932–1933 could bias the estimated rank–rank

and in absolute terms substantially smaller than for the main cohorts. That is, intergenerational mobility was somewhat higher in the high-oil regions prior to the oil shock. However, the estimated effect is not significant, suggesting that there was no significant preexisting difference in intergenerational mobility between low- and high-oil regions. This finding is in line with the patterns plotted in Panel (b) of Figure 1. Conversely, the intergenerational persistence is significantly lower for the main cohorts in the local labor markets that benefited most from the oil boom. In particular, men born in the high-oil regions have an estimated persistence parameter of 0.213 (0.235 – 0.033 + 0.011) after considering preexisting regional differences. Comparing the effect of the oil boom with the overall persistence parameter illustrates the magnitude of the impact: the intergenerational persistence in earnings rank is roughly 9 percent lower in high-oil regions. As the labor markets within Norway are interconnected, the oil boom might impact both high- and the low-oil regions. Hence, the estimated regional differences in intergenerational mobility are likely understated.

The estimated rank–rank correlation for father–daughter pairs in the main cohorts born in 1952–1957 is 0.140 (Column (iv) in Table 1) and the coefficient of the interaction term is very small (-0.001) and insignificant. Hence, intergenerational mobility among women is about the same in high-oil as in low-oil regions. This finding suggests that male dominated employment in the oil extraction sector or industries supplying directly to the oil sector is an important factor driving the regional differences in intergenerational mobility and that sectors with a large share of female employees as the service sector did not provide different possibilities for women from poor backgrounds in high- and the low-oil regions.

To put our main result in perspective, a 9 percent change in intergenerational persistence is about a third of the decrease in intergenerational persistence from the 1930s to the 1950s in Norway and Sweden when the first social welfare programs were established (Pekkarinen, Salvanes, and Sarvimäki, 2017; Björklund, Jäntti, and Lindquist, 2009). In monetary terms, the increase in mobility captures about an average increase of lifetime earnings by NOK 80,000 (measured in 1998 Norwegian Kroner what reflects about USD 15,000 in 2018). Moreover, the main result that large economic fluctuations can change intergenerational mobility corresponds well with Feigenbaum (2015), who shows that the Great Depression lowered intergenerational mobility in the US for sons that grew up in the cities hardest hit by the economic downturn.

5.2 Upward Rank Mobility

Rank persistence may be driven by movements both from the bottom to the middle of the income distribution and from the middle to the top of the income distribution (Chetty, Hendren, Kline, and Saez, 2014). Therefore, measuring upward rank mobility is valuable. It will help us understand both whether individuals that grew up in poor or moderately well-off families benefited most from the natural resource shock, and whether the relationship between the ranks of the earnings of fathers and sons is nonlinear (what is suggested by Figure 1).

We focus on men born between 1952 and 1957 first. Table 2 presents the intergenerational transition

correlation downward and thereby overstate any estimates of intergenerational mobility. However, as this paper focuses on regional differences in the rank–rank correlation, these differences should be unaffected by the imputed earnings unless there are large regional differences in how earnings are imputed. As discussed in Section 4, the earnings imputation was based on occupation. There were, however, no significant differences in occupation types between high- and low-oil regions during the relevant years, and the average earnings of the fathers of the 1932–1933 cohorts did not differ significantly across regions (see Table A1).

matrices, which detail the probabilities of sons being in each quintile of the earnings distribution given a father in a specific quintile if his earnings distribution, in low- and high-oil regions. The numbers in italics indicate that the difference between low- and high-oil regions is significantly different from zero at the 5 percent level. In low-oil regions, the likelihood of sons that grew up in a household in the lowest earnings quintile remaining in the lowest quintile in their own earnings distribution was 29 percent, whereas 12 percent reached the top earnings quintile. On the other hand, the probability of the sons of the poorest 20 percent of families in high-oil regions remaining in their own lowest earnings quintile was 23 percent, and their probability of reaching the top earnings quintile was 17 percent. These differences in upward rank mobility across regions are significant at the 1 percent level. They show that men born to poor families in those regions that benefited early from the oil boom were significantly less likely to remain poor and more likely to move all the way to the top of their cohort's earnings distribution. Table 2 also indicates that there are some nonlinearities in the effect of the oil boom on intergenerational mobility.

To ensure these findings were not driven by preexisting local differences, Table 3 presents the intergenerational transition matrices for the placebo cohorts born in 1932 and 1933. Corresponding with the findings from the rank–rank regression (see Section 5.1), the differences between the low- and high-oil labor markets here are less pronounced. The percentage of bottom-to-top upward mobility (i.e., the percentage of sons with fathers in the bottom 20 percent of their earnings distribution that attained the top 20 percent of their own earnings distribution) was 12 percent in the high-oil regions and 10 percent in the low-oil regions. As for the measure of rank persistence, there was somewhat more upward mobility prior to the oil shock in the oil-affected regions, but the regional differences increased substantially following the resource shock. Moreover, the differences in upward rank mobility across regions are not significant at the 5 percent level for the placebo cohorts.

Table 4 presents the intergenerational transition matrices for women born between 1952 and 1957. There are some differences in upward rank mobility across regions that are significant at the 5 percent level for women. The differences are, however, mostly in the opposite direction as for men. Moreover, the patter is highly non-linear and suggest both that women born to rich and to poor families in low-oil regions are more likely to remain rich or move all the way to the top of their cohort's earnings distribution.[15] This indicates that the oil boom mostly generated economic opportunities for men from poor families (and not women) and corresponds well with previous findings (see, e.g., Cascio and Narayan, 2015).

5.3 Oil Sector Employment

Notably, intergenerational mobility has been higher in high-oil regions, and the oil boom made it less likely that sons would remain in the lower half of the earnings distribution. For daughters, on the other hand, who are less likely to work in oil related professions, there is no benefit. Hence, a question remains concerning the direct link between these mobility patterns and oil sector employment.

Figure A7 shows that a son's probability to work in the oil sector is higher if his father has an income in

[15] Adjusting for the fact that women in high-oil regions are less likely to be in the labor force, the regional differences in the upward mobility are reduced substantially.

the lower 60 percent of the income distribution.[16] Hence, many men from middle class and poorer families got jobs in this new industry. Table A3 shows the rank persistence results from a rank–rank regression where we allow the interaction term of the father's earnings rank and the indicator for high-oil regions to differ for oil-sector and non-oil-sector employees. We find that for both oil- and non-oil-sector employees, mobility was significantly higher in the high-oil regions. However, there is no significance difference in the estimated mobility coefficients between the two types of employees. This suggests that not only men working directly in oil related sectors were, on average, affected by the changes in intergenerational mobility and that the oil boom also generated new opportunities for men from low socioeconomic backgrounds in non-oil professions.

Is oil sector employment more prevalent among the upward-moving individuals (see Section 5.2)? In the high-oil regions, 29.7 percent of sons who reached the top earnings quintile irrespective of their fathers' earnings quintile worked in the oil industry. The corresponding figure was only 9.8 percent in low-oil labor markets. Overall, the percentage of men in the main cohorts employed in the oil sector was about 15 percent in the high-oil regions and 6 percent in the low-oil regions. Therefore, in all labor markets, upward-movers displayed an over-proportional likelihood of working in oil-related industries, and slightly more so in the high-oil regions. The regional differences are however small. Accordingly, while there is some evidence that at least part of the observed increase in intergenerational mobility was directly because of oil sector employment, there is also substantial evidence of employment spillovers for non-oil sectors.

5.4 Shift in Earnings Distributions

The increased intergenerational mobility for cohorts born between 1952 and 1957 in the high-oil regions could be a result of a shift in men's earnings distribution to the right in these regions when oil production in Norway began. Panel (a) in Figure A8 plots the estimated earnings distribution by region for the male cohorts born in 1932 and 1933 along with the male cohorts born from 1952 to 1957. The earnings distributions in the high- and low-oil regions mainly overlap for the placebo cohorts, and the two distributions are not significantly different from each other (p-value of 0.266 for the Kolmogorov–Smirnov test). However, the earnings distribution for the main cohorts is shifted significantly to the right in the lower and middle of the earnings distribution (p-value of <0.001 for the Kolmogorov–Smirnov test). Only for high earnings do the two distributions overlap. Panel (b) in Figure A8 plots the estimated earnings distribution by region for the female cohorts born from 1952 to 1957. Different from men, the earnings distribution for women in the high-oil regions is shifted to the left.[17]

To analyze whether our main findings in Section 5.1 mechanically result from this shift in the earnings distribution in the high-oil regions and the fact that we rank individuals at the national level, we employ an alternative specification. As Mazumder (2016) argues that we need to standardize the earnings distribution at the national level to compare intergenerational mobility across local labor markets, we cannot rank individuals on local levels. Therefore, we instead adjust the earnings distributions of the children born in the high- and low-oil regions to be identical. In particular, we compute the difference in earnings between high- and

[16] We use the same definition for the oil sector as in Section 3.3 and assign an employee to this sector when he is employed during the majority of the years we measure his earnings (age 36 and 41 years) in the oil sector.

