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Abstract

We explore the effects of early life income shocks on human capital using oil price fluctuations in a large sample of relevant African countries and employing micro data from multiple waves of the Demographic and Health Survey (DHS). Such shocks enable human capital investment via the standard income effect; but also crowd it out because of substitutability between natural resource and human capital income sources. The relative strength of the two effects depends on the age at which the shock is experienced. Consistent with these insights, we find that income shocks in early life are associated with enhanced educational attainment and wealth but are sometimes linked to reduced levels of such outcomes if experienced in adolescence. These results survive multiple robustness checks, and their broader implications are discussed.

Keywords: Human capital, income shocks, natural resources

JEL classification: O12, I2

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1. Introduction

The effect of income shocks, in particular those stemming from natural resources, on the accumulation of human capital has been a long standing subject of debate among economists.[1] This work has generated valuable insights on channels and mechanisms of influence, but overall ambiguous conclusions. An early important paper Gylfason (2001) argued for a negative effect, whereby natural resources crowd out human capital investment, and Papyrakis and Gerlagh (2004) reinforce this conclusion. Some subsequent work, however, Sijns (2006), Brueckner and Gradstein (2016) provided contrarian evidence, arguing that income shocks resulting from natural resources are conducive to human capital investment. Even more recently, Abramson and Esposito (2021) find that traditionally coal rich regions in Europe underinvested in universities in the long term – thus providing further evidence for the crowding out of human capital by the abundance of natural resources. Geographically and temporarily closer to the scope of this paper, Ahlerup et al. (2020) detect similar detrimental effect in modern Africa in the context of gold mining. It appears, therefore, that evidence pertaining to the effect of natural resources on human capital is contradictory.

In this paper, we take a more nuanced approach to the issue in order to possibly reconcile the different pieces of existing evidence. Conceptually, we argue that the age range in which the child experiences an income shock is important. In particular, positive income shocks experienced in early life have a larger positive effect on subsequent human capital than those experienced later in life – which helps explain the wide range of results in existing (especially aggregate cross country) work, which typically ignores the specifics of school age distribution, such as Gylfason (2001) and Papyrakis and Gerlagh (2004) on one hand, and Sijns (2006) and Brueckner and Gradstein (2016) on the other hand. Our granular approach to the issue at hand relative to the above work and, in particular, relative to Brueckner and Gradstein (2016), that adopt a more

[1] A large literature has explored in general existence or the lack thereof of a resource curse: a possibly negative effect of natural resources on measures of economic performance, such as economic growth. A very partial sample of this literature includes Alexeev and Conrad (2009), Aragon and Rud (2013), Auty (1994), Black et al. (2005), Caselli and Michaels (2013), Cavalcanti et al. (2019), Gradstein and Klemp (2020), Papyrakis and Gerlagh (2007), Sachs and Warner (2001); Badeeb et al. (2017), and van der Ploeg (2011), are useful surveys, and Havranek et al. (2016) conduct meta-analysis of hundreds of studies on the issue.

aggregate perspective, enables us to specifically address the incidence of income shocks depending on demographics, such as age and gender. This, in turn, enables us to further investigate the mechanisms through which early life income shocks affect human capital accumulation, going beyond existing work.

To explore empirically the potentially differential impact of resource income shocks on education depending on the child's age, we utilize the IPUMS-DHS dataset of oil producing African countries, whereby our primary focus is on within-country income shocks generated through world oil price fluctuations. The dataset allows us to link oil price shocks at different ages in childhood covering the range of 0-14, to subsequent educational attainment. Although the sample countries are oil producers and net exporters, their share in the world oil output is typically small, so that oil price changes can be safely assumed as exogenous from their vantage point, hence can be interpreted as income shocks. By their nature, these shocks are persistent and can be interpreted as carrying a permanent income effect. Our empirical design differentiates between oil rich and oil poor provinces in the sample countries and links outcomes to the differential incidence of oil price shocks by childhood/adolescence age brackets.

Our baseline results, supplemented by a variety of robustness checks, indicate that such shocks are positively related to education if experienced in early childhood (ages 0-4), but are statistically insignificant or are even detrimental for schooling when experienced later on (ages 10-14). These results associating the incidence age of shocks and subsequent education are both consistent with the large and growing literature on future effects of early life circumstances, reviewed below, and with the work on resource curse, and have the potential of reconciling the differing findings in these branches of research. We then explore the effect of income on future wealth and find similar positive (negative) effects of early (late) childhood income shocks on subsequent wealth. While this finding is of independent interest, our above analysis suggests that the reduction in educational attainment is a possible channel for this outcome. We also analyze the role of gender in generating the above results and find that the early childhood positive effect is somewhat larger for boys than for girls, whereas the late childhood negative effect of oil price shocks on education is driven by the far larger effect for girls than for boys. Whereas the positive effect of early childhood shocks on education is well consistent with the established literature, the negative effect in later childhood, especially for girls, is a novel finding.

The rest of the paper proceeds as follows. The next section presents the conceptual issues and places our contribution in existing literature. The data are described in Section 3, followed, in Section 4, by the outline of our empirical strategy. Section 5 contains the main empirical results, followed, in Section 6, by robustness checks. Section 7 then discusses extensions and possible mechanisms, and Section 8 concludes with brief remarks.

2. Income shocks and human capital

Conceptual framework

How can one think about the relationship between early life income shocks and subsequent human capital acquisition, in the presence of credit constraints? The immediate effect of a positive income windfall is to enable the family a higher level of human capital investment. But anticipation of a larger wealth reduces the incentives to do so for as long as it is at least partially substitutable for labor income derived from human capital. This countervailing effect implies that the net outcome is generally ambiguous and hinges upon the relative strength of the income effect versus the substitution effect.

Building on that, existing literature provides further insights on the effect of early life income shocks on subsequent human capital accumulation. This work (see, notably, Almond and Currie (2011) and Cunha and Heckman (2007)) argues that features of the production function of human capital are important to understand this effect. In particular, complementarity between skill investments in periods of life matters, as does dynamic complementarity or self-productivity, implies that early investments in human capital carry a higher return than later investments, because skills acquired in early life facilitate skill acquisition later on. This nature of human capital technology has, among other things, important policy implications in regard to the optimal timing) of human capital investments. As illustrated in a formal model based on Almond and Currie (2011) in Appendix A1, the direct implication of this line of thinking in our context then is that the relative strength of income shocks is higher the earlier they take place.

While this research is focused on a particular world region, our approach, methodology, and some conclusions may well be applicable to other similar countries beyond the African continent. In particular, poor countries before the fertility transition could be suitable candidates for follow up research. In contrast, the external validity of the results with respect to affluent economies is less obvious.[2]

Related literature

A large volume of recent work documents the importance of early life circumstances for future outcomes and, specifically, for human capital; Almond and Currie (2011) Almond et al. (2018) are excellent surveys. Adhvaryu et al. (2019) and Fenske and Zurimendi (2017) are examples of recent papers that exploit, as we do, income shocks for identification purposes. Our findings concur with this literature in detecting a positive effect of such shocks in early childhood; Lavy et al. (2016) specifically focus on educational attainment in this regard, whereas the above papers typically have education as one of their studied outcomes. The paper Fenske and Zurimendi (2017) is particularly related in using oil price shocks in the context of an African country (Nigeria) for identification.

As our particular income shocks are derived from natural resource prices, our findings in this regard are consistent with Sijns (2006) and Brueckner and Gradstein (2016) and differ from Abramson and Esposito (2021) and Papyrakis and Gerlagh (2004). One possible difference between this research and those papers is the underlying social and economic environment. We are specifically interested in poor developing countries, whereas the above work also covers developed areas. Additionally, the above work, ignoring the underlying age structure of the population, potentially masks age related incidence of the shocks, which, we argue, is an essential factor generating important heterogeneous effects.

Our findings complement those in Ahlerup et al. (2020) whose focus, like ours, is Africa and, who as we do, exploit changes in mineral (gold) prices for identification. These authors find that gold booms during adolescence induce less schooling and attribute this to opportunities in the mining sector that increase the cost of schooling. This is inconsistent with our findings being driven by adolescent girls, who are less likely to benefit from work opportunities in the mining sector, see Kotsadam and Tolonen (2016) for evidence in this regard. One possibility is that the nature of income shock matter, as Ahlerup et al. (2020) point out, "…gold mines have a uniquely negative effect on educational attainment compared to other mineral resources, likely because of

[2] This is one reason why oil rich Middle Eastern countries may not necessarily generate similar conclusions despite their appeal in other respects; additionally, such countries are scarcely covered by the DHS.

the amenability of gold mining to small-scale activities." Additionally Ahlerup et al. (2020) abstract form the more general analysis of the age incidence of income shocks. In this latter regard, this research is more closely related to Shah and Steinberg (2017) which detects a differential age effect of productivity shocks on educational attainment. Conceptually, however, productivity shocks, which encapsulate both income and substitution effects, are different from pure income shocks; and that paper's instrument for productivity shocks, annual rainfall, is very different from resource price shocks as employed here. Finally, Gradstein and Ishak, 2024, is a complementary piece of research where the fertility effects of income shocks from natural resources are explored.

3. Data

3.1. Sample

Our sample is focused on oil producing countries in Africa. One reason for this is the relative homogeneity. Another reason is that these countries are well covered, through multiple waves, by our main source of information on outcome variables; this enables us to use repeated cross-section waves from the same environment. A third reason is that for the countries in the sample oil is an important source of revenues, and relatedly, these countries are typically not well economically diversified. Our data on education, wealth, and individual characteristics come from the individual census records conducted by Demographic and Health Survey (DHS) program. The data is retrieved from Integrated Public Use Microdata Series (IPUMS) International that reports harmonized representative samples. Our analysis is restricted to country survey waves with Global Positioning System (GPS) information on the location of the surveyed households. This is because the geocoded data allows us to assign individuals to their respective oil and non-oil producing provinces allocated as explained below. To homogenize the sample, we focus on countries reporting at least one oil-producing province. This leaves us with 65 surveys over the period 1990-2016 for 15 countries: Angola, Cameroon, Democratic Republic of Congo, Ivory Coast, Benin, Ethiopia, Ghana, Madagascar, Namibia, Mozambique, Nigeria, Niger, Senegal, Tanzania, and Egypt.[3]

[3] See Table B0 in online appendix B for the full list of countries, survey waves and oil-producing provinces.

The sampled countries had a population of 757 million people in 2016 representing 62 percent of Africa's population. In assigning oil locations and consequently households, we choose to work on coarser administrative units (ADM 1, or provinces) rather than finer levels (ADM 2, or district). The advantage of this approach is twofold. First, higher administrative levels allow for reducing the measurement error associated with the allocation of oil fields. Second, focusing on provinces can mitigate migration concerns, which is a common phenomenon in periods of high oil prices. Even though migrating from one province to another is possible, it is less frequent as compared migrating from one district to another, especially in the presence delimited ethnic and tribal territories making movement quite restricted. Our sample includes 247 provinces with a mean (median) size of 49 (29) thousands km^2. Figure 1 shows a map of the countries included along with the locations of oil provinces.

It is important to note that in all the countries in our sample, oil producing provinces retain a significant portion of oil revenues, which is accomplished through a variety of means. These include: an explicit subnational sharing formula; ad hoc bargaining procedures between subnational levels of the government; retaining of royalties; specially designed taxes collected by local governments (see Bauer et al. (2016)). In fact, for some of oil producing provinces, oil revenues constitute a major source of local governments' income, helping to reduce tax burden on households (the Extractive Industries Transparency Initiative, reports from various years, https://eiti.org) (see section 6.1). Thus, we regard oil producing provinces as a treated and non-oil producing provinces as a control group.

It is also essential to note that the interviews in the DHS modules are conducted for everyone residing in the surveyed household. Women included in the sample could be married or not; and the men in the sample are not only the women's partners, but could be anyone related to the woman and residing with her in the household (i.e., a brother, a father, or a son). Since initially the DHS focused on women, only later on expanding the scope to include male respondents, as will be seen below, most of the respondents in our sample are women.

3.2. Outcomes

Education. Our main outcome variable is individual's educational attainment measured by the number of years of education. To obtain this information, we make use of two types of surveys:

Women surveys covering women aged 15-53 years old; and Men surveys including male respondents aged 15-56 years old. Our total sample consists of 580,478 individuals born between 1960 and 2001, with 137,924 observations belonging to male respondents, and 442,554 observations representing female respondents. Note that country coverage differs between the two surveys, particularly for male surveys with Egypt and Morocco not included.

Wealth. To measure household's wealth, we construct a wealth index (WI) using information on household characteristics such as household's possession of consumer durable goods, access to basic services, and housing condition. These indicators are then entered into a factor analysis - using the Principal Component Analysis- from which the first factor is selected to derive the asset weights and consequently the wealth index.[4] The obtained WI is rescaled, so that it ranges from 0 to 100, with 0 representing households having no assets and living in lowest quality housing, and 100 representing households possessing all assets and living in highest quality housing. The advantage of using our WI over the wealth index provided by the DHS lies in the fact that latter is only calculated at the country level, making it only possible to compare households relative to other households within a given country. In contrast, the WI can be easily used to compare the households' wealth level across provinces and across countries, since it uses the same combination of assets and standard assets' weights to rank households independently of where they live.

