Educational Resource Curse? A Disaggregated Analysis of Oil Ownership and Human Capital Formation

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Quantitative studies support the claim that extractive industries discourage human capital formation. We contend that the resource-education nexus is contingent on natural resource control rights. State-controlled oil companies are more likely to promote local schooling compared to international firms because they generate more direct public revenue, pursue non-commercial goals and do not face expropriation threats. We test this claim combining novel georeferenced data on hydrocarbon control rights with information from the Demographic Health Survey for 21 sub-Saharan countries over the period 1997–2015. For a more nuanced geographical analysis, we also rely on spatial survey data from Afrobarometer. Our two-level mixed-effects and logistic estimations show that state-controlled oil production increases secondary education and lowers the share of the population without formal schooling. We find this effect to be particularly strong under institutions that promote accountability and secure legal environments. In contrast, internationally controlled oil extraction does not enhance local schooling.

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Introduction

The number of scholarly articles summarising state-of-the-art evidence of the so-called resource curse has soared in recent years. Authors have assessed the impact of natural resource extraction on various socio-economic and political outcomes including wealth, poverty, unemployment, regime stability and social conflict (Gamu et al., 2015; Marchand & Weber, 2017; Van Der Ploeg & Poelhekke, 2017). Increasingly, the literature is utilising sophisticated research methods, by exploiting semi-natural experiments (c.f. Vicente, 2010), examining data on unforeseen events such as giant oil discoveries (c.f. Arezki et al., 2015) or employing highly disaggregated research designs (Kotsadam et al. 2016). However, the empirical evidence supporting the resource curse seems far from conclusive.

One particular channel through which natural resources may affect societal development is human capital formation. Natural resource production may directly influence individuals' educational choices, e.g. by increasing the opportunity costs of attending school when employment in extractive industries is an alternative (c.f. Marchand & Weber, 2017). Natural resources may also indirectly affect education by encouraging rent-seeking activities or promoting economic enclaves and deindustrialisation (Gylfason, 2001). So far, most of the macro and micro evidence reveals that national or regional dependency on natural resources goes hand in hand with poorer educational outcomes (c.f. Ahlerup et al., 2016; Birdsall et al., 2001; Blanco & Grier, 2012; Deaton & Niman, 2012; Edwards, 2016; Gylfason, 2001; Kumar, 2017). The existence of an educational resource curse appears to be virtually uncontested.

We maintain that natural resource extraction does not invariably hamper human capital attainment. Rather, we show that the effect of oil on educational achievement is contingent on control rights. Whether an oilfield is controlled by a multinational company or a domestic, state-owned firm matters for the local provision of public goods such as education. According to our core argument, national oil companies (NOCs) differ from multinational companies in three

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fundamental ways. First, they generate more direct public revenues compared to resource production controlled by non-state companies. These revenues can benefit resource-producing regions through fiscal transfers, promoting local educational spending.

Second, unlike private companies, state-controlled extractive firms do not focus exclusively on profit maximisation. Governments, as principals, often use NOCs for non-commercial tasks, trying to increase political legitimacy and maximise their re-election prospects. The construction of schools and hospitals or the provision of local infrastructure financed via state-owned enterprises may serve this end and increase government's political support.

Finally, foreign resource extractors are often uncertain whether the governments of host countries will comply with negotiated contractual terms such as the length of exploration licenses. Operating under the threat of expropriation, international investors face limited time horizons. We claim that – especially in cases of weak property rights enforcement and insecure political contexts – foreign companies lack incentives to invest in the development of resource-producing regions.

Given that state-controlled oil firms generate more direct public revenue, pursue non-commercial goals and do not face expropriation threats, we expect them to increase educational attainment compared to multinational companies. We test our claim by combining novel data on the property rights structure of oil and gas fields in sub-Saharan Africa with survey data from the Afrobarometer and the Demographic Health Survey (DHS). Our research strategy allows us to identify the number of oilfields controlled by either domestic state-owned or international companies in the geographical vicinity of each survey respondent.