[17] Note that there is a difference in the female employment rates in the high- and low-oil regions. When adjusting for these differences, the two distributions are overlapping in the upper part of the earnings distribution. Results are available on request.

low-oil regions within each percentile rank and then add this computed earnings difference to the earnings of individuals born in the low-oil regions in each percentile rank. We then rank individuals at the new national level and estimate Equation 3. Column (iii) in Table 1 shows that the coefficient of the interaction term θ_2 for men remains significant (at the 5 percent level), but slightly smaller in magnitude. This suggests that the shift in the earnings distribution explains about 21 percent of the effect of the oil boom on intergenerational mobility for men. Clearly, this shift by itself does not fully explain our main result. For women, the difference between the oil regions is still small and not statistically significant (Column (v) in Table 1).

6 Mechanisms

We found that the Norwegian oil boom increased intergenerational mobility among men—mostly bottom-up mobility—in the affected regions. In this section, we explore several possible mechanisms explaining why. First, we examine whether the oil boom changed educational attainment and the relative earnings paid to workers with different skills. Second, we evaluate whether the increase in mobility arose from a risk premium on the earnings of sons, given the increased danger of work in the oil industry, and whether these men were therefore more likely to die early or be enrolled in disability insurance programs later in life. Ultimately, we find that the changes in the returns to education offer the best explanation for geographic differences in intergenerational mobility following the oil boom.

6.1 Educational Attainment and Returns to Education

A resource boom may affect educational attainment through different channels. For example, an increase in the demand for vocationally trained workers in the resource extraction sector may lower the returns to academic education and increase the opportunity cost of schooling. In the context of a standard human capital model (Becker, 1964), both a decrease in the returns to academic education as well as an increase in opportunity cost lower educational investment. By contrast, if a resource shock increases family income, the schooling of children may be prolonged, and thus their educational attainment may increase (see, e.g., Cascio and Narayan, 2015).

In our main analysis, we focus on the cohorts of children that entered the labor market during the first decades of oil extraction in Norway. That is, we focus on cohorts that did not benefit from greater parental resources due to the oil boom while growing up.[18] As discussed in Section 3.3, these cohorts were largely finished with education (or at least enrolled in either vocational or academic high school education) when oil extraction began. Moreover, Panels (a)–(d) of Figure A4 present some empirical evidence that the proportion of individuals that finished either academic or vocational high school was stable across the cohorts of interest and similar in high- and low-oil regions. Therefore, we abstract from the influence of the effect of the oil shock on educational attainment through oil boom-related changes in opportunity costs.

Focusing on cohorts that were largely finished with education when oil extraction commenced also enables us to abstract from the influence of changes in educational attainment through oil boom-related increases in family income. However, the question remains as to whether the oil boom altered the investment

[18] This is different from our analysis in Section 7 where we analyze the children of the 1952–1957 cohorts.

in human capital accumulation contingent on parental background. First, we provide some descriptive evidence documenting the relationship between family background, as proxied by the father's earnings, and the son's or daughter's educational attainment.

Panel (a) of Figure A9 presents a binned scatterplot of the probability that sons born between 1952 and 1957 would attain an academic high school (or higher) education against their fathers' earnings percentile ranks. We find that in both types of labor markets, the sons of richer fathers were more likely to complete an academic high school education. The differences between low- and high-oil regions are small. Therefore, the education gap between sons growing up in poor or rich households was little affected by the oil boom in our main sample. Panel (b) of Figure A9 presents a binned scatterplot of the probability that sons in the placebo cohort would attain an academic high school education versus their fathers' percentile ranks, by type of labor market. Again, for the placebo cohorts, the differences between low- and high-oil regions in the probability of sons completing academic high school (or higher) conditional on their fathers' earnings percentiles are small. Panel (c) of Figure A9 presents descriptive evidence for women and suggests that daughters of richer fathers were more likely to complete an academic high school education and that there are no obvious differences between low- and high-oil regions.

Second, we use a similar specification to Equation 3 to examine whether the earnings rank of fathers is less correlated with their children's probability of completing academic high school in high-oil regions. We regress an indicator variable for whether the son or the daughter completed academic high school on the father's rank in the earnings distribution, and include an interaction term of the father's rank and an indicator variable for being born in a high-oil region. We include controls for local fixed effects, the age of the father at childbirth, and fixed effects for the child's birth year. Figure A9 suggests that the relationship between the rank of fathers and the probability of their children finishing academic high school is not linear. For this reason, we augment this specification with a quadratic function of the father's rank, and the interaction between the father's squared rank and the high-oil regions dummy variable (see Table A4).

The coefficient for the quadratic function of the father's rank is positive and significant in all specifications, implying that the relationship between children's education and the earnings of fathers is flatter at the bottom of the earnings distribution and steeper for richer fathers. The parameter for the interaction term between the rank of fathers (and the quadratic form of this rank) and the indicator variable for being born in a high-oil region is not significant for either the main cohort men or women or the placebo cohort. Consequently, we find no regional differences in human capital investment conditional on fathers' earnings. These results provide empirical evidence that the oil boom did not lead to changes in human capital investment conditional on fathers' earnings, which could explain the change in intergenerational mobility observed for the cohorts born in the 1950s.

Finally, the increase in earnings and intergenerational mobility could result from changes in the relative earnings paid to workers with different skills. Table 5 presents the results from a regression of log average earnings at ages 36 to 41 years on a dummy variable for completing academic high school or college before age 36 years, and interaction terms for the academic education indicator and dummy variables for being born in a high-oil region, cohorts, and local labor market fixed effects. As shown, the average earnings were 35 percent (cohorts 1932–1933) and 45 percent (cohorts 1952–1957) higher for men with an academic education compared with those with a vocational high school degree or without a high school degree. For women, the return to academic education is about 49 percent. The return to college education for the main cohorts is somewhat higher: 46 percent for men and 50 percent for women (see Columns (iii) and (vii) in Table 5).

However, for the main cohort men, there were significant geographical differences in the returns to an academic education. For men born in the high-oil regions in 1952–1957, the returns to an academic education were on average 6 percentage points (0.082 − 0.019) lower. Notably, the interaction term between the academic education indicator and the high-oil region indicator is not significant for the placebo cohorts. As the exploitation of natural resources mostly creates jobs for skilled and semiskilled craftsmen and low-skilled workers, the lower returns to academic education are not surprising. Higher demand for vocationally trained workers increases their price and thus reduces the returns to higher education.[19] This result corresponds with findings from other countries showing that different types of natural resource shocks to local labor markets lowered educational attainment partly through lowering the returns to education (see, e.g., Cascio and Narayan, 2015; Emery, Ferrer, and Green, 2012). For women, on the other hand, there is no significant differences in the relative earnings paid to workers with different skills.

The decreased returns to academic education suggest that the earnings distribution in the high-oil regions for vocationally educated men shifted, especially to the right, when oil production began. Panel (a) of Figure A10 the earnings distribution for vocationally trained individuals working in the oil and the non-oil industries shifted to the right in the high-oil regions. This suggests the presence of earnings spillovers from the oil to non-oil sectors for men. That is, men working in industries supplying goods and services to oil industry workers (e.g., restaurant employees, custodians, car dealers, etc.) also benefited from the higher earnings in the resource sector. Nonetheless, among men with an academic education, only those working in the oil sector experienced a shift in the earnings distribution (see Panel (b) of Figure A10). That many academically trained individuals in the non-oil sector work in the public sector (e.g., teachers, medical doctors, etc.) and are paid according to a nationwide pay scale may explain this.

As discussed by Becker and Tomes (1976) and as depicted in Figure A9, individuals from less affluent backgrounds have a lower probability of finishing an academic education. Accordingly, the fact that the sons of poorer fathers disproportionately benefited from the increasing returns to vocational training in the high-oil regions led to greater upward mobility in these regions. The hypothesis that changes in the returns to human capital are a main driver of earnings mobility has been pointed out by Aaronson and Mazumder (2008), who show that the increase in the intergenerational elasticity observed in the US during the 1980s and 1990s corresponds with the period of increased returns to tertiary education. Likewise, in a cross-country comparison, Corak (2013) finds that there is less intergenerational mobility in countries with larger college wage premiums.