Additional outcomes. We also consider additional outcomes, such as women age at first marriage, the number of children, employment and type of occupation, work frequency, and husband's level of education and employment the source of which is the women DHS questionnaires.

3.3. Independent variables

The main independent variables are an indicator for oil provinces, international oil prices and their interaction.

Oil provinces are allocated based on the map of world oil deposits from PRIO petroleum dataset (Lujala et al., 2007). Onshore oil deposits were assigned to a given province, if the centroid of the deposit lie within its boundaries. For offshore oil deposits, we first calculated the distance between the centroids of the province and the deposit and assigned the latter to the nearest province.

[4] Figure B1 in online appendix B contains the scree plot of the eigenvalues for each component., which clearly shows that the first component has by far the highest eigenvalue.

International oil prices are given by the average of Dubai, Brent and Texas prices expressed in real 2010 USD and taken from the World Bank Commodities prices dataset.

Other variables. The DHS contain a set of demographic information for both men and women, which we use to construct birth cohorts and control for individual characteristics. These include age, religion, place of residence (i.e. urban vs. rural) and sex of the household head.

3.4. Descriptive statistics

Our sample consists of more than 580,000 individuals interviewed over period from 1990 to 2016. Table 1 report some basic descriptive statistics of our main variables of interest (Appendix Table A1 contains more detailed information). Several features are worth mentioning. First, individuals residing in oil provinces have on average more years of schooling than their peers in non-oil provinces, and the difference is statistically significance. Male (female) respondents in oil provinces possess on average 2.5 (2.6) more years of schooling. Second, within both oil and non-oil provinces, male respondents have more years of schooling than female respondents, and the difference is larger in non-oil provinces. Third, the highest attained educational level for an individual is, on-average, 7.3 years in oil provinces, which is equivalent to the completion of primary education plus some post primary education. In non-oil provinces, on average individuals do not manage to complete primary education. Similarly, the household wealth tends to be higher in oil provinces than in non-oil provinces, with more wealth possessions reported by male respondents than female respondents.

4. Empirical strategy

Estimation: Our conceptual framework proposes that income shock has differential effects on the educational attainment - and wealth - depending on the age of the child, with positive effects dominating at early life of a child. To test this hypothesis, our empirical strategy looks at the effect of oil price shocks at different periods of individual's life. Our baseline specification takes the following form:

$$Y_{irBt} = \beta\,(OPS_{Bt} \times Oil\,Province_r) + X_{iBt} + \theta_{Bt} + \alpha_r + \alpha_r \cdot B \cdot t + \epsilon_{irBt} \qquad (1)$$

where the outcome Y_{irBt} is either the years of schooling or, alternatively, the aggregate household's wealth of individual i born in year B and residing in province r during the age interval $t \epsilon (1,2,3)$. We focus on three periods over the individual's life course: (i) pre-school years (t=1, ages 0-4); (ii) primary school years (t=2, 5-9); and (iii) years with completed primary education and some post-primary education (t=3, 10-14), referred sometimes to as adolescence. OPS_{Bt} is the logarithm of the five year moving average of real oil prices. $Oil\ Province_r$ is a dummy variable that takes a value of 1, if a given province is producing oil. θ_{Bt} is age interval fixed effects to capture period-varying shocks that are common across individuals in a cohort, and α_r is provincial fixed effects to control for time-invariant unobserved heterogeneity at the province level. The $\alpha_r \cdot Bt$ is provincial-specific time trend to account for provincial trends that might be correlated with both educational attainment and oil prices. X_{iBt} is a set of time-varying controls at the individual level including indicators for urban residency, religion, female household head, month of survey, and year of survey.[5] The above equation is estimated on the full sample of individuals for each age interval separately and on sub-samples of men and women to reflect potential gender heterogeneous effects. When estimating the full sample, we additionally control for gender. Standard errors are clustered at the province level.[6] Based on our conceptual framework, we expect the sign of β to be positive at period $t = 1$, or during early childhood years. For the next two periods, the sign of β could be either positive or negative, with the former being smaller in magnitude compared to period 1.

Specification: Our approach assumes that oil prices are exogenous, which is plausible because, with the exception of Nigeria and Angola, most of our sampled countries are low oil-producing countries contributing less than 1% to total world oil production. For Nigeria and Angola, despite being the largest two oil-producing countries in Africa, their production in 2016 accounted for only 2% of world production each.[7] Furthermore, by interacting oil prices with indicators for oil

[5] Note that because of the high correlation between oil prices across the three age intervals, we were unable to run a saturated regression with oil price shocks of the three periods, all at once. However, we are able to control for shocks of two sufficiently time-spaced periods to avoid multicollinearity following Shah and Steinberg (2017). Specifically in Appendix Table A10, we confront shocks occurring at the age interval (10-14) with shocks occurring during the childhood age interval (0-4), and results remain the same.

[6] Appendix Table B6 also presents results for double clustering, at the province and survey year levels. Since the results are robust with respect to this alternative clustering procedure, we feel reassured of using our preferred clustering. Ideally, it would be useful to control for household circumstances of the respondents in their childhood, when being faced with a shock, such as its size or gender composition. Unfortunately, this information is not available in the DHS.

[7] https://www.cia.gov/library/publications/the-world-factbook/rankorder/2241rank.html

provinces conditional upon provincial and age-interval fixed effects, we are exploiting differential effects of oil price changes depending on access on oil in the spirit of a difference-in-difference strategy, whereby individuals from the same birth cohort are divided into treatment and control groups, depending on the experience of an oil price shock.

In addition, our identification strategy requires the satisfaction of two assumptions (1) parallel trends assumption, and (2) the stability of treatment effect between groups and over time. The first assumption requires that oil and non- provinces are not systematically different in any other aspect that might affect education - hence, in the absence of oil, both groups of provinces must witness the same pattern in educational attainment. In other words, our estimates should be unbiased in the absence of pretends or pre-existing factors that might affect education in the long run. To ensure that, we make use of geographic, environmental and social information available from DHS surveys at the cluster level to check if oil and non-oil provinces differed systematically in these features, which might influence investment in education in the long-term. In this regard, we test whether oil and non-oil provinces are comparable in terms of level of vegetation, precipitation, minimum and maximum temperature, elevation, population density and incidence of malaria. The vegetation, precipitation and temperature indicators are calculated by taking the median of their monthly values in the four years prior to the survey. The population density and malaria index are given for the year 2000. The statistical insignificance of the estimates reported in Table 2 suggests no systematic differences of these features between the types of provinces.

The second assumption requires that the number and status of treatment and control groups should be constant over time. Hence, no switch from being treated to being non-treated and vice versa. We unfortunately do not have full information on the starting production years for all the allocated oil fields. This information is only available for a limited number of oil fields (around 10%). Hence, we are unable to fully investigate whether there has been a changing in the oil production status of all oil provinces over time. Nevertheless, we believe that working on coarser administrative units (ADM 1 or provinces) rather than finer levels (ADM 2 or district) has the advantage of allowing for reducing the measurement error associated with the allocation of oil fields and with the production status of the provinces. Most of our sampled provinces contain more than one oil field, and hence, even if we doubt the starting production date of a given field, this should have limited effect on whether the provinces is an oil producer or not. The larger the number of oil fields contained in a given province, the less doubts we have about the status of the provinces as an oil producer. Furthermore, having data on the starting dates of oil production at country level can guide a bit on the producing status of the country's respective provinces. Following this logic, we conduct several robustness checks on our sample of treated provinces and countries as explained below in the robustness checks section (see section 6.1).

5. Main results

5.1. Preliminaries

Persistence of oil shocks: Before addressing our main hypotheses, we make sure that some of our fundamental assumptions hold true. One of these assumptions is that oil price shocks over designated time intervals are at least somewhat persistent, so as to generate some income windfall after schooling is completed.[8] While existing research (e.g., Brueckner et al. (2012), Gradstein and Klemp (2020)) has established that international oil prices behaved persistently over the last decades of 1900s-early 2000s, we confirm persistence in our current sample whose full range covers the period of 1965-2015. To this end, consider Figure 2, which describes the behavior of oil prices over time in its three panels corresponding to our 5-year intervals and shows the presence of a steady upward (downward) trend in the price series. To substantiate the visual impression that it is persistent, Appendix Table A2 presents results of formal tests for unit roots, which provides econometric support for our assumption. Throughout the three age-periods, we fail to reject the null hypothesis of existence of a unit root in the oil prices series in levels.

Oil shocks as income shocks: Then we test whether oil price changes can be interpreted as income changes at a provincial level in our sample. As there is no reliable data on the latter, we resort to Lessmann and Seidel's (2017) estimates of provincial income obtained using nighttime light as a proxy. The data is computed based on nighttime lights collected from satellite data provided by the National Oceanic and Atmospheric Administration (NOAA) and is available for the period 1992-2012. Correlating oil prices with these estimates in Figure 3 reassure that, indeed, oil price changes can be interpreted as provincial income change. This is further illustrated in Appendix

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[8] Note that, as it follows from the theoretical model in the Appendix A1, in principle a modicum of persistence should be sufficient for our argument to go through. It is common to think of oil prices as exhibiting much more persistence than alternative shocks, such as weather conditions (rain or temperature) that have been used in the related literature, e.g., Maccini and Yang (2009), Shah and Steinberg (2017).

Table A3a where we report the estimated coefficients of regressing the (log) provincial GDP on oil price shocks at different lag points. These coefficients grow in magnitude and remain statistically significant until the lagged 10-year average beyond which the estimates become smaller and insignificant, suggesting that variations in the oil price have long-rum effects on the level of GDP per capita. To further investigate the issue at the household level, we employ the World Bank's General Household Survey for Nigeria in years 2010, 2012, 2015 and 2018. Using detailed data on all sources of earnings received by a household, we manage to construct total household income per capita and aggregate that to provincial level. Total household income per capita is defined as the sum of all labor and non-labor income (i.e., savings, remittances, rents, property income, etc.), divided by the number of household members. All monetary values are expressed in real 2018 values, with nominal values deflated by the Nigerian CPI. Appendix Table A3b shows a strong positive correlation between provincial income and different lags for OPS in oil producing provinces, with the effect becoming stronger in magnitude and statistical significance the longer the lag before it turns insignificant at the lagged 10-year average as previously found with provincial GDP.[9]

Parallel trend: As our empirical strategy is based on a parallel trend assumption, we test it in two ways. First, we provide a placebo test for it by focusing on the period of stable oil prices, during the oil bust of 1989-2000. As shown in Table A4a, none of our estimated coefficients are statistically significant, indicating that there is no statistically significant difference in educational attainment between oil and non-oil provinces across different age groups. Additionally, we interact a dummy variable for being an oil producer with time for each year in oil bust period following an event study approach in order to make sure that there is no systematic difference in the change in time of the educational outcomes between oil and non-oil producing regions. As seen in Table A4b, the resulting coefficients are statistically insignificant, further reassuring that the parallel trend assumption holds.

5.2. Educational attainment

We begin by taking a broad look at the data. To this end, we run an OLS regression on our sample, with the outcome variable being years of schooling attained by a resident i in province r; and the

[9] We have also conducted analysis of leads variables, see Appendix Table B2, where it is shown that that lagged OPS remain significant.

main explanatory variable being ($OPS_{0-14} \times Oil\ Province_r$), where OPS_{0-14} is the logarithm of the 14 year moving average of real oil prices, and $Oil\ Province_r$ is a dummy variable that takes a value of 1, if a given province is producing oil. Table 3 presents the results for the compiled three age periods, with and without individual controls. For the entire sample, in column 1, they are just barely significant (at 10% level) when all controls are included, in which case the negative estimated coefficient implies that oil price shocks experienced in childhood reduces the subsequent educational attainment. When the analysis is decomposed by gender, in columns 2 and 3, it turns out that the negative effect of oil price shocks on educational attainment is driven through the effect on females; the male regression returns insignificant results.[10]

We then proceed with our main analysis, by age groups, as the above analysis potentially masks differences across those. The results of estimating equation (1) are presented in Table 4. Panel A presents the results of the oil price shocks experienced in early childhood years (0-4 years old), while panel B contains the results of the shocks experienced between the ages 5-9 years old, and finally, panel C is concerned with results of these such shocks in early adolescence (ages 10-14 years old). They indicate (Panel A) that oil price shocks experienced in early childhood enhance subsequent educational attainment, in the entire sample, and separately for females and males. This is consistent with the vast literature on the effect of early childhood income shocks on future outcomes, such as Fenske and Zurimendi (2017) in the context of Nigeria's oil price shocks. Interestingly, and a new finding relative to the early childhood perspective, oil price shocks experienced between the ages 5-9 have an insignificant effect on subsequent educational attainment for neither gender group, nor for the entire sample (Panel B).