Multilevel and fixed-effects estimations on time-series cross-sectional district data as well as logistic cross-sectional estimations corroborate our hypothesis. Units hosting domestic state-controlled oil extraction show better educational attainment compared to areas where oil is

extracted by multinational corporations. The results prove robust to different model specifications and estimation techniques.

This article proceeds as follows: The next section reviews the existing literature on the impact of natural resources on socio-economic outcomes, with a particular emphasis on education. The article's main argument is presented in the third section, which outlines how control rights over oilfields influence the formation of human capital. A description of the data as well as the research design employed is provided in the fourth section, followed by the quantitative findings in section five. The final section presents the conclusion and highlights areas requiring further research.

Educational Resource Curse: The Evidence

Following the seminal work of Sachs and Warner (1995), a growing body of literature has analysed the existence and causes of the so-called resource curse.[3] Positive as well as negative evidence of the counter-intuitive finding that countries rich in particular natural resources tend to experience slower growth has grown steadily over the last two decades (c.f. Havranek et al., 2016).[4] In addition to addressing the effects of resources on countries' aggregated output, country-level analyses have linked natural resources to weak institutions, durable autocracies, intra- and inter-state conflict, and adverse socio-economic outcomes such as unemployment, inequality or poverty.

In a review article, Ross (2015) outlines the evidence linking petroleum to the stability of authoritarian regimes, corruption, and the incidence of armed conflict in low- and middle-

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[3] According to Sachs and Warner (1995), natural resources may hinder economic growth in developing countries when resource booms prompt the appreciation of the real exchange rate and reduce the competitiveness of non-resource commodities.

[4] Badeeb et al. (2017) provide comprehensive overviews of the mechanisms linking natural resources to economic growth.

income countries.[5] Cross-country studies further show that resource abundance may lead to lower levels of rule of law, property rights protection and government effectiveness (Isham et al., 2005; Norman, 2009), or lower democratic accountability (Tsui, 2011). On an aggregated scale, natural resources have also been associated with more inequality (Gylfason & Zoega, 2002), poorer health (Daniele, 2011), undernourishment and depreciation in the Human Development Index (Bulte et al., 2005).

A recent wave of studies has developed more sophisticated research designs to assess the impacts of natural resources on various socio-economic and political outcomes. Authors have employed quasi-experimental settings to test the impact of oil deposits on corruption (e.g. Vicente, 2010), relied on novel data on oil discoveries to tackle the possible endogeneity of political and economic institutions (e.g. Arezki et al., 2015; Tsui, 2011) or explored within-country variance at disaggregated levels of analysis when estimating the impact of resource production on income levels and living standards (Aragón & Rud, 2013; Loayza et al., 2013), poverty (Deaton & Niman, 2012), inequality (Loayza et al., 2013), unemployment (Kotsadam & Tolonen, 2013), conflict (Berman et al., 2015) or the provision of public goods (Caselli & Michaels, 2013).

As several recent review articles point out, these innovative studies often provide mixed evidence regarding a socio-economic or political resource curse (c.f. Badeeb et al., 2017; Gamu et al., 2015; Marchand & Weber, 2017; Van Der Ploeg & Poelhekke, 2017). It appears that the impact of natural resources at the local and country levels is contingent on a complex interplay between institutional contexts, resource types, the extent of resource dependence vis-à-vis resource abundance, and possible economic spillovers (c.f. Havranek et al., 2016).

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[5] For an overview of how natural resources may impact intra- and interstate conflict, see Koubi et al. (2014).

Besides studying the effects of natural resources on the socio-economic and political outcomes outlined above, some authors have also examined the evidence of an educational resource curse. Countries or regions rich in natural resources could experience lower educational attainment, coverage or quality. Gylfason (2001) and Birdsall et al. (2001) were among the first to address the possibly detrimental effects of resource wealth on human capital formation at the country level. According to the authors, extractive industries require less high-skilled labour, thereby weakening public and private incentives to accumulate human capital. Commodity-dependent economies seem to have little incentive to prioritise long-term education investments. Commodity price uncertainty often leads to erratic and restrictive public spending (Gylfason & Zoega, 2006; Mikesell, 1997).