[19] Note that when we simulate data for both the high- and low-oil regions where we impose the same education distributions and only change the returns to education and the earnings distribution in the high-oil regions to re-estimate Equation 3, the results suggest that the change in returns to education explains a substantial fraction of the total decrease in intergenerational earnings persistence. The results are available on request.

6.2 Adverse Health Effects

Moving up the income ladder as a less-skilled worker may come at a risk to health. If the values of all job characteristics are embedded in the wage rate, employers need to compensate employees for job-related risk (Thaler and Rosen, 1976). For this reason, the increases in earnings among less-skilled workers in the oil industry could partly result from compensation for hard physical work and job-related risk. In addition, most oil sector employees working offshore work shifts, and this represents an additional adverse health risk (Kate, Cary, Yitzhak, and Arie, 1997). Hence, bottom-to-top movers in high-oil regions may have been more likely to die at an early age from fatal accidents or death from occupational health hazards (e.g., exposure to certain chemicals) or eventually receive disability insurance payments. Tables A5, A6, and A7 show the probability of dying before 2010, the probability of a fatal accidents, or receiving disability insurance payments at least once between 1991 and 2008, respectively, conditional on both the son's and the father's earnings quintiles. On average, about 5% of men born between 1952 and 1957 died before 2010 (i.e. before the age of 53 to 58 years) and the percentage of early death was higher in the high-oil regions than the low-oil regions. However, men that move from a lower socioeconomic background to the highest quintile of their earnings distribution in the high-oil regions were less likely to die early. There is a similar pattern for the likelihood of having a fatal accident. On average, the fatal accident rates are higher in the high-oil region than in the low-oil region, but they are lower for the bottom-to-top movers. Consequently, we do not find any evidence that bottom-to-top movers in the high-oil regions gained their earnings at ages 36 to 41 years predominantly through employment exposing them to increased health risks later in life.

However, the individuals born between 1952 and 1957 might still be too young in 2010 to observe an overall lower life expectancy from occupational health hazards. Therefore, we study also the uptake of disability insurance payments. The percentage of individuals that ever received a disability insurance payment was, on average, higher in the high-oil regions for sons in the first and second quintiles of the earnings distribution. However, sons in the two highest quintiles of their earnings distribution in the high-oil regions were less likely to receive disability insurance payments. This also holds for bottom-to-top movers in the high-oil regions, who were significantly less likely to ever enroll in a disability insurance program, compared with the bottom-to-top movers in the low-oil regions. Note that these results have to be interpreted as suggestive evidence only as previous research has shown that there is a negative relationship between the strength of local labor markets and disability insurance receipt (see, e.g., Autor, Dorn, and Hanson, 2013). Hence, disability receipt might have declined even stronger for bottom-to-top movers during the oil boom in the absence of the adverse health impacts of oil and gas jobs.

7 Multigenerational Persistence

We presented empirical evidence that the Norwegian natural resource shock increased intergenerational mobility for male cohorts directly affected early in their working life. However, a question remains as to whether this natural resource shock was sufficiently strong to also have an impact upon the children of the affected men. Lindahl, Palme, Massih, and Sjögren (2015) and Clark (2014) argue that evaluating intergenerational persistence using data from just two generations severely underestimates long-run intergenerational persistence. That is, if there are generation-specific deviations from the long-run social position of a family, only considering two generations could overestimate the convergence toward mean earnings in the population. Conversely, grandparent outcomes could exert an independent effect when these outcomes are a better representation of the long-run social position of the family. Moreover, Nybom and Stuhler (2013) argue that periods of structural change may reduce the transmission of social status in the generation directly affected. However, this decrease in intergenerational persistence does not necessarily persist for the next generation, because family ties may again tighten, and the society could enter a new steady state with lower intergenerational mobility. Moreover, Stuart (2017) shows that being hit in early childhood by an economic downturn as large consequences for educational attainment. Hence, we study the sons and daughter of the 1952–1957 male cohorts to analyze whether the changes in the intergenerational transmission of economic status persist over multiple generations.

7.1 Rank Persistence

We focus on men first. Panel (a) of Figure A11 presents some descriptive evidence of the intergenerational mobility across multiple generations of men. In particular, the plots present binned scatterplots of the mean percentile ranks of the third generation versus those of the first generation (the fathers of the main cohorts) and the second generation (the main cohorts) in the high- and low-oil regions. The third generation is ranked based on their earnings at age 30 years relative to other men with fathers born in the same cohort.[20] The conditional expectation of a third-generation man's rank given the first generation's rank is nearly linear in the lowest four quintiles of the first generation's earnings distribution. In the top quintile of the first generation's earnings distribution, the relationship decreases sharply. In the low-oil regions, there is a positive relationship between the first and third generations' ranks. This indicates that men with higher-earning grandfathers in low-oil regions were receiving higher earnings at age 30 years on average than men with lower-earning grandfathers. In the high-oil regions, the relationship between the first and third generations' ranks is nearly flat. That is, we find no intergenerational persistence between the first and the third generation in local labor markets affected by the oil boom. In addition, the estimated intercept for the high-oil regions is higher, indicating that the expected rank is higher for men whose grandfathers were at the bottom of the earnings distribution. Panel (b) of Figure A11 plots the mean percentile ranks of third-generation men versus their fathers' (i.e., the second generation) percentile ranks. Besides the top and bottom part of the second generation's earnings distribution, the conditional expectation of an individual's rank given his father's rank is nearly linear. Unlike Panel (a), the relationship between the second and third generations' ranks has a positive gradient in both types of regions. However, the relationship between the second and third generations' ranks is less steep in the high-oil regions, implying a weaker earnings link and less intergenerational persistence. This indicates that the higher intergenerational mobility caused by the oil boom in the high-oil regions persisted over multiple generations.

Table 6 presents the regression results of Equation 3 and these regressions control for local labor market

[20] As we can only observe earnings until 2014, we measure the earnings of the third generation at age 30 years. As discussed earlier, earnings between ages 36 and 40 years would be a better measure of lifetime earnings, as individuals with a college education have much less experience at age 30 years than vocationally trained individuals, but display steeper earnings profiles in their early 30s. In Section 8 we provide results where we adjust the earnings of the third generation for experience.

fixed effects, the age of second-generation men at the time of the birth of the third generation, and fixed effects for the second generation's birth year. For the first and third generation comparison (Column (i)), the estimated rank–rank correlation is 0.053 in low-oil regions. In the high-oil regions, we identify an intergenerational earnings persistence parameter that is not significantly different from zero. This indicates that the oil boom completely broke the earnings link between grandfathers and their grandsons in the oil boom-affected regions. The estimated persistence parameter for the second and third generation comparison (Column (ii)) is on average 0.053 in low-oil regions and on average 32 percent (5.4 percentage points) lower in the high-oil regions. This finding suggests that the natural resource shock was sufficiently strong to increase also intergenerational mobility for the male offspring of the directly affected men. These findings are reflected in estimates in Column (iii) of Table 6 where we control for the ranks of both the first and second generations. Overall, we find that there are significant geographic differences in intergenerational mobility, and that both the first and second generations' ranks significantly explain the third generation's rank. The most important difference to Columns (i) and (ii) is that the estimated rank–rank correlation between the first and third generations conditional on the second generation's rank is significantly negative in the high-oil regions. That is, holding the second generation's rank constant, a lower first-generation rank predicts a higher third-generation rank. In other words, the greater the change in percentile rank between the first and second generations, the higher the predicted rank of the third generation. Overall, the results demonstrate that a large economic shock can dissolve the strong multigenerational persistence described by Lindahl, Palme, Massih, and Sjögren (2015) and Clark (2014).