Even more interesting is the negative effect of such shocks in early adolescence (ages 10-14) on subsequent educational attainment (Panel C), which is more pronounced for women. Not only are these results statistically significant, they are also economically meaningful. Thus, recalling our regression specification, the estimated coefficients, between -0.44 and -0.24, indicate that a one percent increase in the average oil price during the 10-14 age decreases subsequent educational attainment in oil producing provinces by a third of the year. A back of the envelope calculation may help to translate these figures into elasticities. A one percent increase in the average oil price

[10] We check whether the difference between the male and female estimated coefficients are statistically different using a triple interaction term (i.e., Oil price shock × Oil Province × female dummy). The triple interaction term was always significant confirming that the estimated coefficients are indeed different.

can be estimated to be about five percent aggregate increase over the adolescence period. And, since the average of years of schooling in our sample is 5.3, the decrease of a third of the year constitutes some seven percent of this average. With the five percent increase in the oil price results being equivalent to a seven percent decrease in schooling, it then follows that the elasticity of educational attainment of an adolescent individual with respect to an oil price shock is about -1.4 on average.[11]

5.3. Wealth

Eventual wealth later in life is our secondary outcome of interest. In Table 5 we, therefore, replicate our analysis using wealth as the outcome variable. Panel A in that table confirms the positive effect of early childhood income shocks on subsequent wealth, and Panel B presents insignificant results for the 5-9 age group. Panel C yields negative coefficients for the entire sample as well as for each of the two gender groups, indicating that the results with respect to wealth are qualitatively similar to those with respect to schooling. In particular, positive oil shocks in adolescence reduce subsequent wealth. While this finding is also of an independent interest, our above analysis suggests that the reduction in educational attainment is a possible channel for this outcome.[12]

6. Robustness checks

We now carry out several robustness checks. They pertain to various selections of the sample provinces and periods; the population demographics; prices of other minerals than oil; and interrelationship between shocks experienced at different ages in childhood/adolescence.[13] We also consider variations on the construction of the wealth index and explore additional outcomes

[11] We have also explored, rather than years of schooling, completion of educational stages, as our outcome variable. The results, reported in the Appendix Table B1, note for publication, are qualitatively the same.

[12] There may also be additional channels directly related to natural resource curse, as briefly reviewed in the Introduction.

[13] These robustness results are presented for educational attainment as the outcome variable, but they also broadly hold for the wealth index as well.

as an extension. The role of these checks is to reassure that the results are robust with respect to the empirical specification employed.

6.1. Oil provinces, countries, period selection, and design inference

We first explore the robustness of our results to the sample of treated oil provinces and countries in the main analysis. To this end, we cut the sample in several ways. In Table 6, columns 1-3, we focus on the two biggest oil producing countries in our sample, Nigeria and Angola. We observe that relative to the baseline results, while the results remain qualitatively unchanged, both their statistical and economic significance increase. Thus, in this context, oil price shocks in the lowest (highest) age group positively (negatively) affect future schooling attainment, typically at the 1% statistical significance level. We also replicate, in columns 4-6 of Table 6, our baseline analysis for a group of long-term oil producing countries (Angola, Nigeria, Egypt, Congo and Morocco) that have continuously produced oil beginning in 1960 – the earliest year for which we have data from the DHS. Again, like in the case of Nigeria and Angola, the results are only reinforced relative to the baseline analysis. In a similar fashion, we drop oil provinces with oil fields that have started production after 1960 in Table 7 and results remain robust.

We then alternatively drop countries with only one oil producing province (which leaves us with 177 provinces as opposed to 247 in the full sample). Here, the results (presented in Appendix Table A5, columns 1-3) are not substantively different from those in the main analysis. Likewise, when non-oil producing African countries are added, the results (in Appendix Table A5, columns 4-6) remain qualitatively unchanged, although their statistical significance, not surprisingly, drops. Finally, we randomly reshuffle oil producing and non-oil producing provinces as a placebo test. We find, in Appendix Table A6, that this results in nonsignificant correlations with oil price changes, indicating that the latter are relevant for oil producing provinces.

Oil prices spiked in the post 1973 period, and one may wonder if this structural break may have affected the identified effects. To this end, we replicate our analysis for the post 1973 period – which reduces our sample by more than 15 percent; yet, the results remain essentially the same, see Table 6, columns 7-9. We, further, explore symmetry in the effect of oil booms and oil busts, i.e., whether our results are driven by periods of rising versus declining oil prices. To this end, we define oil boom (bust) periods as all years in which oil prices are strictly higher (lower) than their long-run average calculated as a simple average of real oil prices over the period 1965-2015.

Consequently, oil boom covers then the years over the periods 1973-1984 and 2000-2015, while oil bust covers the rest of the years. The results presented in Appendix Table A7 are based on sub-samples of oil boom and bust periods. Interestingly, we only find significant results for the former case, whereas the results during oil busts appear insignificant. Thus, the effects differ in a meaningful way. We have also conducted a robustness analysis based on only onshore oil fields, the idea being that the attribution of oil revenues accrued in offshore explorations is potentially subject to measurement errors. The results, see Appendix Table A8, are qualitatively quite similar to the main ones.

We have also implemented a randomization inference exercise by randomly assigning the dummy for being an oil producer to match the same number of treated and control regions. We estimate the effect of this fake treatment for 1000 draws under the null hypothesis of no treatment effect. Appendix Table A9 presents the results showing the p-values from the original OLS analysis (in curly brackets) and the p-values based on randomization inference (in square brackets). In most cases, both p-values are very similar in value and the statistical significance of the estimated effects remains the same. This ensures that we're indeed picking up a true effect.

6.2. Demographics

In Table 8, we restrict our sample to respondents being at least 18 years old, the standard high school graduation age. This reduces the sample by almost fifteen percent, but leaves our baseline results almost unchanged qualitatively. We then consider the possibility that migration may have a bearing on our results. To this end, we define a non-migrant as a respondent who has always resided in her current place of residence and introduce an additional control variable – the interaction term between oil price shock and the non-migrant dummy. The results, in Appendix Table A10a, are by and large very similar to the baseline results, and the newly introduced control is never significant. We further split our sample into (i) migrants only, and (ii) all but migrants. The results, in Appendix Tables A10b and A10c, indicate that the former yields non-significant results, whereas the latter generates results fully consistent with those for the entire sample. This reassures us that migration is not an important factor at play. More generally, one may be concerned about broader demographic changes that took place in the sample provinces and that could be correlated with oil price shocks. To alleviate those, we correlate the latter with various demographic measures at a provincial level, including migration. We observe, in Appendix Table

A11, that none of those (total population, urban vs rural, gender composition, migration flows) displays a significant correlation with lagged oil prices.

6.3. Other minerals

Africa's continent is rich with minerals, and one potential concern is that our results might be driven by fluctuations in the prices of those minerals as opposed to that of oil. To alleviate this concern about potential confounders, we introduce in our baseline regression as an additional control variable prices of other minerals interacted with their producing province. We specifically focus on gold, silver, aluminum, copper, lead, nickel, zinc and tin. This choice is dictated by the following two main considerations. For one, a mineral has to be of at least some importance for at least one country in our sample; and the country should not be a major world producer of the mineral so as to be able to affect its price. We then construct the variable, mineral price shock, as follows. For each province in our sample, we select the main mineral produced based on the frequency of the production of this mineral across different mines which is cross-checked by the main minerals that the country is producing.[14] This enables us to construct a dummy variable for each province indicating presence of lack thereof of a main mineral. Multiplying this variable by the oil price yields a variable interpreted as a potential confounder. Regression results are shown in Table 9. Comparing with respective columns 2, 4, and 6 in Table 4, we observe that the main coefficients of interest in columns 1, 2, and 3, get marginally reduced (in absolute value), but still remain significant. In particular, one of our main findings, that oil price shocks are detrimental for schooling when experienced in adolescence, remains highly significant.

6.4. Controlling for early life shocks, robustness with respect to the definition of age intervals and the supply of schooling

While our results with respect to the positive effect of early life shocks on subsequent educational attainment and wealth are not too surprising in the light of much existing work on the subject, the negative effect of shocks in adolescence is more novel. To further tease out this result, we now would like to more clearly separate this type of shock from the early life shock. To do so, we run

[14] Minerals are allocated to provinces using the Mineral Resources Data System (MRDS) from U.S. Geological Survey (USGS) (https://mrdata.usgs.gov/mrds/).

a regression with adolescence shocks, now controlling for early life (ages 0-4) shocks.[15] The results, in Appendix Table A12, while indicating a reduced significance for the males sample, continue to hold. In particularly noteworthy is the highly significant negative effect of the shock in the female sample.

We have also conducted multiple robustness checks with respect to our definition of age brackets, by dividing them up in numerous ways. Appendix Tables B3 and B4, report a sample of these exercises, from which it follows that the results are not at all qualitatively sensitive to the way these brackets are defined.

Finally, we consider the supply side, namely, we check whether school availability has changed differentially in oil rich and oil poor provinces in response to oil price shocks.[16] To this end, we employ the Afrobarometer rounds 2-6 (covering the years from 2002-2015),[17] and construct the school availability variable utilizing the following question "Is there a school present in your neighborhood?" Aggregation of these responses at the provincial level yields the number of schools we use in online Appendix Table B5. As can be seen from that table (even rows), school availability does not react differentially to lagged oil price shocks – which is reassuring as it indicates that the supply side is not a major factor in our case.

6.5. Modifications of the wealth index

Our construction of the wealth index combines several household amenities and aggregates them via the principal component procedure. We now conduct some robustness exercises with respect to amenities' selection (using the same aggregation procedure throughout). In Appendix Table A15, we add the number of sleeping rooms in the house as yet another attribute; and in Appendix Table A16 we omit two items least correlated with the principal component, namely, radio and bike ownership. As can be seen, the results remain virtually unchanged relative to the baseline analysis in Table 4.

7. Further extensions

[15] Annual oil prices are autocorrelated, but this autocorrelation is much less pronounced over the span of a decade.

[16] Note that, for our purposes, what primarily matters are the differences in availability of schooling for the different age groups, but this information is not available. However, if aggregate school supply is not differentially reactive to oil price shocks, that would be a solid indication that the supply side is immaterial here.

[17] Not all provinces and countries in our sample are covered across all the waves.

7.1. Mechanisms and additional outcomes

One of our results indicates that early life (adolescence) income shocks positively (negatively) affect female educational attainment, with negative effects of shocks appearing to be stronger for female during their adolescence years. To explore how these gender differences arise, we consider additional outcomes pertaining to adult female circumstances, specifically, age at first marriage, the number of children, employment and type of occupation, work frequency, and husband's level of education and employment. This analysis will shed some light on the mechanisms that are associated with the aforementioned finding.

The results, in Table 10, column 1, indicate that early life (adolescence) income shocks increase (reduce) females' age at first marriage, which is consistent with broad empirical regularities, specifically, the positive association between female schooling and age of marriage as documented in sociological literature, see Saardchom and Lemaire (2005). Further, as follows from Table 10, column 2, early life (adolescence) income shocks reduce (increase) their number of children. Recalling our main result, this finding indicates that early life income shocks enhance women schooling and also reduce their number of children as has been extensively documented in general (Cochrane (1978)); for poor countries (Schultz (1998)); and, specifically, in Africa's context (Osili and Long (2008)). Taken together, these results suggest, through the effect on schooling, income windfalls also affect the age of females' first marriage and the number of children. The former, in particular, may explain why income windfalls in adolescence both decrease the level of schooling and the age of marriage for females, with the two constituting alternatives to each other.[18] This is also consistent with existing literature in relating low investment in girls' education and schooling attainments, among other factors, as being associated with child marriage, Petroni et al. (2017).

[18] Whereas many countries in Africa have legislated a minimum marriage age of 18 years for women, this happened relatively recently, for the most part a decade or so ago, and some countries still permit marriage below age 18 years with parental consent, hence creating a compromise for parents to marry off their daughters before they attain adult age. Additionally, marriage laws in several countries have provisions that allow children to marry in certain circumstances, which complicates even more the implementation of the ban on early marriage, especially because child marriage is a long term practice, culturally acceptable as the means to protect young women from premarital sex and the consequences of unintended pregnancy and sexually transmitted infections, see Petroni et al. (2015). Consequently, even nowadays almost 15 percent of girls marry our before they reach the age of 15 and some even before they reach the age of 10, Yaya et al. (2019).

In columns 3 and 4, we check whether early life (adolescence) income shocks affect women's employment status and type of occupation. Results show that these income shocks do not have a statistically significant impact on women's likelihood to be employed; however, the quality of the job matters. Early life (adolescence) income shocks increase (reduce) females' chances to get a skilled job, which is not surprising given that skilled jobs require a higher level of educational attainment. Finally, columns 6-8 show that females who have experienced income shocks in their childhood are more likely to work on all year basis and have a partner with active employment status; in contrast, females who have experienced that in their adolescence years are less likely to work on annual basis and more likely to have a partner who is not working. However, income shocks do not seem to affect the partner's educational level of attainment in a statistically significant manner.