Quantitative country-level analyses provide evidence of the neglect of education in resource-rich states. Blanco and Grier (2012), for example, find a significant negative direct effect of petroleum export dependence on human capital in 17 Latin American countries. Instrumentalising the relative size of the mining sector, Edwards (2016) shows that states with larger mining shares exhibit poorer educational outcomes than states with similar per capita incomes, geographical characteristics and institutional quality that are less dependent on mining.

Several studies have also found evidence of an educational resource curse at the subnational level. Using data from a survey of Chilean households, Jensen et al. (2012) find that children of household heads employed in extractive industries are less likely to attend school. The authors argue that the labour-intensive and low-skilled character of extractive industries may lead children to 'leave school either to work or to help at home so other adults in the family can work' (Jensen et al. 2015, p. 8). They also stress that the remoteness of rural areas where many such industries are located makes school access difficult.

The sudden demand for highly paid low-skilled labour during resource booms may increase the opportunity costs of education. Black et al. (2005) find that coal booms lead to more school dropouts in the USA due to lower expected returns to skills. Similarly, Kumar (2017) reveals a decline in college wage premiums within oil-rich US regions after oil booms. Analysing survey data, Ahlerup et al. (2016, p.1) conclude that 'the educational costs of mines are likely due to households making myopic educational decisions when employment in gold mining is an alternative'.

Using Indonesian socio-economic surveys, Edwards (2016) shows that children in mining-dependent districts are less likely to pursue secondary schooling than those in neighbouring districts in the same province. Yet, in line with Ahlerup et al. (2016), the author finds no causal link between mining and lower government educational investments. In fact, some disaggregated studies point to a positive relationship between education spending and hydrocarbon booms. Newell and Raimi (2015) and Weber et al. (2016), for example, show that the development of shale oil and gas increased revenues for schools within hydrocarbon-rich areas in the US. James (2015) reports that public spending on education is higher in resource-rich US states. Caselli and Michaels (2013) show that oil revenues have moderately increased educational spending in Brazilian municipalities.

Overall, the quantitative aggregated and disaggregated evidence reviewed supports the idea of an educational resource curse. Nevertheless, various mechanisms linking resource extraction to educational outcomes remain poorly understood. The effects of natural resources on human and economic development are likely to depend on the national regulatory capacity and regional institutional settings (c.f. Daniele, 2011). We agree with Marchand and Weber (2017, p. 3) that 'the link between natural resources and human capital accumulation is an additional area ripe for more research.' In particular, moderating institutional factors at the national and local levels deserve further attention.

In this article, we seek to address the major shortcomings of the literature reviewed above. Instead of focusing on a specific region within a country, we analyse the effect of hydrocarbons on educational outcomes using a geographically disaggregated analysis that relies on a large sample of African countries. Moreover, we consider local institutional contexts by recognising that this effect is contingent on control rights regimes.[6] As shown in the next section, state-owned oil enterprises often pursue a wide range of non-commercial goals such as job creation; local capacity building; or improved local social infrastructure via direct funding of schools, hospitals and other community services (Wolf, 2009).

Natural Resources and Educational Outcomes: The Importance of Control Rights

This article claims that the effect of resource production on the provision of education depends largely on the ownership of the extracting companies. We argue that state-controlled oil production is more conducive to the provision of public goods such as education than internationally controlled resource extraction. Three fundamental features of national oil companies may explain their greater inclination to promote educational attainment.

First, national resource-extraction companies generate more revenues for government coffers. Through fiscal transfers, these rents may be used to improve educational outcomes in resource-extracting regions. Second, government-controlled enterprises have politicians as principals.[7] Rather than prioritising profit maximisation, politicians may seek to promote social benefits through the provision of public goods in order to attain political legitimacy. Finally, state-

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[6] Initially, Luong and Weinthal (2006) drew attention to the importance of ownership structures when analysing the resource curse, arguing that state-controlled oil production has a particularly detrimental effect on economic growth. More recently, Wegenast (2016) has shown that high levels of state-owned oil extraction are associated with increased welfare spending.