The education and career decisions of men and women conditional on their family background may be substantially different. Although the likelihood of being in the labor force is about equal for male and female offspring of the 1952–1957 male cohorts, most individuals currently working in the oil or related industries are men. Hence, the multigenerational persistence might differ substantially for third generation men and women. Column (iv)–(vi) in Table 6 present the estimated rank–rank correlations between the first- and second-generation men's earnings ranks and the third-generation women's earnings ranks.[21] For the first and third generation comparison (Column (iv)), we find slightly higher intergenerational persistence for women than for men (Column (i)). However, there are no significant regional differences. For the second and third generation comparison (Column (v)), the results are not substantially different from the results for male offspring (see Column (ii)). For women, the estimated rank–rank correlation is 0.168 (men: 0.166), and the estimated persistence parameter is on average significantly lower in the high-oil regions. When controlling for both first and second generations' ranks in Column (vi), the result that there are regional differences for the fathers' ranks but not the grandfathers' ranks remains. Overall, we find that also female offspring of the directly affected cohorts (1952–1957) faces less intergenerational earnings persistence in high-oil regions. Nevertheless, the oil boom did not break the earnings link between the first and third generations for women in oil boom-affected regions. Hence, this result supports the strong link between the social status of grandparents and their grandchildren suggested by Lindahl, Palme, Massih, and Sjögren (2015) and Clark (2014).

[21] Figure A11 plots the mean percentile ranks of third-generation women versus their fathers' or grandfathers' (i.e., the second or third generation) percentile ranks.

7.2 Upward Rank Mobility

Next, we analyze third-generation men's upward rank mobility. This allows us to consider nonlinearities in the relationship between the earnings percentile of the three generation. We focus on men first. Figure 2 plots the mean rank of the third generation conditional on the first and second generations' ranks in the high- and low-oil regions.[22] The average ranks for third-generation men whose grandfathers (the first generation) were poor and whose fathers (the second generation) moved to the top of the earnings distribution are substantially higher in the high-oil regions. However, there are no regional differences in average ranks for third-generation men whose grandfathers (the first generation) were very rich and whose fathers (the second generation) remained in the top earnings percentile. Interestingly, the regional differences in early career earnings caused by the natural resource shock are largest among the sons of the bottom-to-top movers. This reflects the previous findings that grandfathers' earnings percentile ranks are no or a negative predictor of the grandsons' earnings percentile ranks.

The pattern in upward rank mobility among third-generation men in the oil regions is closely related to the likelihood that they work in the oil sector given the earnings rank of their fathers and grandfathers. Figure A12 shows that the sons of the bottom-to-top movers in the high-oil region have the highest likelihood of having an oil related occupation. Hence, oil sector jobs might still be one of the important means by which men can achieve high earnings early in their career.

Figure A13 focuses on women and plot the average earnings percentile rank of third-generation women conditional on the earnings percentile ranks of the first and second generations. Compared with the patterns for the third-generation men (see Figure 2), the first generation's earnings percentile—particularly when the first generation is in the highest percentile—seems to be a more important determinant of the third-generation women's earnings percentile than for men in both high- and low-oil regions. This finding is strongly supported by the results discussed above (Table 6). Moreover, the average earnings percentile of the daughters of second-generation bottom-to-top movers did not differ significantly between the two types of regions (see Table A9). Instead, the daughters of the second-generation men that moved from middle class families to the top of the income distribution have lower average earnings quintile in the high-oil regions than in the low-oil regions.

In summary, we find that persistence decreased over the generations in both the high- and low-oil regions. While the social status of the grandfather is a strong predictor of the status of the granddaughter in both regions, we show that for men intergenerational mobility across the three generations was significantly higher in the high-oil regions. Importantly, we find that the oil boom broke the link between men born in the 1920s and 1930s and their grandsons born in the 1970s and 1980s. Thus, a large economic shock can not just mitigate but even dissolve the strong intergenerational persistence described by Lindahl, Palme, Massih, and Sjögren (2015) and Clark (2014). Our results for both third generation men and women also differ from the findings of Nybom and Stuhler (2013), who show that educational reform in Sweden increased intergenerational mobility in income and education from parents to their offspring in the directly affected generation, but increased intergenerational persistence in the following generation. A possible explanation

[22] The transition matrices corresponding to Figure 2 are presented in Table A8.

for this difference is the longer duration of the oil boom in Norway studied in our analysis compared with the limited implementation period of the educational reform studied in Nybom and Stuhler (2013). That is, the oil boom affected not only the cohorts born in the 1950s but also their offspring. In our analysis, the structural change that reduced the transmission of social status lasted more than 40 years, and society may not yet have entered a new steady state with lower intergenerational mobility.

7.3 Multigenerational Educational Persistence

Changes in educational attainment or in persistent regional differences in returns to skills might be channels though which the intergenerational earnings persistence across three generations manifest. Table A10 presents the regression results of Equation 3 adapted to educational outcomes. These regressions control for local labor market fixed effects, the age of second-generation men at the time of the birth of the third generation, and fixed effects for the second generation's birth year. For men, we find that there are no regional differences in the estimated correlation of the first, second, and third generation's propensity to obtain an academic education. Even when controlling for father's education, the grandfather's education is a significant and important predictor for the third generation's educational outcomes. Different from the findings on earnings ranks, these findings correspond well with the strong intergenerational persistence in educational outcomes discussed by Lindahl, Palme, Massih, and Sjögren (2015) and Clark (2014). The results for women differ along two dimensions. First, the correlations of the first, second, and third generation's propensity to obtain an academic education is substantially smaller than among men. That is, for third generation women, the education of the father and grandfather are less good predictors of their own education then for third generation men. This difference between third-generation men and women might be driven by the steeper increase in the likelihood of academic education for women in Norway. Since the 1957 birth cohort, women in Norway are more likely to obtain a college degree than men. Second, the correlation between the first and the third generation is significantly smaller in the high-oil regions suggesting that women who's grandfathers have an academic education are less likely to obtain academic education themselves if their fathers were exposed to the oil boom in the 1970s.

To obtain a better understanding of this strong persistence in educational outcomes and on how vulnerable the children of second-generation bottom-to-top movers are with respect to future changes in employment prospects in the oil sector, we plot the probability of the third generation having an academic education conditional on the first and second generations' earnings ranks in high- and low-oil regions in Figures A14 and A15.[23] On average, men whose grandfathers (the first generation) were poor and whose fathers (the second generation) remained in a low earnings percentile have similar education levels across the high- and low-oil regions. There are also small regional differences in the average education levels for men whose grandfathers were very rich and whose fathers remained in the top earnings percentile. However, men whose grandfathers were relatively poor and whose fathers moved to the top of the earnings distribution have on average a significantly higher education level in the low-oil regions. That is, second-generation bottom-to-top movers in the high-oil regions invested less in the education of their offspring than did bottom-to-top movers in the low-oil regions. Note that for the same comparison in Figure 2, sons in the high-oil regions earned substantially more.

[23] The transition matrices corresponding to these Figures are in Tables A11 and A12.

That is, while the sons of bottom-to-top movers have benefited most in terms of early career earnings, their level of education is lower. Focusing on female offspring, we find that the pattern for third-generation women's education conditional on the ranks of the first and second generations is similar to the pattern for third-generation men. This suggests that the daughters of second-generation bottom-to-top movers acquired less academic education in the high-oil regions. This finding is in contrast to the earnings result above showing no regional differences in average earnings percentile of the daughters of second-generation bottom-to-top movers.

One possibility is that the sons of bottom-to-top movers could still achieve high earnings despite lower educational investment through higher returns to vocational training in high-oil regions. In Column (iii) of Table 5, we show that the returns to academic education are 33 percent lower in high-oil regions for third generation men. The geographical difference in the returns to academic education is significant at the 5 percent level. While the lower investment in academic education among third-generation men in high-oil regions can be rationalized by the lower returns to an academic education, Column (iv) in Table 5 shows that regional differences in the returns to education cannot explain lower investments in education for third-generation women. This indicates that the families of second-generation bottom-to-top movers in the high-oil regions were less encouraging toward education (of women) than those of bottom-to-top movers in the low-oil regions, regardless of the returns to education.

To investigate whether human capital investment changes for the third generation in high-oil regions, we also analyze regional differences in standardized test scores from middle school. We include the children of the oil boom affected men who are born between 1986 and 1999 and for whom we can observe test scores in middle school.[24] Figure A16 and A17 demonstrate that sons and daughters of second-generation bottom-to-top movers and second-generation men with high earnings perform worse in standardized test scores in middle school in the high-oil regions. Similarly, Figure A18 plots the third-generation men's IQ conditional on the first and second generations' percentile ranks in high- and low-oil regions.[25] Men whose grandfathers (the first generation) were poor scored substantially lower in IQ tests at age 19 in the high-oil regions compared with the low-oil regions. Moreover, having a father (the second generation) in the highest earnings percentile was less predictive of IQ score in the high-oil regions, independent of the grandfather's rank. As IQ scores reflect not only genetic traits but also early parental investments, this suggests that the sons of bottom-to-top movers could have either lower genetic ability or accumulated less ability during early childhood.