While these results suggest that, beyond marriage, employment is also linked to income windfalls via schooling, they also indicate a stronger response of women's age at marriage to income shocks compared to employment opportunities. To further investigate that, Appendix Table A3 provides descriptive statistics of women's age at marriage and employment opportunities in both oil and non-oil provinces, and in comparison with men. The figures show that, indeed, women tend to marry at younger age compared to men with the difference being statistically significant: the average age of marriage for women in oil (non-oil) provinces is 19 (18) years old compared to men which is 25 (24) years old. This is consistent with existing literature that finds spousal age differences to be the largest in Africa across the world regions, see e.g., Polachek et al. (2010). While employment levels for men seem to be somewhat higher in both oil and non-oil provinces compared to women, these differences are not statistically significant. This is in line with our previous findings in Table 8 that income shocks do not have a statistically significant impact on women's likelihood to be employed. However, the descriptive analysis also shows differences in the types of jobs taken by residents of oil and non-oil provinces. Whereas individuals generally tend to work relatively more in service and professional sectors in oil provinces, and in agriculture in non-oil provinces, in both types of provinces women tend to be more employed in domestic and home production sectors compared to men. This is also consistent with the idea that marriage and non-market activity is a possible channel linking income shocks and lower response of educational attainment among adolescent girls.

7.2. Additional heterogeneity analyses and multiple hypothesis correction

While the above analysis already contains exhaustive heterogeneity analysis, such as with respect to gender, countries' and period's selection, we now take a further look at the issue. First, we explore whether the results significantly differ with respect to geographic areas in Africa. To this end, we have divided the sample of countries into five broad geographic areas, namely: North, East, South, West, and Central Africa. We then run our basic specification supplemented with interactions with geographic dummies, which are being analyzed relative to the North (i.e. omitted area). The results contained in Appendix Table A13 show that our average effect still holds. The dummies' interactions are insignificant with the exception of East Africa, which, however, contains just two countries, Ethiopia and Madagascar. This suggests that there is little heterogeneity in the effect of geographic areas on the fundamental relationship. Additionally, we perform a similar heterogeneity exercise with respect to religious denominations distinguishing between two major ones in our sample, Christians, Muslims, and Animists, with the latter category being the omitted one. As indicated in Appendix Table A14, the respective interaction terms lack statistical significance suggesting that the results affect all major religious groups in a similar manner.

Finally, we extend our analysis to check whether our baseline results regarding the age distribution of experiencing income windfalls also hold in countries outside Africa. Unfortunately, the DHS dataset does not have a good coverage of non-African countries, especially oil producers, and has limited provision of GPS data. Recall, we have specifically focused on African countries because they are well covered through multiple waves and because the corresponding GPS information of the surveyed households are provided. The latter is very important because it allows us to assign households to their respective oil and non-oil provinces. The only developing country outside of Africa that contains the required information, for which oil is of importance, yet which is not a major player in international oil markets is Indonesia. Indonesia is an oil producer, and oil is considered an important sector in its economy; at the same time, it is not a major oil producer, with total oil production representing around 0.01 of total world production in 2018.[19] Further, there are significant regional differences in Indonesia in terms of oil endowments.

[19] https://www.cia.gov/the-world-factbook/field/crude-oil-production/country-comparison

Hence, keeping these considerations in mind, we replicate the main portion of our analysis on Indonesia for the survey year 2003, for which the GPS data is available, and distinguishing as in the above analysis between oil rich and oil poor provinces. The results, shown in Table 11, are broadly consistent with the pattern displayed in the main analysis, see Table 4, above. They, in particular, indicate similar positive (negative) significant effects for income windfalls experienced during childhood (adolescence) on educational attainment, especially for the males. Not only are the coefficients statistically significant for the entire sample and for the male group, they are also similar in magnitude to the ones exhibited in Table 4. This suggests that our results may be relevant for developing countries outside of Africa, although further work in this direction is warranted.

As our analysis is conducted with two main outcome variables, education and wealth, one may want to apply a more stringent test to evaluate statistical significance of results. Recently, a number of such procedures have been developed, and we utilize one of these approaches, the Romano-Wolf multiple hypothesis correction, see Clarke et al., 2020. As seen from adjusted p-values in Appendix Table A17, with the exception of two cases our results remain statistically significant when using this more stringent test.

8. Conclusion

Whether or not natural resource wealth is a blessing or a curse for human capital accumulation, has been a long-standing subject of interest for economists, with existing literature having come up with contradictory conclusions in this regard. We contribute to this literature studying how income shocks resulting from oil price fluctuations have affected educational attainment and additional derived outcomes, depending on children age of incidence of these shocks and utilizing a large sample of Africa's households. Our empirical analysis finds, in line with the vast existing work, that income shocks in early childhood (ages 0-4) have a positive effect on subsequent educational attainment (and wealth), for both gender groups. More surprisingly, however, we find that income shocks in adolescence (ages 10-14) sometimes have a negative effect, especially for girls. These results hold under a variety of robustness checks, and they are economically significant. Focusing on adolescent girls who have experienced a positive oil price shock, we further find that they tend to marry earlier and have more children than those who have not experienced such a shock. These findings are consistent with those on educational attainment and with existing literature documenting that education causes women to marry later and to have fewer children.

Summarizing, therefore, this research depicts a convoluted picture of the effect of persistent income windfalls on schooling and associated outcomes that crucially depends on the incidence period of such windfalls. Our results help to reconcile the often contradictory findings pertaining to the effect of natural resource wealth on educational attainment and indicate that the aggregate effect crucially depends on the age distribution of the affected children. Further, such income windfalls have important distributional consequences across the households, depending on the age and gender distribution of the children within a household. While our results pertain to a specific world region, they are likely to extrapolate to other less developed countries that have yet to undergo fertility transition, whereas external validity with respect to richer more developed countries is less obvious.

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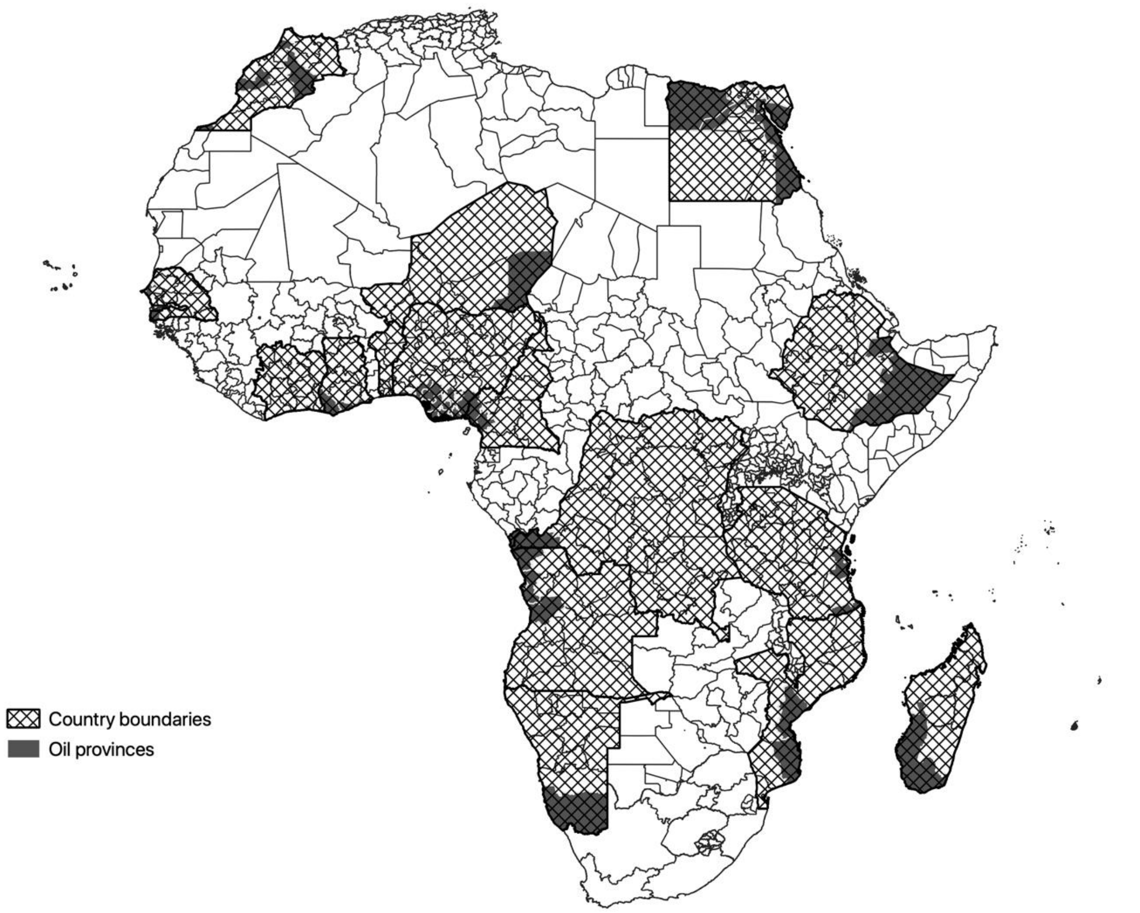


Figure 1. Location of oil provinces

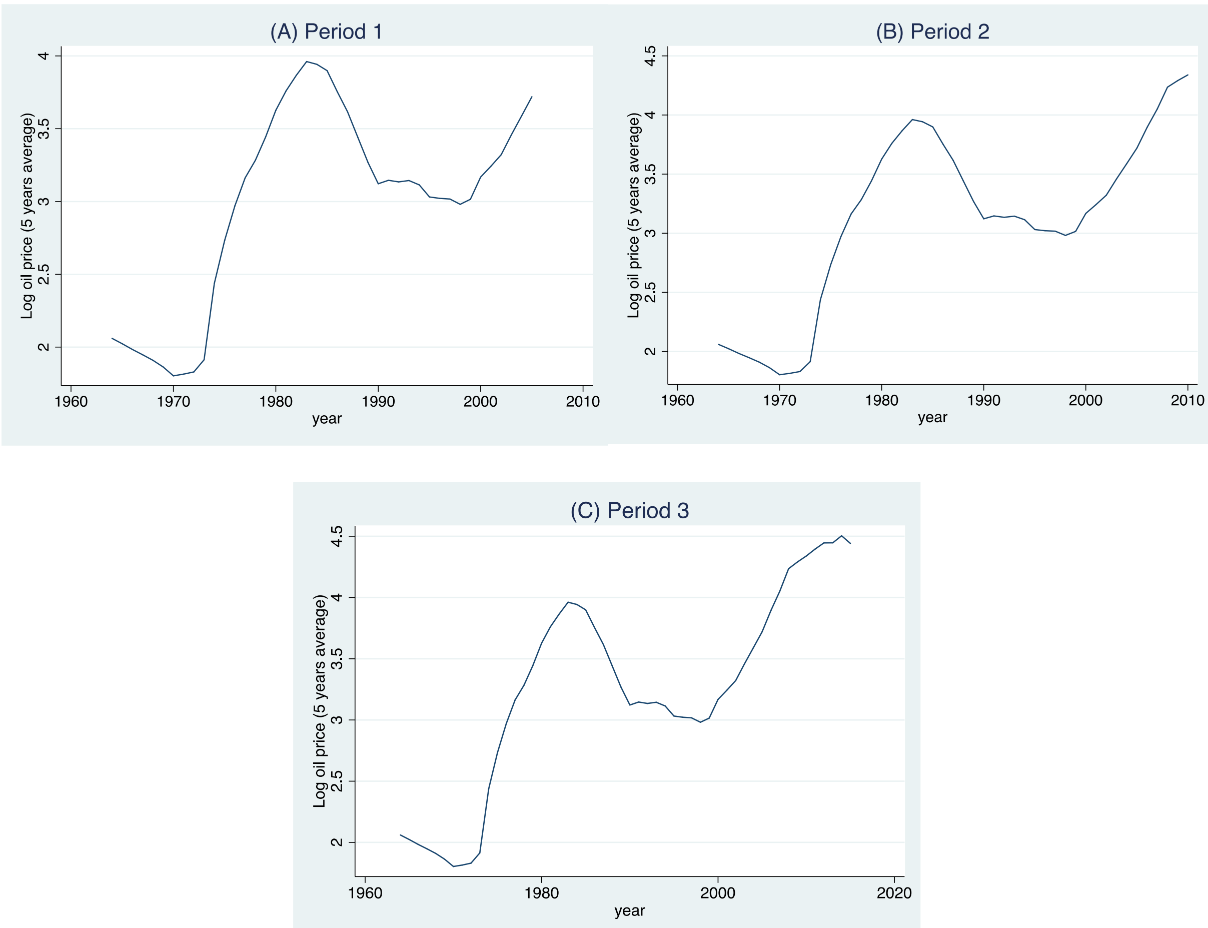
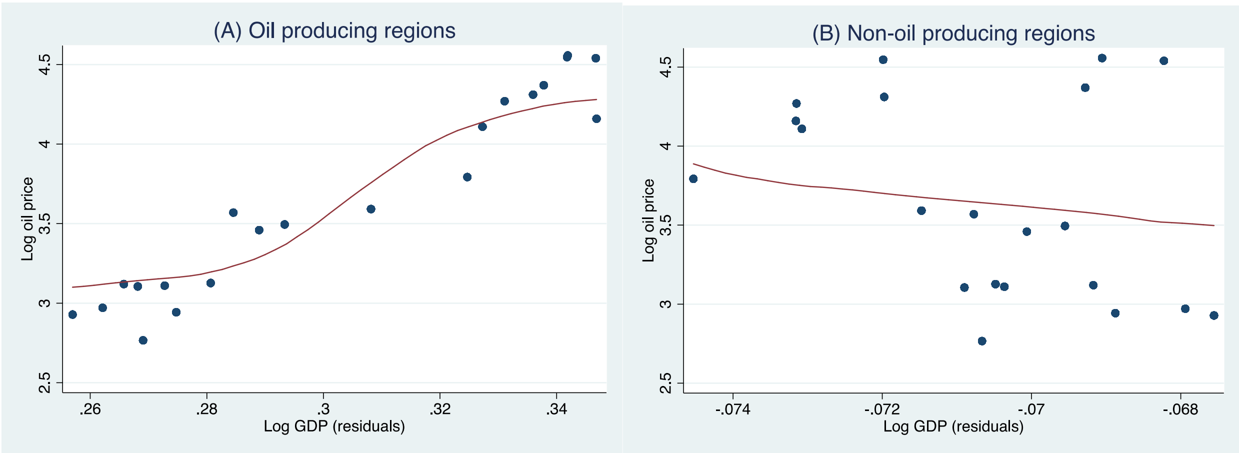


Figure 2. Log oil price over the 3 periods



Note: Both figures are net of province and year fixed effects. The solid line represents the nonparametric local polynomial fit computed using an Epanechnikov kernel.

Figure 3. Correlation- Log oil prices and average log GDP per capita at the province level

Table 1. Summary statistics

Variable	N	Mean	SD	Min	Max	Difference (oil vs. non-oil)
Education						
Oil provinces (All sample)	112,982	7.330	4.836	0	24	***
Oil provinces (Male sample)	27,854	8.430	4.455	0	24	***[a]
Oil provinces (Female sample)	85,128	6.970	4.901	0	24	***
Non-oil provinces (All sample)	467,496	4.802	4.832	0	24	
Non-oil provinces (Male sample)	110,070	6.032	4.801	0	24	
Non-oil provinces (Female sample)	357,426	4.423	4.778	0	24	
Wealth						
Oil provinces (All sample)	112,982	0.861	2.431	-1.608	8.274	***
Oil provinces (Male sample)	27,854	1.314	2.359	-1.608	8.274	***[a]
Oil provinces (Female sample)	85,128	0.712	2.435	-1.608	8.274	***
Oil provinces (All sample)	467,496	-0.165	1.986	-1.608	8.274	
Oil provinces (Male sample)	110,070	0.024	2.003	-1.608	8.274	
Oil provinces (Female sample)	357,426	-0.223	1.977	-1.608	8.274	
Log oil price						
Period 1	580,478	3.049	0.660	1.803	3.962	
Period 2	580,478	3.231	0.550	1.803	4.340	
Period 3	580,478	3.458	0.451	2.437	4.504	

[a] indicates the different between male and female samples is statistically significant. Difference is based on nonparametric K-sample test on the equality of medians.

Table 2. Oil price shocks and correlations with provincial pre-existing factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Period 1 (0-4 years old)						
	Vegetation index	**Min temperature**	**Max temperature**	**precipitation**	**Malaria index**	**population density**	**Elevation**
Oil province × survey year	-0.009	0.001	-0.006	0.428	-0.289	-1.626	-0.003
	(0.014)	(0.058)	(0.104)	(3.016)	(1.963)	(108.278)	(0.027)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	12,894	15,186	15,186	15,186	12,894	15,186	15,384
Number of provinces	212	220	220	220	212	220	220
R-squared	0.998	0.907	0.860	0.389	0.845	0.714	0.998
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, and month of survey. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 3. The effect of OPS experienced at any point in childhood/adolescence (ages 0-14) on education

	All Periods (0-14 years old)					
	Education	**Education**	**Education**	**Education**	**Education**	**Education**
	Full Sample	**Full Sample**	**Male sample**	**Male sample**	**Female sample**	**Female sample**
Oil price shock × Oil Province	-0.190	-0.210*	0.025	0.017	-0.246*	-0.268**
	(0.127)	(0.119)	(0.144)	(0.145)	(0.131)	(0.126)
Controls	No	Yes	No	Yes	No	Yes
Number of observations	580,478	580,478	137,924	137,924	442,554	442,554
Number of provinces	247	247	220	220	247	247
R-squared	0.320	0.420	0.297	0.387	0.350	0.431
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
Number of provinces	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-14 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 4. The effect of OPS experienced in different age periods on education

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.190*	0.203**	0.184*
	(0.097)	(0.099)	(0.101)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.084	0.057	-0.120
	(0.075)	(0.093)	(0.078)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.397***	-0.240*	-0.436***
	(0.124)	(0.139)	(0.126)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the region is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the region level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 5. The effect of OPS experienced in different age periods on future wealth

	(1)	(2)	(3)
		Panel A. Period 1 (0-4 years old)	
	Wealth	**Wealth**	**Wealth**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.647**	0.849**	0.592**
	(0.270)	(0.345)	(0.295)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.455	0.458	0.456
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
		Panel B. Period 2 (5-9 years old)	
Oil price shock × Oil Province	0.042	0.208	-0.001
	(0.242)	(0.408)	(0.252)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.455	0.457	0.456
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
		Panel C. Period 3 (10-14 years old)	
Oil price shock × Oil Province	-0.899***	-0.821*	-0.942***
	(0.314)	(0.426)	(0.328)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.455	0.457	0.456
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the household wealth index constructed as explained in text. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 6. Robustness for selection of countries and period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Only Angola and Nigeria			Oil producing countries since 1960			Post 1973 period		
	Panel A. Period 1 (0-4 years old)								
	Education	Education	Education	Education	Education	Education	Education	Education	Education
	Full Sample	Male sample	Female sample	Full Sample	Male sample	Female sample	Full Sample	Male sample	Female sample
Oil price shock × Oil Province	0.356***	0.214**	0.410***	0.265***	0.246***	0.258***	0.159*	0.209*	0.158*
	(0.115)	(0.103)	(0.126)	(0.088)	(0.093)	(0.094)	(0.086)	(0.107)	(0.088)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	134,846	37,911	96,935	237,383	49,328	188,055	479,319	114,876	364,441
Number of provinces	55	55	55	108	81	108	247	220	247
R-squared	0.459	0.341	0.491	0.372	0.324	0.377	0.426	0.383	0.442
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)								
Oil price shock × Oil Province	-0.180	-0.145	-0.173	-0.074	-0.087	-0.078	-0.553***	-0.057	-0.676***
	(0.117)	(0.132)	(0.126)	(0.090)	(0.122)	(0.095)	(0.180)	(0.202)	(0.181)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	134,846	37,911	96,935	237,383	49,328	188,055	479,319	114,876	364,441
Number of provinces	55	55	55	108	81	108	247	220	247
R-squared	0.459	0.341	0.491	0.372	0.324	0.377	0.426	0.383	0.442
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)								
Oil price shock × Oil Province	-0.689***	-0.385***	-0.775***	-0.501***	-0.363***	-0.520***	-0.490***	-0.252	-0.556***
	(0.141)	(0.132)	(0.148)	(0.112)	(0.119)	(0.115)	(0.157)	(0.161)	(0.160)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	134,846	37,911	96,935	237,383	49,328	188,055	479,319	114,876	364,441
Number of provinces	55	55	55	108	81	108	247	220	247
R-squared	0.459	0.341	0.491	0.372	0.324	0.377	0.426	0.383	0.442
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 7. Robustness for selection of oil provinces – drop oil fields that have started production after 1960

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.342***	0.316***	0.346***
	(0.101)	(0.099)	(0.103)
Controls	Yes	Yes	Yes
Number of observations	544,160	127,834	416,326
Number of provinces	238	238	238
R-squared	0.431	0.398	0.443
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.031	-0.004	-0.044
	(0.083)	(0.104)	(0.084)
Controls	Yes	Yes	Yes
Number of observations	544,160	127,834	416,326
Number of provinces	211	211	211
R-squared	0.431	0.398	0.443
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.595***	-0.483***	-0.629***
	(0.112)	(0.143)	(0.111)
Controls	Yes	Yes	Yes
Number of observations	544,160	127,834	416,326
Number of provinces	238	238	238
R-squared	0.431	0.398	0.443
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 8. Sample restricted to at least 18 years old

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.147*	0.196**	0.136
	(0.081)	(0.094)	(0.087)
Controls	Yes	Yes	Yes
Number of observations	506,949	117,951	388,998
Number of provinces	247	220	247
R-squared	0.427	0.395	0.436
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.009	0.083	-0.027
	(0.079)	(0.090)	(0.085)
Controls	Yes	Yes	Yes
Number of observations	506,949	117,951	388,998
Number of provinces	247	220	247
R-squared	0.427	0.395	0.436
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.263***	-0.215*	-0.276***
	(0.088)	(0.123)	(0.092)
Controls	Yes	Yes	Yes
Number of observations	506,949	117,951	388,998
Number of provinces	247	220	247
R-squared	0.427	0.395	0.436
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 9. Controlling for potential mineral confounders

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.200**	0.209**	0.187*
	(0.099)	(0.098)	(0.104)
Mineral confounder × Oil Province	0.018**	0.016	0.004
	(0.008)	(0.016)	(0.011)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.099	0.054	-0.129*
	(0.074)	(0.091)	(0.078)
Mineral price shock × Oil Province	0.002	0.004	-0.016*
	(0.007)	(0.017)	(0.009)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.427***	-0.264**	-0.431***
	(0.127)	(0.131)	(0.128)
Mineral price shock × Oil Province	0.012	0.017	-0.005
	(0.008)	(0.014)	(0.010)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Mineral price shock is the ln-5 years average of mineral price for period t multiplied by a dummy that take a value of 1 if the province is producing a given mineral. Minerals included are gold, silver, aluminum, copper, lead, nickel, zinc and tin. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 10. Other outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A. Period 1 (0-4 years old)						
	Number of children	**Age at first marriage**	**Employment**	**Skilled occupation**	**Work all year**	**Husband's education**	**Husband working**
	Female sample	**Female sample**	**Female sample**	**Female sample**	**Female sample**	**Female sample**	**Female sample**
Oil price shock × Oil Province	-0.124***	0.400***	0.008	0.006**	0.015**	0.015	0.018**
	(0.040)	(0.088)	(0.009)	(0.003)	(0.006)	(0.059)	(0.009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	442,479	336,429	441,627	441,627	233,134	318,689	328,181
Number of provinces	247	220	247	247	220	220	220
R-squared	0.589	0.242	0.264	0.050	0.199	0.393	0.222
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)						
Oil price shock × Oil Province	-0.068*	0.243***	-0.010	0.002	0.006	-0.015	-0.000
	(0.040)	(0.077)	(0.009)	(0.002)	(0.006)	(0.059)	(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	442,479	336,429	441,627	441,627	233,134	318,689	328,181
Number of provinces	247	220	247	247	220	220	220
R-squared	0.589	0.242	0.264	0.050	0.199	0.393	0.222
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)						
Oil price shock × Oil Province	0.121**	-0.274***	-0.017	-0.008*	-0.017*	-0.071	-0.031*
	(0.047)	(0.075)	(0.011)	(0.004)	(0.010)	(0.060)	(0.016)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	442,479	336,429	441,627	441,627	233,134	318,689	328,181
Number of provinces	247	220	247	247	220	220	220
R-squared	0.589	0.242	0.264	0.050	0.199	0.393	0.222
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table 11. Replication for Indonesia sample

	(1)	(2)	(3)
		Panel A. Period 1 (0-4 years old)	
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.318***	0.945**	0.167
	(0.114)	(0.398)	(0.125)
Controls	Yes	Yes	Yes
Number of observations	29,153	5,610	23,543
Number of provinces	26	26	26
R-squared	0.197	0.181	0.201
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
		Panel B. Period 2 (5-9 years old)	
Oil price shock × Oil Province	-0.193	-0.480	-0.127
	(0.142)	(0.300)	(0.151)
Controls	Yes	Yes	Yes
Number of observations	29,153	5,610	23,543
Number of provinces	26	26	26
R-squared	0.197	0.181	0.201
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
		Panel C. Period 3 (10-14 years old)	
Oil price shock × Oil Province	-0.308**	-0.767**	-0.160
	(0.140)	(0.297)	(0.133)
Controls	Yes	Yes	Yes
Number of observations	29,153	5,610	23,543
Number of provinces	26	26	26
R-squared	0.197	0.181	0.201
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the household wealth index constructed as explained in text. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

APPENDIX A

A1. MODEL

Consider the following model which is a simple extension of the one in Almond and Currie (2011). Suppose a household consisting of a parent and a child living for two generation-periods.[20] The child lives for two subperiods, j=1,2 and obtains schooling in each, so we denote $S_j, j = 1,2,$ skill investments in these subperiod. Income my be subject to a windfall, and we write it Y_j = Y+W_j, where Y is the basic level of income and W_j is the windfall. In each period, income is allocated between family consumption, C_j and schooling, S_j, subject to the budget constraint:

$$C_j + S_j = Y_j \tag{A1}$$

As in Cunha and Heckman, 2007, consider the following production function of human capital:

$$H = [\gamma(S_1)^{\phi} + (1-\gamma)(S_2)^{\phi}]^{1/\phi} \tag{A2}$$

so that the elasticity of substitution between the skill levels in the two periods is $\frac{1}{1-\phi}$.