There are several possible reasons why second-generation bottom-to-top movers in the high-oil regions invested less in the education of their offspring. First, bottom-to-top movers in the low-oil regions were better educated (see Table A13). That is, bottom-to-top movers in the low-oil regions were more likely to be better off than their fathers because of their education. Consequently, their own experience could have motivated them to invest in the education of their own children, or their children may have had their fathers as role models and so been more likely to aspire to an academic education. Second, family formation could be important. Figure A19 shows that second-generation men in the high-oil regions were on average slightly younger when they had their first child (Panel (a)), and that they had more children on average (Panel

[24]This is about half of the third generation sample as 55% of the third generation sample is born before 1986.

[25]The transition matrices corresponding to Figures A16 to A18 are presented in Tables A16, A17, and A18.

(b)).[26] Table A14 shows that the spouses of bottom-to-top movers in the high-oil regions were less likely to have had an academic education. Although not many differences are significant, Table A15 provides some evidence that bottom-to-top movers in the low-oil regions marry women from a higher socioeconomic background (measured by the average earnings percentile rank of the father) than bottom-to-top movers in the high-oil. Thus, the mothers of the bottom-to-top movers' sons in low-oil regions may also have been more inclined to encourage their children to pursue an academic education than mothers in the high-oil regions. Last, regional differences in educational spending might make it more difficult for second-generation bottom-to-top movers to invested in their children's human capital. Figures A20 plots the average school spending per capita at the municipality level in the different regions and suggests that spending differences are an unlikely driver for the differences in educational outcomes.[27]

Overall, we can summarize that while the intergenerational ties in earnings ranks among three generations of men are substantially weakened by the oil boom, the intergenerational persistence in education among men is not affected. Moreover, both sons and daughters of second-generation bottom-to-top movers in the high-oil regions have lower educational outcomes indicating that they do not benefit in terms of human capital investment of the newly acquired economic status of their families.

8 Robustness Analysis

In this section, we first present the results of a variety of sensitivity tests for the two-generations comparison. In particular, we analyze whether selective migration biases our results, the effects change when we remove father's age from the control variables, we drop the Oslo labor market from the analysis, we consider the middle-oil regions, and we analyze whether the age at which a father's earnings were measured influences our main findings. Our results are robust to all of these sensitivity tests. In a second step, we show the results of two sensitivity tests for the multigenerational comparison. Notably, we use experience adjusted earnings for the third generation and limit the sample to the first born children in the third generation. Our results mostly persist the sensitivity analysis.

8.1 Father's Age

Note that we control for the father's age at the birth of his child in the rank–rank regressions, as we rank fathers based on their earnings relative to other men with children born in the same cohort. There is, however, a very small difference in average ag at birth between the high- and the low-oil region. When dropping the father's age at childbirth as a control variable, the intergenerational persistence of the earnings rank is found to be roughly 11 percent lower in high-oil regions than in low-oil regions (see Table A19, Column (i)). Thus, controlling for the father's age at the birth of his son does not alter our main result much. Moreover, removing father's age from the control variables does not change the results for women (Table A19, Column (v)).

[26]Section 8.7 discusses the potential bias that could arise if intergenerational persistence differs by birth order.

[27]Data are recovered from the yearly municipal accounts.

8.2 Regional Migration

There is evidence elsewhere that local economic booms affect migration (Dinkelman, 2011; Basso, 2016). As discussed in Section 4, we assigned each individual to a local labor market based on their municipality of birth to avoid the possibility that oil-shock-related selection for migration would bias our results. Nonetheless, there could still be bias through selective migration. For example, if a large share of individuals from a poor family background moved from a low-oil region to a high-oil region where they earned more than in their region of birth, and thereby moved up in the national earnings distribution, the regional differences in intergenerational earnings persistence would be underestimated. We would also underestimate the regional differences in the intergenerational earnings persistence if the children of richer fathers migrated out of a high-oil region and remained in the top part of the national earnings distribution. However, we would overestimate the regional differences in intergenerational earnings persistence if individuals from a poor family background migrated from a high-oil to a low-oil region and earned more. To analyze how selective migration could affect our estimates of intergenerational mobility, we proceed in three steps. First, we document the number and characteristics of migrants that moved from the low- to high-oil regions and vice versa. Second, we re-estimate our main analysis based on the sample of children that remained in their region of birth throughout their working lives. Third, we assign each individual to a local labor market based on their place of residence at age 36 years and re-estimate our main analysis.

We defined an individual as a 'mover' if he was registered as a resident in a different region from the region of his birth for at least a year between the ages of 18 and 41 years. Table A20 provides descriptive statistics for movers and stayers by the type of region. Note that the proportions do not sum to one because we do not consider individuals that moved to or from middle-oil regions (see Section 3.3). Overall, our figures suggest that regional mobility has been relatively low, but that men born in the 1950s were more likely to move than men born in the 1930s. In addition, movers were more likely to be from a richer and better-educated family background, and they themselves were better educated. The number of stayers was substantially higher in the low-oil regions for both the main and placebo cohorts. Men born in the 1950s in high-oil regions were substantially more likely to move to low-oil regions than those born in low-oil regions were to move to high-oil regions. Thus, we do not observe a large stream of migrants moving toward the regions where the oil sector was booming. We can conceive of several reasons why relatively few individuals born in low-oil regions moved to high-oil regions. For example, Bartik (2017) shows that in the context of hydraulic fracturing (fracking) in the US, workers did not respond to a local resource boom as predicted by a model with no moving costs. He concludes that the type of workers who would benefit from a resource shock have positive moving costs. Moreover, redistribution policies by the Norwegian government, which distributed the windfall oil revenue across all regions, could be another explanation why low-skilled individuals did not always move to high-oil regions. Last, the cost of housing in the regions that benefitted most from the oil boom might also be a factor that limits mobility among individuals from a less privileged background.

Overall, focusing on stayers and changing the allocation of individuals to local labor markets do not alter our results much. Table A21 presents the regression results of Equation 3 for three different samples.

In Columns (i) and (iv), movers were excluded. In Columns (ii) and (v), we assigned an individual to a local labor market based on the municipality of residence at age 36 years. In the regressions, we controlled for local labor market fixed effects, the age of the father at childbirth, and fixed effects for the son's birth year. Excluding all migrants increases the difference between the estimated intergenerational persistence parameters in the high- and low-oil regions (see Columns (i) and (iv)). For women, we now observe a significant difference in intergenerational persistence in the high- and low-oil regions. That is, the intergenerational mobility of women who are born in the high-oil regions and do not move out of these regions is enhanced by the oil boom.

Table A22 presents the transition matrices for the sample excluding all male movers. When excluding movers, the likelihood of sons that grew up in a household in the lowest earnings quintile remaining in the lowest earnings quintile is similar to the estimates in Table 2 for both types of regions. In high-oil regions, the likelihood of sons that grew up in a household in the lowest earnings quintile reaching the top earnings quintile is slightly lower when excluding movers than in our baseline sample. The largest difference arises for sons of rich families. That is, the likelihood of sons that grew up in a household in the highest earnings quintile remaining there is substantially lower when excluding movers than in our baseline sample in the high-oil regions. That is, some of the movers born to rich families in high-oil regions did exceptionally well in low-oil regions. This is true also for women, as shown in Table A23. The drop in the probability of remaining at the top of the earnings distribution for the daughters of rich fathers when we exclude the movers is in magnitude larger than it is for sons. This implies that the lower persistence at the top is part of the reason why we find decreased intergenerational persistence in earnings rank in the high oil area for women when we exclude the movers. This is a result, which contrasts with the one for men, where the decreased persistence comes from more mobility at the bottom.

When we assigned individuals to local labor markets based on their place of residence instead of their place of birth, the estimated rank–rank correlations became slightly lower for both men and women than in our baseline specification (see Table A21, Columns (ii) and (v)). However, the difference between the coefficient of the interaction term θ_2 is not significant when comparing our main results in Table 1 and Columns (ii) and (v) in Table A21, and the estimated intergenerational persistence parameter in high-oil regions shifts only from 0.213 to 0.207 for men when reassigning the local labor market. Comparing the transition matrices in Table A24 (assignment based on residency) with our baseline results in Table 2 (assignment based on place of birth), the differences are small. Hence, we find some indication that the actual difference between the intergenerational persistence parameters in the high- and low-oil regions could be either somewhat smaller or larger, but the biases are not large, and the significant differences found earlier between the two types of regions remain. For women, the differences when assigning individuals based on the place of residence instead of the place of birth are limited as confirmed also by the transition matrices in Table A25, suggesting that migration does not play a crucial role in explaining regional patterns in intergenerational mobility.