The parent derives utility from family consumption and child's human capital:[21]

$$U(C_1, C_2, H) = \ln(C_1) + \ln(C_2) + \delta \ln(H) = \ln(C_1) + \ln(C_2) + \delta ln[\gamma(S_1)^{\phi} + (1-\gamma)(S_2)^{\phi}]^{1/\phi} \tag{A3}$$

where $\delta > 0$ designates time preference – or is related to the extent of parental altruism. Suppose for simplicity that C_1 is fixed; we then write upon substituting the budget constraints:

$$U(C_1, C_2, H) = \ln(C_1) + \ln(C_2) + \delta ln[\gamma(Y_1 - C_1)^{\phi} + (1-\gamma)(Y_2 - C_2)^{\phi}]^{1/\phi} \tag{A4}$$

Following Almond and Currie, 2011, it then can be shown that when ϕ, the parameter capturing the elasticity of substitution, is low enough, so that the substitution across the subperiods is hard, then $\frac{dS_2}{dW_1} > 0$, so that the second period schooling investment increases in response to a positive first period shock. It then follows that the cumulative effect on human capital consists of a positive effect on the first subperiod human capital (because of the income effect) and also on the second

[20] This is a simplified version of an OLG model whereby, in each period populated by parent-child units, parents derive utility from family consumption and children's human capital and are responsible for making budget allocation decisions.

[21] Assuming that human capital determines the next-period income leads to an OLG formulation of the model.

subperiod human capital. In contrast, an increase in the second period windfall causes, after a partial crowding out, only an increase in the second period human capital, $0 < \frac{dS_2}{dW_2} < 1$. Our empirical analysis, indicating that the positive effect of income shocks on human capital is stronger when experienced in early childhood, is consistent with a degree of complementarity across period in human capital. While it is not sufficient to generate a quantitative assessment of the degree of complementarity, it does at least provide some qualitative evidence in this regard.

This result is strengthened in the presence of dynamic complementarity in the accumulation of human capital as introduced in Cunha and Heckman, 2007. For instance, suppose that its production function is modified as follows:

$$H = [\gamma(S_1)^{\phi} + (1-\gamma)\left(\alpha(S_1)^{\phi}\right) + (S_2)^{\phi})]^{1/\phi} \qquad (A5)$$

where $\alpha > 0$ captures the dynamic complementarity or self productivity in the production of human capital. This reinforces the above identified positive effect of early life windfalls on human capital by a factor which is a function of α, the dynamic complementarity parameter, implying potential existence of an additional channel through which early life shocks affect the accumulation of human capital.

A further extension of the model could incorporate investment in health, which acts as a complement to human capital, see Ehrlich (2000) where this point is forcefully made. This, in turn, could open up interesting possibilities of studying the joint determination of the effects wealth and income have on both aspects, depending on the age incidence. Thus, Ehrlich, 2000, relying on the insurance motive, finds a positive effect of earnings capacity and wealth on health investment; reconciling this finding with our results in the context of such an extended model would be of interest.

A1. APPENDIX TABLES

Table A1. Detailed summary statistics

Variable	N	Mean	Difference (oil vs. non-oil)
Age at first marriage			
Oil provinces (All sample)	72,194	20.7	***
Oil provinces (Male sample)	12,897	25.3	***[a]
Oil provinces (Female sample)	59,297	19.7	***
Non-oil provinces (All sample)	336,110	18.9	
Non-oil provinces (Male sample)	58,978	23.6	
Non-oil provinces (Female sample)	277,132	18.0	
Work = 1			
Oil provinces (All sample)	112,750	0.570	N.a.
Oil provinces (Male sample)	27,820	0.727	N.a.[a]
Oil provinces (Female sample)	84,930	0.518	N.a.
Non-oil provinces (All sample)	466,615	0.567	
Non-oil provinces (Male sample)	109,918	0.764	
Non-oil provinces (Female sample)	356,697	0.506	
Agriculture = 1			
Oil provinces (All sample)	111,711	0.044	***
Oil provinces (Male sample)	27,562	0.062	***[a]
Oil provinces (Female sample)	84,149	0.039	***
Non-oil provinces (All sample)	462,448	0.077	
Non-oil provinces (Male sample)	109,331	0.110	
Non-oil provinces (Female sample)	353,117	0.067	
Service = 1			
Oil provinces (All sample)	111,711	0.031	***
Oil provinces (Male sample)	27,562	0.032	***[a]
Oil provinces (Female sample)	84,149	0.031	***
Non-oil provinces (All sample)	462,448	0.019	
Non-oil provinces (Male sample)	109,331	0.019	
Non-oil provinces (Female sample)	353,117	0.018	
Domestic = 1			
Oil provinces (All sample)	111,711	0.011	***
Oil provinces (Male sample)	27,562	0.004	***[a]
Oil provinces (Female sample)	84,149	0.013	***
Non-oil provinces (All sample)	462,448	0.005	
Non-oil provinces (Male sample)	109,331	0.002	
Non-oil provinces (Female sample)	353,117	0.006	
Professional = 1			
Oil provinces (All sample)	111,711	0.060	***
Oil provinces (Male sample)	27,562	0.086	***[a]
Oil provinces (Female sample)	84,149	0.052	***
Oil provinces (All sample)	462,448	0.039	
Oil provinces (Male sample)	109,331	0.060	
Oil provinces (Female sample)	353,117	0.032	

[a] indicates the different between male and female samples is statistically significant. Difference is based on nonparametric K-sample test on the equality of medians.

Table A2. Unit root testing

Variable	Log Oil Prices (Period 1)		Log Oil Prices (Period 2)		Log Oil Prices (Period 3)	
	without trend	with trend	without trend	with trend	without trend	with trend
Dickey-Fuller	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Dickey-Fuller-GLS	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Philipps-Perron	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Note: All tests are based on 5-years average oil prices (log). Abbreviation: n.s., not significant at the 10% level.

Table A3a. Oil prices and provincial GDP

	(1)	(2)	(3)	(4)	(5)	(6)
	Log (GDP per capita)	Log (GDP per capita)	Log (GDP per capita)	Log(GDP per capita)	Log (GDP per capita)	Log(GDP per capita)
log(oil price), t x oil province	0.052**					
	(0.024)					
log(oil price), t-1 x oil province		0.053**				
		(0.025)				
log(oil price), lag 3-year average x oil province			0.058**			
			(0.028)			
log(oil price), lag 5-year average x oil province				0.060**		
				(0.030)		
log(oil price), lag 7-year average x oil province					0.065*	
					(0.033)	
log(oil price), lag 10-year average x oil province						0.070*
						(0.038)
Number of observations	4,830	4,830	4,830	4,830	4,830	4,830
Number of provinces	230	230	230	230	230	230
R-squared	0.979	0.979	0.979	0.979	0.979	0.979
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the log(GDP per capita) for the period 1992-2012. Oil province is a dummy that takes a value of 1 if the province is producing oil. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A3b. Oil prices and household income – Nigeria

	(1)	(2)	(3)	(4)	(5)	(6)
	Real household income per capita (log)	**Real household income per capita (log)**	**Real household income per capita (log)**	**Real household income per capita (log)**	**Real household income per capita (log)**	**Real household income per capita (log)**
log(oil price), t x oil province	0.061					
	(0.485)					
log(oil price), t-1 x oil province		1.843*				
		(0.944)				
log(oil price), lag 3-year average x oil province			1.929*			
			(1.000)			
log(oil price), lag 5-year average x oil province				3.627**		
				(1.722)		
log(oil price), lag 7-year average x oil province					1.359	
					(1.384)	
log(oil price), lag 10-year average x oil province						-0.273
						(1.089)
Number of observations	136	136	136	136	136	136
Number of provinces	37	37	37	37	37	37
R-squared	0.181	0.215	0.218	0.213	0.185	0.181
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A4a: Parallel trend test 1989

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	-0.327	0.447	-0.524
	(0.476)	(0.624)	(0.584)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of provinces	247	220	247
R-squared	0.427	0.375	0.447
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.248	0.744	-0.631
	(0.395)	(0.581)	(0.435)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of provinces	247	220	247
R-squared	0.449	0.405	0.466
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	0.427	0.761	0.224
	(0.338)	(0.726)	(0.402)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of provinces	247	220	247
R-squared	0.452	0.414	0.466
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

A4b. Event study

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province X 1989	-0.657	-0.657	-0.550
	(0.968)	(2.473)	(1.360)
Oil price shock × Oil Province X 1990	-0.408	-0.630	-0.238
	(0.880)	(2.293)	(1.224)
Oil price shock × Oil Province X 1991	-0.344	-0.547	-0.157
	(0.812)	(1.977)	(1.130)
Oil price shock × Oil Province X 1992	-0.406	-0.684	-0.234
	(0.727)	(1.774)	(0.985)
Oil price shock × Oil Province X 1993	-0.385	-0.698	-0.191
	(0.588)	(1.526)	(0.830)
Oil price shock × Oil Province X 1994	-0.346	-0.491	-0.231
	(0.513)	(1.266)	(0.728)
Oil price shock × Oil Province X 1995	-0.251	-0.406	-0.157
	(0.421)	(1.076)	(0.578)
Oil price shock × Oil Province X 1996	-0.283	-0.408	-0.212
	(0.338)	(0.871)	(0.418)
Oil price shock × Oil Province X 1997	-0.195	-0.320	-0.153
	(0.272)	(0.568)	(0.334)
Oil price shock × Oil Province X 1998	-0.114	-0.257	-0.071
	(0.136)	(0.407)	(0.218)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of regions	247	220	247
R-squared	0.427	0.375	0.447
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province X 1989	0.214	0.356	-0.018
	(1.216)	(1.917)	(1.325)
Oil price shock × Oil Province X 1990	-0.139	-0.185	-0.277
	(1.113)	(1.767)	(1.202)
Oil price shock × Oil Province X 1991	0.063	0.045	-0.047
	(0.963)	(1.519)	(1.054)
Oil price shock × Oil Province X 1992	0.188	0.455	-0.018
	(0.870)	(1.370)	(0.959)
Oil price shock × Oil Province X 1993	0.213	0.273	0.086
	(0.741)	(1.187)	(0.812)
Oil price shock × Oil Province X 1994	0.245	0.398	0.081
	(0.619)	(0.975)	(0.687)
Oil price shock × Oil Province X 1995	0.347	0.255	0.278
	(0.522)	(0.849)	(0.566)
Oil price shock × Oil Province X 1996	0.316	0.220	0.301
	(0.391)	(0.650)	(0.429)

Oil price shock × Oil Province X 1997	0.110	-0.029	0.105
	(0.307)	(0.463)	(0.335)
Oil price shock × Oil Province X 1998	0.077	-0.113	0.123
	(0.203)	(0.306)	(0.215)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of regions	247	220	247
R-squared	0.449	0.405	0.466
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province X 1989	0.521	-1.388	1.251
	(0.993)	(2.151)	(1.005)
Oil price shock × Oil Province X 1990	0.581	-1.415	1.351
	(0.915)	(1.971)	(0.903)
Oil price shock × Oil Province X 1991	0.527	-0.950	1.115
	(0.808)	(1.789)	(0.813)
Oil price shock × Oil Province X 1992	0.500	-0.752	1.012
	(0.745)	(1.571)	(0.743)
Oil price shock × Oil Province X 1993	0.558	-0.680	1.018
	(0.664)	(1.412)	(0.643)
Oil price shock × Oil Province X 1994	0.457	-0.711	0.892
	(0.527)	(1.136)	(0.546)
Oil price shock × Oil Province X 1995	0.010	-1.101	0.427
	(0.444)	(0.937)	(0.438)
Oil price shock × Oil Province X 1996	0.132	-0.736	0.479
	(0.351)	(0.696)	(0.372)
Oil price shock × Oil Province X 1997	0.138	-0.208	0.288
	(0.272)	(0.585)	(0.270)
Oil price shock × Oil Province X 1998	0.076	-0.235	0.211
	(0.181)	(0.399)	(0.192)
Controls	Yes	Yes	Yes
Number of observations	185,366	46,964	138,402
Number of regions	247	220	247
R-squared	0.452	0.414	0.466
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the region is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the region level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A5. Further robustness for selection of countries