Overall, these findings differ from Feigenbaum (2015), who finds that migration is a key mechanism for his result, in that the sons of richer fathers migrated to locations that suffered less-severe effects from the Great Depression. However, this difference in the relative importance of different drivers of intergenerational transmission is not surprising because Feigenbaum (2015) analyzes a bust instead of a boom period and the data are from different countries and decades.

8.3 Excluding the Oslo Labor Market Region

Compared with other local labor markets in Norway, the capital city, Oslo, is substantially larger in terms of both population and economic power. However, with an oil employment share of only 4.7 percent in 1980, Oslo is among the low-oil regions. To ensure that the Oslo labor market did not drive our results, Column (iv) in Table A21 presents the regression results of Equation 3 after excluding all individuals born in the Oslo labor market. For men, both the estimated intergenerational earnings persistence and the coefficient of the interaction term are slightly smaller when excluding Oslo. However, the regional difference in intergenerational persistence is not significantly different from the baseline results in Column (i) in Table A21. For women, the estimated intergenerational earnings persistence and the coefficient of the interaction term are, in absolute terms slightly larger when excluding Oslo, but do not change substantially compared to the main results in Table 1.

8.4 Middle-Oil Regions

In our main analysis, we ignored individuals born in middle-oil regions and only compared individuals that grew up in high- and low-oil regions. In our earlier analysis, we found that the oil boom clearly affected men in the high-oil regions, unlike men in the low-oil regions. The treatment intensity in the middle-oil regions is less obvious. In Table A19, Column (ii) shows how intergenerational mobility differed between the low-oil and middle-oil regions. We find that intergenerational mobility was higher for men that grew up in middle-oil regions than in low-oil regions. But the difference in intergenerational mobility between the high- and middle-oil regions was not significant. For women, we find no differences in intergenerational persistence between either of the three regions (see Table A19, Column (vi)).

As an alternative, we could analyze how the oil industry affected intergenerational mobility using a continuous treatment variable (see Table A19, Column (iv)). Using the proportion of workers employed in the oil industry in 1980 as a continuous measure, we still find a significant and negative coefficient for the interaction term for men. Therefore, the higher the proportion of oil sector employees, the greater the intergenerational mobility for cohorts that benefited from the oil boom. As expected, we find no effect of this measure on intergenerational mobility for women (see Table A19, Column (vii)). There were, however, large differences in the number of individuals employed in the oil industry in 1980 across regions, and there are relatively sharp changes at the cutoffs we use to allocate local labor markets to different oil regions. Because of these nonlinearities, the specification using indicator variables for high-oil regions is preferred.

8.5 The Father's Age When Measuring Earnings

In most previous studies of intergenerational income mobility, the incomes of fathers were measured when they were in their 40s (Haider and Solon, 2006). Here, we measured fathers' earnings between the ages of 50 and 55 years, as our earnings data commence in 1967. For 26 percent of our sample of sons, we could compute the earnings of their fathers between the ages of 40 and 45 years; this being the subsample of fathers who were relatively young when their sons were born. The estimated coefficients of the intergenerational persistence parameter θ_1 and of the interaction term θ_2 are very similar to the baseline estimates. For women, the point estimate of the coefficient for this analysis would imply higher persistence in the high oil regions, but it is not statistically significant, suggesting no clear differences in earnings mobility between regions (see Table A19, Column (iv) and (viii)). This indicates that our results are relatively robust to changing the age at which parental earnings were measured.

8.6 Experience Adjusted Earnings

Note that because of data limitations we only measure the earnings of the third generation at age 30 years. As discussed, earnings between the ages of 36 and 40 years would be a better measure as individuals who obtain a college education have little work experience at age 30 years and are still on a steep earnings trajectory. Therefore, we predict earnings at age 30 years based on a second-order polynomial function of experience and provide the results discussed in Table 6 when the earnings of the third generation are adjusted for experience. The results in Table A26 scarcely deviate from those discussed in Section 7.1.

8.7 First Born Children

In Section 7.3 we show that second-generation men in the high-oil regions had, on average, more children. If intergenerational persistence differs by birth order, the geographical differences in intergenerational mobility could be driven by the geographical differences in family size. Table A27 shows that the main results are unaltered when focusing only on first-born children.

9 External Validity

We have shown that a resource boom can increase intergenerational earnings mobility. Is this result unique to Norway or are there similar geographic patterns in intergenerational mobility in other countries? Connolly, Corak, and Haeck (2017) show that areas with high intergenerational mobility in Canada include significant parts of the provinces of Alberta, Saskatchewan, Newfoundland, and Labrador, which experienced booms from oil, potash, and other commodities during a period when child income was measured. Moreover, Chetty, Hendren, Kline, and Saez (2014) suggest that part of the geographic variation in upward mobility could be driven by local shocks such as the discovery of a natural resource and subsequent boom periods.

To further investigate whether there is a significant correlation between intergenerational mobility and oil extraction in the US, we link the county-level mobility measures derived by Chetty, Hendren, Kline, and Saez (2014) with information on oil well openings collected by Feyrer, Mansur, and Sacerdote (2017). Between 2004 and 2012, at least one oil well opened in 724 of 2,766 US counties. As Chetty, Hendren, Kline, and Saez (2014) measure the income of the second generation in 2012, we can investigate whether income mobility was higher in counties where the second generation was affected by the oil boom early in their working career. We find that while rank–rank mobility does not differ between counties with and without oil well openings, upward rank mobility is significantly higher in counties where oil wells were opened between 2004 and 2012 (see Table A28). In particular, the expected rank of a child whose father was in the 25th percentile of the income distribution was on average 43.1 in counties without oil well openings, and 44.4 in counties with oil well openings, and thereby significantly higher on a 5 percent significance level. This provides descriptive evidence that resource shocks are also likely drivers of upward rank mobility in the US and that similar bottom-up mobility as in our findings might exist in other countries as a result of a resource boom.

A remaining question is whether our results have implications for other economic shocks than resource related booms. The resource boom we analyze lead to an increase in labor demand for vocationally trained workers in industries such as the manufacturing of metal products, machinery and equipment, and construction (Brunstad and Dyrstad, 1997). Hence, other economic booms where such sectors are suddenly expanded and returns to vocational skills are increased may alter the intergenerational mobility in a similar way between the affected generations and their parents.

10 Conclusion

Do large economic shocks break the links between generations through the creation of new economic opportunities or increase intergenerational persistence by reinforcing the ties between generations? In this paper, we examined how the Norwegian oil boom starting in the 1970s affected the transmission of economic status from fathers to children who entered the labor market around the start of the oil boom. Our results indicate that the oil boom increased intergenerational earnings mobility among men: sons born in high-oil regions experienced more intergenerational earnings mobility than sons born in low-oil regions. In addition, while the new economic opportunities were beneficial for men from all socioeconomic backgrounds, they mostly increased bottom-up mobility. Although we found that earnings distributions in high-oil regions shifted to the right, we also showed that these shifts explained only a small share of the overall effect of the oil boom on intergenerational mobility. The lower levels on intergenerational persistence are not only concentrated among oil sector workers; there are also large spillovers to employees in other sectors. We revealed that these effects were not driven by preexisting location-specific differences in intergenerational earnings mobility. Moreover, we show that there are no oil-related regional differences in the intergenerational earnings persistence from fathers to daughters. Turning to the underpinning mechanisms, we found that changes in relative earnings paid to male workers with different skills offer the best explanation for the geographic differences in intergenerational mobility among men following the oil boom. School resources, educational attainment, and educational attainment by socioeconomic background did not differ by region. Moreover, we show that the increase in mobility is unlikely to arise from a risk premium due to dangerous work environments in the oil industry. Putting our results in perspective, our main finding that large economic fluctuations can change intergenerational mobility corresponds well with Feigenbaum (2015), who shows that the Great Depression lowered intergenerational mobility in the US for sons who grew up in the cities hit hardest by the economic downturn. Moreover, we present suggestive evidence that our main findings are potentially relevant to other resource-rich countries. For example, Chetty, Hendren, Kline, and Saez (2014) and Connolly, Corak, and Haeck (2017) provide some descriptive evidence that intergenerational mobility is higher in resource-rich counties in the US and Canada.

In addition, we found that intergenerational mobility was significantly higher in oil-affected labor markets across three generations. In particular, the earnings rank of the second generation was less predictive of the earnings rank of third-generation men in high-oil regions and the oil boom broke the earnings link between first- and third-generation men in high-oil regions. As the oil boom lasted for more than 40 years and potentially also affected the third generation's earnings, it is not surprising that our results differ from Nybom and Stuhler (2013) who show that an educational reform increased intergenerational mobility from parents to their offspring in the directly affected generation, but increased intergenerational persistence in the next generation. For third-generation women, the ranks of both the first and second generations of men was predictive of their earnings rank. There was, however, only regional variation in the relationship between the second and third generations. Increases in educational attainment were no channel for the increased intergenerational mobility in the oil-region, rather are children of bottom-to-top movers in the high-oil regions less educated and their middle school grades are lower. This indicates that bottom-to-top movers in the high-oil regions are likely investing less into their children's human capital development. Whereas these lower educational investments could be explained by a lower return to education in the high-oil region for third-generation men, there are no regional differences in the returns to education for third-generation women. Overall, the results were not sensitive to selective migration, to the definition of high- and low-oil regions, or the age at which first- or third-generation earnings were measured.

When analyzing persistence across multiple generations, we find that the sons of bottom-to-top movers in the high-oil regions have on average the highest early-career earnings. However, their level of education is significantly lower than for comparable individuals in the low-oil regions, and they are therefore more vulnerable to negative resource shocks and decreasing returns to their specific skills. One qualification regarding our findings is that as oil prices fell dramatically in the second half of 2014 and the workforce—particularly the less skilled—in the Norwegian oil sector declined substantially.[28] From 2014 to 2015, direct and indirect employment in the oil sector fell by 35,000 workers, corresponding to an 18 percent decrease in the workforce in the oil sector. Although this displacement shock was not very long-lived, this indicates that the third generation's earnings, and thereby also intergenerational earnings persistence, could change again over the coming decade depending on the development of the oil price and productivity in the oil sector. Therefore, future research should seek to analyze how consecutive economic shocks affect intergenerational mobility across multiple generations and whether the effects of booms and busts are symmetric.

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11 Tables and Figures

Table 1: Rank–Rank Regressions

	Men			Women	
	Cohorts 1932–1933	Cohorts 1952-1957	Adjusted rank 1952-1957	Cohorts 1952-1957	Adjusted rank 1952-1957
	(i)	(ii)	(iii)	(iv)	(v)
Fathers' rank	0.228	0.235	0.238	0.140	0.152
	(0.013)	(0.004)	(0.004)	(0.005)	(0.005)
High oil × fathers' rank	–0.011	–0.033	-0.026	-0.001	0.001
	(0.023)	(0.011)	(0.011)	(0.010)	(0.010)
Number of observations	16,230	85,927	85,927	82,243	82,243
R-squared	0.125	0.076	0.072	0.030	0.029

Note: Each column is from a separate regression of the rank of the child in his own birth cohort's earnings distribution on the father's rank in the earnings distribution of fathers with children born in the same year, and an interaction term for the father's rank and a dummy variable indicating whether the child was born in a high-oil region. Robust standard errors adjusted for clustering at the municipality level are shown in parentheses. We include birth cohorts from 1932 to 1933 in Column (i) and birth cohorts from 1952 to 1957 in Columns (ii), (iii), (iv) and (v). All specifications include a full set of cohort and local labor market fixed effects. In Columns (ii), (iii), (iv) and (v), we also control for the father's age at childbirth. Columns (iii) and (v) we adjust the children's earnings distributions to be identical in the low- and high-oil regions.

Table 2: Probabilities of Sons Being in Different Earnings Quintiles Given the Earnings Quintile of the Father, Main Cohorts (1952–1957)

	Panel A: Low-Oil Regions				
	Sons in 1st quintile	Sons in 2nd quintile	Sons in 3rd quintile	Sons in 4th quintile	Sons in 5th quintile
Fathers in 1st quintile	*28.6*	*24.6*	18.9	*15.9*	*11.7*
Fathers in 2nd quintile	*21.2*	*26.2*	21.0	*19.0*	*12.6*
Fathers in 3rd quintile	*17.7*	*22.6*	22.6	20.9	*16.1*
Fathers in 4th quintile	*15.6*	*18.1*	21.2	*23.5*	*21.5*
Fathers in 5th quintile	*13.5*	12.0	15.6	21.8	37.0
	Panel B: High-Oil Regions				
	Sons in 1st quintile	Sons in 2nd quintile	Sons in 3rd quintile	Sons in 4th quintile	Sons in 5th quintile
Fathers in 1st quintile	*23.0*	*21.9*	19.3	*19.2*	*16.6*
Fathers in 2nd quintile	*16.7*	*21.1*	22.5	*22.2*	*17.5*
Fathers in 3rd quintile	*12.7*	*19.6*	24.0	22.0	*21.6*
Fathers in 4th quintile	*11.3*	*14.8*	20.7	*26.8*	*26.1*
Fathers in 5th quintile	*10.6*	11.5	17.1	22.8	38.0

Note: Each cell indicates the percentage of sons that grew up in a given earnings quintile in their father's earnings distribution who ended up in a specific earnings quintile in their own cohort's earnings distribution. The son's earnings are ranked in his own birth cohort's earnings distribution. The father's earnings are ranked in the earnings distribution of fathers with sons born in the same year. We include birth cohorts from 1952 to 1957. The figures in italics indicate that the difference between the low- and high-oil regions is significantly different from zero at the 5% level.

Table 3: Probabilities of Sons Being in Different Earnings Quintiles Given the Earnings Quintile of the Father, Placebo Cohorts (1932–1933)

	Panel A: Low-Oil Regions				
	Sons in 1st quintile	Sons in 2nd quintile	Sons in 3rd quintile	Sons in 4th quintile	Sons in 5th quintile
Fathers in 1st quintile	25.4	26.7	21.1	16.9	9.8
Fathers in 2nd quintile	21.2	25.3	21.6	19.0	12.8
Fathers in 3rd quintile	15.4	23.3	23.1	21.3	16.9
Fathers in 4th quintile	10.1	18.4	21.7	23.7	*26.0*
Fathers in 5th quintile	7.8	11.6	17.3	25.4	37.9
	Panel B: High-Oil Regions				
	Sons in 1st quintile	Sons in 2nd quintile	Sons in 3rd quintile	Sons in 4th quintile	Sons in 5th quintile
Fathers in 1st quintile	22.0	23.3	23.9	18.4	12.4
Fathers in 2nd quintile	23.5	24.7	21.0	17.9	12.9
Fathers in 3rd quintile	12.7	21.1	24.1	22.3	19.6
Fathers in 4th quintile	10.4	18.9	24.3	24.3	*22.0*
Fathers in 5th quintile	7.7	13.0	16.7	21.2	41.3

Note: Each cell indicates the percentage of sons that grew up in a given earnings quintile in their father's earnings distribution who ended up in a specific earnings quintile in their own cohort's earnings distribution. The son's earnings are ranked in his own birth cohort's earnings distribution. The father's earnings are ranked in the earnings distribution of fathers with sons born in the same year. We include birth cohorts from 1932 to 1933. The figures in italics indicate that the difference between the low- and high-oil regions is significantly different from zero at the 5% level.

Table 4: Probabilities of Daughters Being in Different Earnings Quintiles Given the Earnings Quintile of the Father, Main Cohorts (1952–1957)

	Panel A: Low-Oil Regions				
	Daughter in 1st quintile	Daughter in 2nd quintile	Daughter in 3rd quintile	Daughter in 4th quintile	Daughter in 5th quintile
Fathers in 1 quintile	17.5	*22.1*	21.7	*22.5*	15.9
Fathers in 2 quintile	14.0	*22.1*	23.4	*23.0*	*17.2*
Fathers in 3 quintile	13.9	*20.1*	*22.8*	*23.1*	*19.9*
Fathers in 4 quintile	12.3	*18.3*	20.6	*23.9*	*24.7*
Fathers in 5 quintile	11.7	*15.5*	*16.9*	21.2	*34.6*
	Panel B: High-Oil Regions				
	Daughter in 1st quintile	Daughter in 2nd quintile	Daughter in 3rd quintile	Daughter in 4th quintile	Daughter in 5th quintile
Fathers in 1 quintile	17.6	*25.7*	21.3	*18.4*	16.4
Fathers in 2 quintile	14.7	*26.5*	23.4	*20.0*	*15.3*
Fathers in 3 quintile	14.3	*24.9*	*24.5*	*20.2*	*15.9*
Fathers in 4 quintile	11.4	*23.0*	22.1	*21.6*	*21.7*
Fathers in 5 quintile	11.2	*19.3*	*20.3*	20.0	*29.1*

Note: Each cell indicates the percentage of daughters that grew up in a given earnings quintile in their father's earnings distribution who ended up in a specific earnings quintile in their own cohort's earnings distribution. The daughter's earnings are ranked in her own birth cohort's earnings distribution. The father's earnings are ranked in the earnings distribution of fathers with daughters born in the same year. We include birth cohorts from 1952 to 1957. The figures in italics indicate that the difference between the low- and high-oil regions is significantly different from zero at the 5% level.