	(1)	(2)	(3)	(4)	(5)	(6)
	Drop countries with only 1 province			**Including non-oil producers**		
	Panel A. Period 1 (0-4 years old)					
	Education	**Education**	**Education**	**Education**	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**	**Full Sample**	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.198**	0.204*	0.204**	0.132	0.169*	0.131
	(0.097)	(0.105)	(0.103)	(0.090)	(0.087)	(0.095)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	430,541	99,387	331,154	1,122,325	291,450	830,872
Number of provinces	177	150	177	462	435	462
R-squared	0.401	0.375	0.407	0.435	0.393	0.451
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)					
Oil price shock × Oil Province	-0.088	0.034	-0.106	-0.058	-0.029	-0.064
	(0.076)	(0.096)	(0.081)	(0.073)	(0.092)	(0.074)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	430,541	99,387	331,154	1,122,325	291,450	830,872
Number of provinces	177	150	177	462	435	462
R-squared	0.401	0.375	0.407	0.435	0.393	0.451
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)					
Oil price shock × Oil Province	-0.414***	-0.270*	-0.446***	-0.278**	-0.289**	-0.288**
	(0.135)	(0.158)	(0.137)	(0.117)	(0.127)	(0.121)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	430,541	99,387	331,154	1,122,325	291,450	830,872
Number of provinces	177	150	177	462	435	462
R-squared	0.401	0.375	0.407	0.435	0.393	0.451
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A6. Placebo test- Reshuffling of oil provinces

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.007	0.011	0.005
	(0.004)	(0.008)	(0.005)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 1 (5-9 years old)		
Oil price shock × Oil Province	0.001	-0.003	0.002
	(0.004)	(0.008)	(0.005)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 1 (10-14 years old)		
Oil price shock × Oil Province	-0.001	-0.006	0.001
	(0.004)	(0.008)	(0.005)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A7. Differentiating between oil boom and bust periods

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Period 1 (0-4 years old)					
	Education	**Education**	**Education**	**Education**	**Education**	**Education**
	Full Sample	**Full Sample**	**Male sample**	**Male sample**	**Female sample**	**Female sample**
	Oil boom	**Oil bust**	**Oil boom**	**Oil bust**	**Oil boom**	**Oil bust**
Oil price shock × Oil Province	0.319***	0.209	0.360***	0.073	0.317***	0.244*
	(0.108)	(0.128)	(0.110)	(0.144)	(0.117)	(0.134)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	230,247	350,230	53,350	84,572	176,896	265,657
Number of provinces	247	247	220	220	247	247
R-squared	0.419	0.425	0.388	0.394	0.432	0.437
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)					
Oil price shock × Oil Province	-0.048	0.069	0.090	0.164	-0.075	0.045
	(0.087)	(0.107)	(0.128)	(0.114)	(0.090)	(0.123)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	272,948	307,530	64,988	72,936	207,960	234,593
Number of provinces	247	247	220	220	247	247
R-squared	0.404	0.441	0.378	0.407	0.415	0.454
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)					
Oil price shock × Oil Province	-0.372***	-0.018	-0.191*	0.239	-0.420***	-0.145
	(0.111)	(0.182)	(0.127)	(0.280)	(0.120)	(0.214)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	317,991	262,487	78,169	59,753	239,821	202,731
Number of provinces	247	247	220	220	247	247
R-squared	0.409	0.441	0.384	0.406	0.419	0.453
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A8. Oil provinces with only onshore fields

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	Education	Education
	Full Sample	Male sample	Female sample
Oil price shock × Oil Province	0.354***	0.359***	0.340**
	(0.120)	(0.101)	(0.132)
Controls	Yes	Yes	Yes
Number of observations	536,109	125,923	410,186
Number of provinces	231	231	231
R-squared	0.428	0.395	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	0.050	0.122	0.023
	(0.073)	(0.137)	(0.074)
Controls	Yes	Yes	Yes
Number of observations	536,109	125,923	410,186
Number of provinces	206	206	206
R-squared	0.428	0.395	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.503***	-0.413**	-0.515***
	(0.176)	(0.192)	(0.178)
Controls	Yes	Yes	Yes
Number of observations	536,109	125,923	410,186
Number of provinces	231	231	231
R-squared	0.428	0.395	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Non-migrants is a dummy that takes the value of 1 if the respondent answered that he/she has been always residing in the place of residency. The dummy is also included on its own. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

A9. Design Inference

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.190*	0.203**	0.184*
	(0.097)	(0.099)	(0.101)
p-value OLS	{0.50}	{0.041}	{0.070}
p-value randomization test	[0.09]	[0.083]	[0.100]
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.084	0.057	-0.120
	(0.075)	(0.093)	(0.078)
p-value OLS	{0.262}	{0.545}	{0.124}
p-value randomization test	[0.350]	[0.586]	[0.194]
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.397***	-0.240*	-0.436***
	(0.124)	(0.139)	(0.126)
p-value OLS	{0.002}	{0.087}	{0.001}
p-value randomization test	[0.002]	[0.096]	[0.003]
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of regions	247	220	247
R-squared	0.420	0.387	0.431
Region FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the region is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the region level. The p-value in square brackets is based on randomization inference test of 1000 draws under the null hypothesis of no treatment effect. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A10a. Controlling for migration

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.189*	0.202**	0.188*
	(0.098)	(0.099)	(0.103)
Oil price shock × Oil Province × Non-migrants	0.006	0.134	-0.014
	(0.046)	(0.205)	(0.050)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.085	0.056	-0.118
	(0.074)	(0.094)	(0.078)
Oil price shock × Oil Province × Non-migrants	0.005	0.148	-0.012
	(0.044)	(0.206)	(0.047)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.398***	-0.239*	-0.436***
	(0.124)	(0.139)	(0.126)
Oil price shock × Oil Province × Non-migrants	-0.010	0.109	-0.028
	(0.043)	(0.200)	(0.046)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Non-migrants is a dummy that takes the value of 1 if the respondent answered that he/she has been always residing in the place of residency. The dummy is also included on its own. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A10b. Migrants only

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.191	0.232	0.134
	(0.122)	(0.154)	(0.112)
Controls	Yes	Yes	Yes
Number of observations	178,004	68,985	109,019
Number of provinces	236	209	236
R-squared	0.412	0.411	0.421
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	0.052	0.086	0.000
	(0.090)	(0.103)	(0.097)
Controls	Yes	Yes	Yes
Number of observations	178,004	68,985	109,019
Number of provinces	236	209	236
R-squared	0.412	0.411	0.421
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.162	-0.216	-0.150
	(0.112)	(0.172)	(0.118)
Controls	Yes	Yes	Yes
Number of observations	178,004	68,985	109,019
Number of provinces	236	209	236
R-squared	0.412	0.411	0.421
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A10c. No migrants

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.216**	0.238*	0.208*
	(0.105)	(0.136)	(0.107)
Controls	Yes	Yes	Yes
Number of observations	402,473	68,926	333,534
Number of provinces	247	170	247
R-squared	0.435	0.380	0.444
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.133*	0.049	-0.148*
	(0.080)	(0.144)	(0.079)
Controls	Yes	Yes	Yes
Number of observations	402,473	68,926	333,534
Number of provinces	247	170	247
R-squared	0.435	0.380	0.444
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.148*	-0.324*	-0.494***
	(0.079)	(0.202)	(0.157)
Controls	Yes	Yes	Yes
Number of observations	402,473	68,926	333,534
Number of provinces	247	170	247
R-squared	0.435	0.380	0.444
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A11. Oil price shocks and population characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Total poulation	**Total female**	**Total male**	**Urban population**	**Rural population**	**Migrants**
log(oil price), t-1 x oil province	-61.068	-17.217	-34.947	9.194	-70.262	-29.584
	(80.128)	(77.162)	(34.166)	(87.859)	(65.787)	(85.518)
Number of observations	802	640	584	802	802	802
Number of provinces	217	189	184	217	217	217
R-squared	0.964	0.951	0.977	0.960	0.957	0.963
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey-month FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific time trend	Yes	Yes	Yes	Yes	Yes	Yes

Oil province is a dummy that takes a value of 1 if the province is producing oil. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A12. Controlling for early life shocks

	Period 3 (10-14 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	-0.386***	-0.133	-0.450***
	(0.118)	(0.149)	(0.119)
Oil price shock × Oil Province in Period 1	0.016	0.141	-0.018
	(0.093)	(0.102)	(0.099)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	247	220
R-squared	0.420	0.387	0.431
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A13. Robustness for wealth index – adding indicators

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Wealth	**Wealth**	**Wealth**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.568**	0.883**	0.498*
	(0.278)	(0.382)	(0.294)
Controls	Yes	Yes	Yes
Number of observations	406,691	113,467	293,224
Number of provinces	247	220	247
R-squared	0.437	0.432	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.084	0.177	-0.136
	(0.248)	(0.390)	(0.308)
Controls	Yes	Yes	Yes
Number of observations	406,691	113,467	293,224
Number of provinces	247	220	247
R-squared	0.437	0.432	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.921***	-0.991**	-0.917**
	(0.349)	(0.439)	(0.357)
Controls	Yes	Yes	Yes
Number of observations	406,691	113,467	293,224
Number of provinces	247	220	247
R-squared	0.437	0.432	0.441
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the household wealth index constructed as explained in text. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A14. Robustness for wealth index – dropping indicators

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Wealth	**Wealth**	**Wealth**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.648**	0.869**	0.587*
	(0.272)	(0.347)	(0.299)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.452	0.454	0.453
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	0.026	0.177	-0.007
	(0.246)	(0.415)	(0.254)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.452	0.454	0.453
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.920***	-0.871**	-0.948***
	(0.318)	(0.428)	(0.336)
Controls	Yes	Yes	Yes
Number of observations	466,754	129,652	337,102
Number of provinces	247	220	247
R-squared	0.452	0.454	0.453
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the household wealth index constructed as explained in text. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A15: Heterogeneity analysis – by geographic area

	(1)	(3)	(5)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.230***	0.345**	0.221***
	(0.079)	(0.150)	(0.080)
Oil price shock × Oil Province × South	-0.119	-0.195	-0.150
	(0.293)	(0.220)	(0.311)
Oil price shock × Oil Province × East	-0.370**	-0.538**	-0.381***
	(0.148)	(0.230)	(0.135)
Oil price shock × Oil Province × West	-0.024	-0.119	-0.037
	(0.135)	(0.174)	(0.146)
Oil price shock × Oil Province × Center	0.046	0.051	0.111
	(0.204)	(0.264)	(0.196)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.421	0.389	0.432
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.184**	-0.045	-0.216***
	(0.076)	(0.108)	(0.077)
Oil price shock × Oil Province × South	0.177	0.169	0.146
	(0.294)	(0.183)	(0.312)
Oil price shock × Oil Province × East	-0.060	-0.172	-0.066
	(0.146)	(0.204)	(0.131)
Oil price shock × Oil Province × West	0.273**	0.244*	0.260*
	(0.134)	(0.127)	(0.145)
Oil price shock × Oil Province × Center	0.342*	0.363**	0.405**
	(0.192)	(0.141)	(0.189)
Controls	Yes	Yes	Yes
Number of observations	0.421	0.389	0.432
Number of provinces	247	220	247
R-squared	0.403	0.374	0.412
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.388***	-0.115*	-0.454***
	(0.113)	(0.145)	(0.113)
Oil price shock × Oil Province × South	-0.075	0.096	-0.148
	(0.296)	(0.188)	(0.313)
Oil price shock × Oil Province × East	-0.288**	-0.238	-0.330**
	(0.143)	(0.188)	(0.133)
Oil price shock × Oil Province × West	0.025	0.172	-0.027
	(0.115)	(0.112)	(0.131)
Oil price shock × Oil Province × Center	0.094	0.291	0.119
	(0.218)	(0.180)	(0.210)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.421	0.389	0.432
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A16: Heterogeneity analysis – by religion