Table 5: Returns to Education

	Men				Women		
	Cohorts 1932–1933 (i)	Cohorts 1952–1957 (ii)	Cohorts 1952–1957 (iii)	Third generation (iv)	Cohorts 1952–1957 (v)	Cohorts 1952–1957 (vi)	Third generation (vii)
Academic high school	0.349	0.447		0.144	0.489		0.304
	(0.011)	(0.010)		(0.013)	(0.015)		(0.017)
Academic high school	-0.019	-0.082		-0.046	0.010		0.017
× high oil	(0.032)	(0.018)		(0.022)	(0.036)		(0.037)
College			0.462			0.496	
			(0.009)			(0.015)	
College			-0.094			0.010	
× high oil			(0.016)			(0.036)	
Number of observations	16,092	82,986	82,986	12,989	77,110	52,790	12,513
R-squared	0.127	0.069		0.023	0.049	0.050	0.047

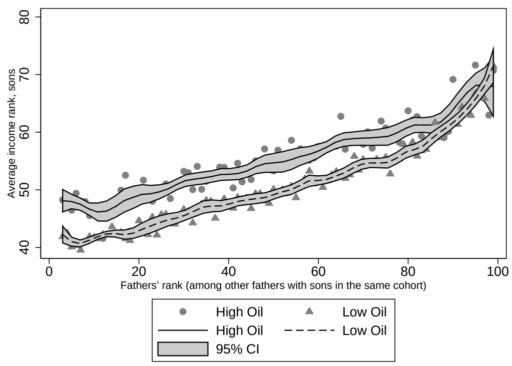
Note: Each column is from a separate regression of the log average earnings at ages 36–41 (30–40 in Columns (iv) and (vii)) on dummies for educational attainment at age 36 (30). The regression equation includes an indicator variable for having completed academic high school education, i.e., either an academic high school and/or a college degree, or a college education and an interaction term of the education indicator and an indicator for being born in a high-oil region (fathers born in high-oil regions). Robust standard errors clustered at the municipality level are in parentheses. We include birth cohorts from 1932 to 1933 in Column (i), birth cohorts from 1952 to 1957 in Columns (ii), (iii), (v), and (vi), the sons of birth cohorts 1952–1957 in Column (iv), and the daughters of birth cohorts 1952–1957 in Column (vii). All specifications include a full set of cohort and local labor market fixed effects.

Table 6: Rank–Rank Regressions Across Three Generations

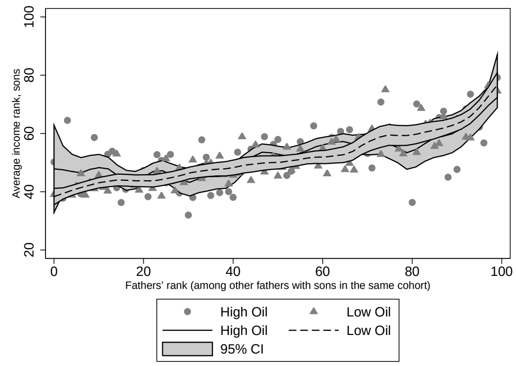
	Men			Women		
	3rd and 1st generation (i)	3rd and 2nd generation (ii)	3rd, 1st, and 2nd generation (iii)	3rd and 1st generation (iv)	3rd and 2nd generation (v)	3rd, 1st, and 2nd generation (vi)
1st generation rank	0.053		0.019	0.083		0.048
	(0.006)		(0.005)	(0.007)		(0.007)
High oil ×	-0.063		-0.051	-0.015		0.000
1st generation rank	(0.014)		(0.015)	(0.012)		(0.012)
2nd generation rank		0.166	0.161		0.168	0.157
		(0.007)	(0.006)		(0.007)	(0.006)
High oil×		-0.054	-0.043		-0.039	-0.037
2nd generation rank		(0.014)	(0.004)		(0.014)	(0.014)
Number of observations	39,684	39,684	39,684	37,752	37,752	37,752
R-squared	0.053	0.072	0.072	0.081	0.098	0.100

Note: Each column is from a separate regression of the earnings pecentile rank of the third generation (sons and daughters of the main cohorts) on the first generation's rank (fathers of the main cohorts) in Column (i), on the second generation's rank (main cohorts) in Column (ii), and on both the first and second generations' ranks in Column (iii). The third generation's earnings are ranked in the earnings distribution of other men or women with fathers born in the same year; the first generation's earnings are ranked in the earnings distribution of men with sons born in the same year; and the second generation's earnings are ranked in the earnings distribution of other men born in the same year. Robust standard errors adjusted for clustering at the municipality level are in parentheses. All specifications include a full set of the second generation's cohort and local labor market fixed effects and the second generation's age at childbirth.

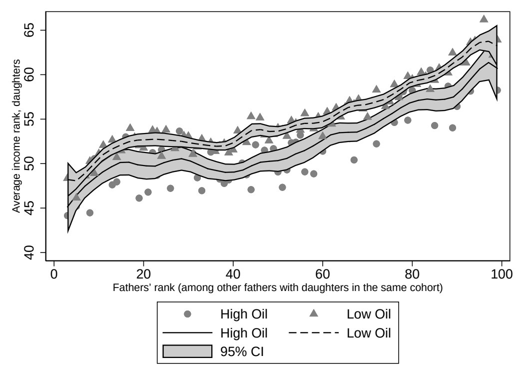
Figure 1: Association between Children's and Fathers' Earnings Ranks by Region



(a) Main Cohorts (1952–1957), Men



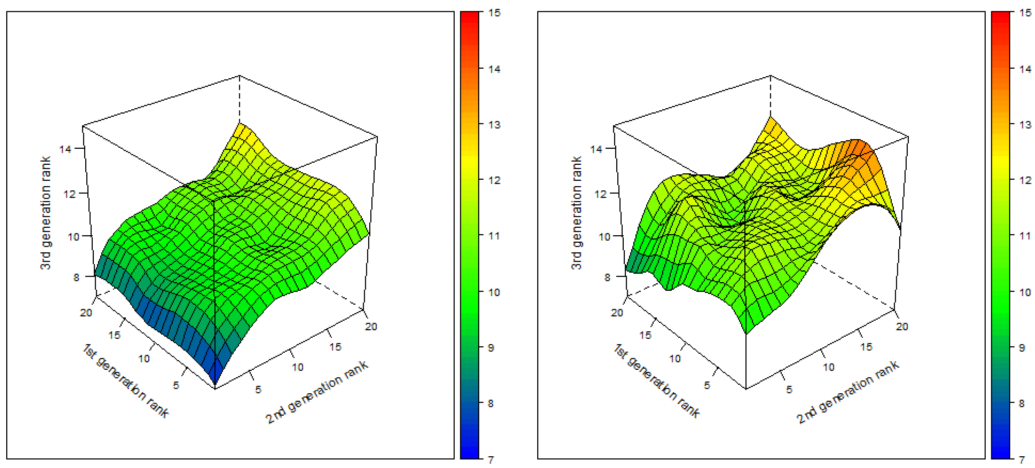
(b) Placebo Cohorts (1932–1933), Men



(c) Main Cohorts (1952–1957), Women

Notes: The plots present nonparametric binned scatterplots of the relationship between children's earnings percentile ranks and their fathers' earnings ranks in high- and low-oil regions. In Panel (a) and (c), we include birth cohorts 1952–1957 and their fathers. In Panel (b), we include birth cohorts 1932–1933 and their fathers. Children's earnings are ranked in their birth cohort's earnings distribution. Fathers' earnings are ranked in the earnings distribution of fathers with children born in the same year.

Figure 2: Association Between Third-Generation Men's Earnings Rank and the Ranks of the First and Second Generations



(a) Low-Oil

(b) High-Oil

Notes: This figure plots the average earnings percentile rank (expressed in 20 percentiles) for the sons of the 1952–1957 cohorts in low-oil and the high-oil regions as a function of the first and second generations' earnings ranks. The sample includes third-generation men born before 1985.