	(1)	(3)	(5)
	Panel A. Period 1 (0-4 years old)		
	Education	**Education**	**Education**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.161*	0.236**	0.138*
	(0.102)	(0.109)	(0.104)
Oil price shock × Oil Province × Christian	0.009	-0.025	0.025
	(0.077)	(0.080)	(0.079)
Oil price shock × Oil Province × Muslim	-0.035	-0.100	-0.019
	(0.075)	(0.113)	(0.071)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.403	0.374	0.412
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.081	0.065	-0.123
	(0.072)	(0.094)	(0.076)
Oil price shock × Oil Province × Christian	0.002	-0.031	0.017
	(0.075)	(0.077)	(0.077)
Oil price shock × Oil Province × Muslim	-0.012	-0.055	-0.003
	(0.069)	(0.107)	(0.064)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.403	0.374	0.412
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.354***	-0.236*	-0.386***
	(0.111)	(0.124)	(0.114)
Oil price shock × Oil Province × Christian	-0.004	-0.037	0.012
	(0.072)	(0.073)	(0.074)
Oil price shock × Oil Province × Muslim	-0.003	-0.049	0.007
	(0.067)	(0.104)	(0.061)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.403	0.374	0.412
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Table A17. Multiple hypothesis correction

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Period 1 (0-4 years old)					
	Education	**Wealth**	**Education**	**Wealth**	**Education**	**Wealth**
	Full Sample	**Full Sample**	**Male sample**	**Male sample**	**Female sample**	**Female sample**
Oil price shock × Oil Province	0.190*	0.647**	0.203**	0.849**	0.184*	0.592**
	(0.097)	(0.270)	(0.099)	(0.345)	(0.101)	(0.295)
Romano-Wolf p-value	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	580,478	466,754	137,924	129,652	442,554	337,102
Number of regions	247	247	220	220	247	247
R-squared	0.420	0.455	0.387	0.458	0.431	0.456
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)					
Oil price shock × Oil Province	-0.084	0.042	0.057	0.208	-0.120	-0.001
	(0.075)	(0.242)	(0.093)	(0.408)	(0.078)	(0.252)
Romano-Wolf p-value	[0.01]	[0.732]	[0.277]	[0.396]	[0.01]	[1.00]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	580,478	466,754	137,924	129,652	442,554	337,102
Number of regions	247	247	220	220	247	247
R-squared	0.420	0.455	0.387	0.457	0.431	0.456
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)					
Oil price shock × Oil Province	-0.397***	-0.899***	-0.240*	-0.821*	-0.436***	-0.942***
	(0.124)	(0.314)	(0.139)	(0.426)	(0.126)	(0.328)
Romano-Wolf p-value	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	580,478	466,754	137,924	129,652	442,554	337,102
Number of regions	247	247	220	220	247	247
R-squared	0.420	0.455	0.387	0.457	0.431	0.456
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Region specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the region is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the region level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix B (online)

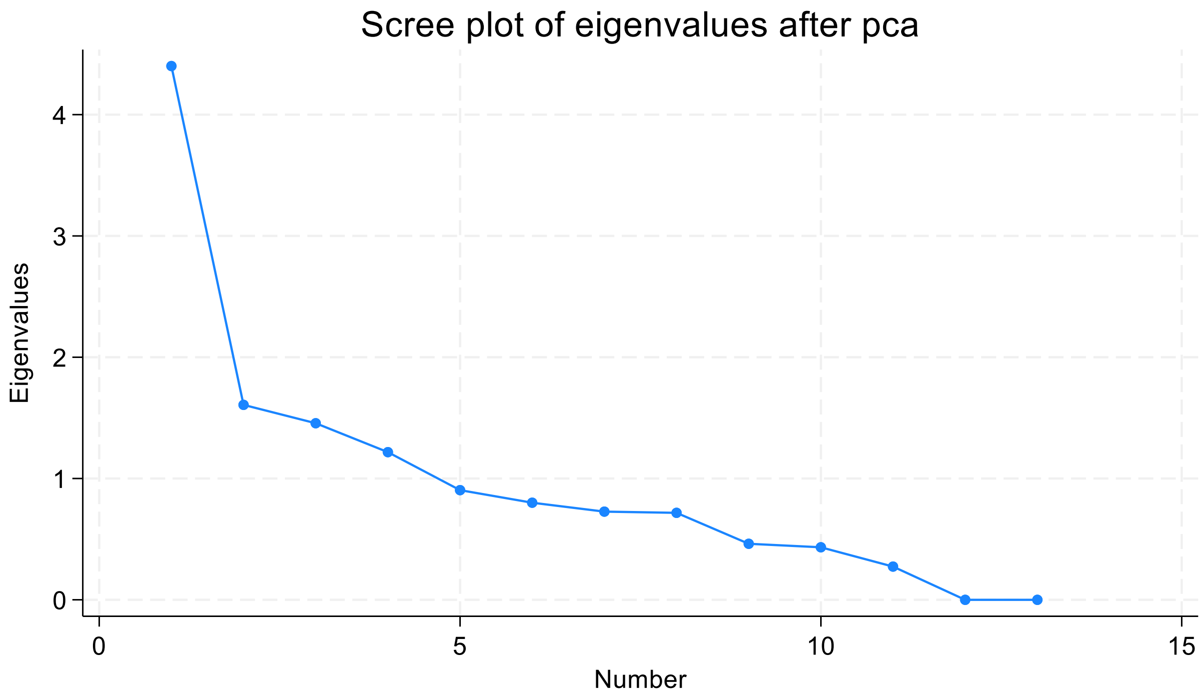


Figure B1. Scree plot of the eigenvalues for each component

Appendix Table B0. Sampled countries and survey waves

Country	Number of oil provinces	Number of non-oil provinces	Year	Country	Number of oil provinces	Number of non-oil provinces	Year
Angola	5	13	2015	Namibia	1	12	2000
Cameroon	2	8	1991	Namibia	1	12	2006
Cameroon	2	8	2004	Namibia	1	12	2013
Cameroon	2	8	2011	Niger	1	7	1992
Congo democratic republic	1	25	2007	Niger	1	7	1998
Congo democratic republic	1	25	2013	Nigeria	11	26	1990
Benin	1	11	1996	Nigeria	11	26	2003
Benin	1	11	2001	Nigeria	11	26	2008
Benin	1	11	2011	Nigeria	11	26	2013
Ethiopia	1	10	2000	Nigeria	11	26	2018
Ethiopia	1	10	2005	Senegal	3	11	2005
Ghana	3	7	1993	Senegal	3	11	2010
Ghana	3	7	1998	Senegal	3	11	2012
Ghana	3	7	2003	Senegal	3	11	2014
Ghana	3	7	2008	Senegal	3	11	2015
Ghana	3	7	2014	Senegal	3	11	2016
Cote d'ivoire	1	14	1994	Egypt	5	17	1992
Cote d'ivoire	1	14	1998	Egypt	5	17	1995
Cote d'ivoire	1	14	2011	Egypt	5	17	2005
Madagascar	1	5	1997	Egypt	5	17	2008
Madagascar	1	5	2008	Egypt	5	17	2014
Mozambique	2	9	2011	Tanzania	3	27	1999

Appendix Table B1: Oil price shocks and educational quality

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Educational quality	**Educational quality**	**Educational quality**
	Full Sample	**Male sample**	**Female sample**
Oil price shock × Oil Province	0.037**	0.039**	0.037*
	(0.018)	(0.019)	(0.019)
Controls	Yes	Yes	Yes
Number of observations	580837	138055	442782
Number of provinces	247	220	247
R-squared	0.413	0.357	0.427
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.009	0.018	-0.016
	(0.013)	(0.016)	(0.014)
Controls	Yes	Yes	Yes
Number of observations	580837	138055	442782
Number of provinces	247	220	247
R-squared	0.413	0.357	0.427
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.070***	-0.039	-0.436***
	(0.026)	(0.027)	(0.126)
Controls	Yes	Yes	Yes
Number of observations	580837	138055	442782
Number of provinces	247	220	247
R-squared	0.413	0.357	0.427
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the educational quality measured by the completion of educational stages, with higher values indicating completion of higher educational stages. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix Table B2: Lags and leads

	(1)	(2)	(3)	(4)	(5)
	Log(GDP per capita)	**Log(GDP per capita)**	**Log(GDP per capita)**	**Log(GDP per capita)**	**Log(GDP per capita)**
log(oil price), t x oil province	0.044*				
	(0.023)				
log(oil price), t+4 x oil province	0.009				
	(0.016)				
log(oil price), t-1 x oil province		0.039*			
		(0.023)			
log(oil price), t+4 x oil province		0.020			
		(0.014)			
log(oil price), lag 3-year average x oil province			0.052*		
			(0.031)		
log(oil price), forward 5-year average x oil province			0.013		
			(0.020)		
log(oil price), lag 5-year average x oil province				0.067*	
				(0.036)	
log(oil price), forward 6-year average x oil province				0.014	
				(0.021)	
log(oil price), lag 10-year average x oil province					0.090***
					(0.035)
log(oil price), forward 10-year average x oil province					0.035
					(0.023)
Number of observations	3,910	3,680	3,680	3,450	2,530
Number of provinces	230	230	230	230	230
R-squared	0.985	0.986	0.987	0.989	0.992
Province FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Country specific-time trend	Yes	Yes	Yes	Yes	Yes

The dependent variable is the log(GDP per capita) for the period 1992-2012. Oil province is a dummy that takes a value of 1 if the region is producing oil. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the region level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix Table B3: Disaggregating period 2 age bracket into 2 groups: ages (5-7 years old) and ages (8-9 years old)

	(1)	(2)	(3)	(4)	(5)	(6)
	Period 2 (5-9 years old)					
	Education	**Education**	**Education**	**Education**	**Education**	**Education**
	Full Sample	**Full Sample**	**Male sample**	**Male sample**	**Female sample**	**Female sample**
Oil price shock × Oil Province (5-7 years)	-0.145**		-0.000		-0.181**	
	(0.068)		(0.091)		(0.071)	
Oil price shock × Oil Province (8 & 9 years)		0.025		0.116		-0.001
		(0.073)		(0.085)		(0.076)
Controls	Yes	Yes				Yes
Number of observations	580,478	580,478	137,924	137,924	442,554	442,554
Number of provinces	247	247	220	220	247	247
R-squared	0.420	0.420	0.387	0.387	0.431	0.431
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the number of years of education. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix Table B4: Disaggregating period 3 age bracket into 2 groups: ages (10-12 years old) and ages (13-14 years old)

	(1)	(2)	(3)	(4)	(5)	(6)
	Period 3 (10-14 years old)					
	Education	**Education**	**Education**	**Education**	**Education**	**Education**
	Full Sample	**Full Sample**	**Male sample**	**Male sample**	**Female sample**	**Female sample**
Oil price shock × Oil Province (10-12 years)	-0.387***		-0.264*		-0.414***	
	(0.133)		(0.138)		(0.137)	
Oil price shock × Oil Province (13 & 14 years)		-0.253***		-0.109		-0.293***
		(0.071)		(0.098)		(0.073)
Controls	Yes	Yes				Yes
Number of observations	580,478	580,478	137,924	137,924	442,554	442,554
Number of provinces	247	247	220	220	247	247
R-squared	0.42	0.42	0.387	0.387	0.431	0.431
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the number of years of education. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix Table B5: Oil price shocks and number of schools

	(1)	(2)	(3)
	Number of schools	Number of schools	Number of schools
log(oil price), t-1 x oil province	-4.468		
	(18.384)		
log(oil price), 3-year average x oil province		-3.479	
		(17.637)	
log(oil price), 5-year average x oil province			-5.650
			(18.633)
Number of observations	628	628	628
Number of provinces	183	183	183
R-squared	0.081	0.081	0.081
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

The dependent variable is the number of schools covering the years from 2002-2015. Oil province is a dummy that takes a value of 1 if the province is producing oil. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.

Appendix Table B6: Double clustering (province and survey year)

	(1)	(2)	(3)
	Panel A. Period 1 (0-4 years old)		
	Education	Education	Education
	Full Sample	Male sample	Female sample
Oil price shock × Oil Province	0.200*	0.199**	0.195
	(0.107)	(0.083)	(0.116)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.384	0.430
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel B. Period 2 (5-9 years old)		
Oil price shock × Oil Province	-0.076	0.055	-0.105
	(0.095)	(0.087)	(0.100)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.384	0.430
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes
	Panel C. Period 3 (10-14 years old)		
Oil price shock × Oil Province	-0.405***	-0.237*	-0.440***
	(0.134)	(0.122)	(0.143)
Controls	Yes	Yes	Yes
Number of observations	580,478	137,924	442,554
Number of provinces	247	220	247
R-squared	0.418	0.384	0.430
Province FE	Yes	Yes	Yes
Age-interval FE	Yes	Yes	Yes
Province specific-time trend	Yes	Yes	Yes

The dependent variable is the number of years of education. Oil price shock is the ln-5 years average of oil price for period *t* multiplied by a dummy that take a value of 1 if the province is producing oil. Controls include year of survey, month of survey, religion, urban residency, and sex of household head. For the full sample, we control for gender. The method of estimation is ordinary least squares with Huber-robust standard errors (reported in parentheses) clustered at the province level. Significantly different from zero at *10% significance, **5% significance level, ***1% significance level.