[7] For a review of the evolution of the principal-agent paradigm see Miller (2005).

controlled companies are safeguarded against expropriation resulting from poor property rights enforcement. Facing longer time horizons than private firms, they may be more inclined to invest in local public goods. Thus, NOCs have a motive and the means to promote educational attainment.

Although resource-dependent states often feature weak institutions, rent-seeking economies and a corrupt state apparatus (c.f. Karl, 1997; Luciani, 1987; Mahdavy, 1970), oil revenue may be employed to finance welfare policies and public goods such as healthcare or education. Several authors have shown that oil rents are associated with increased social spending. Morrison (2008) demonstrates that non-tax revenues such as those from oil are associated with higher social spending and more regime stability in non-democratic settings. According to Herb (2005, p. 297), rich rentier states often use oil rents to create a larger middle class or to pay for schoolteachers. Hinojosa et al. (2012) find a positive association between resource state revenue and social policy and conclude that rents could may be employed by governments as a springboard to launch social policies devoted to enhance social welfare. In a similar vein, Wegenast (2016) stresses that high levels of state-controlled hydrocarbon production lead to more welfare spending.

Why should state-controlled natural resources be more conducive to the provision of public goods than internationally controlled resources? Our first explanation is based on the differing amounts of state revenue generated by either state or private ownership. Several authors show that governments decide to nationalise their oil and gas production to increase state revenues (see Friedman, 2006 or Guriev et al., 2011). Nationalisation is perceived as a better strategy for achieving more state income than taxing private oil companies (Mahdavi, 2011, p. 5).

The empirical evidence demonstrates that public revenues are greater whenever resource extraction lies in public hands. Andersen and Ross (2014), for example, note that most oil-producing autocracies nationalised their oil and gas production in the 1970s to collect rents that

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previously benefitted international oil companies. Consequently, government revenues grew considerably (see also Ross, 2012). Mommer (2002) finds that nationalisations increased governments' shares of oil profits from 50 per cent in the early 1960s to 98 per cent by 1974. Mares (2010) describes how state ownership increased governments' capacity to capture resource income and manage its distribution amongst societal actors in several Latin American countries.

In the case of wealth-sharing agreements and fiscal decentralisation, regional and local governments may receive a larger share of the resource income accruing to states' coffers. The governments of various resource-rich African countries transfer substantial resource revenues to subnational units. In Angola, Cameroon, Chad, the Democratic Republic of Congo (DRC), Ethiopia, Ghana, Guinea, Madagascar, Niger, South Sudan and Uganda, a portion of natural resource income is transferred back to the area of origin through derivation-based intergovernmental transfer systems (Bauer et al., 2016). Uganda's 2015 Public Finance Management Act, for example, stipulates that 6 per cent of petroleum royalties should be 'shared among the local governments located within the petroleum exploration and production areas' (Bauer et al., 2016, p. 34).

According to the DRC Mining Code, producing provinces should retain 40 per cent of the royalties derived from minerals extracted in their territory.[8] In Nigeria, the Niger Delta Development Commission, a federal body controlled by representatives from oil-producing states, receives intergovernmental oil transfers to finance projects that support economic development in the Niger Delta. According to Nigeria's 1999 constitution, 13 per cent of all oil revenues collected at the federal level must be redistributed to the producing states in the south. Although such revenue-sharing formulas may boost regional and local governments' budgets, several authors stress that they often promote rent-seeking, embezzlement, patronage, partisan

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[8] As noted by Bauer et al. (2016, p.39); however, this rule often lacks efficient enforcement.

rivalry, and conflict at the subnational level (Ahmadov & Guliyev, 2016; Bauer et al., 2016; Caselli & Michaels, 2013).

The examples show that in most sub-Saharan countries a designated share of oil revenue is specifically earmarked for the oil-producing regions. Moreover, the constitutions of many of these states stipulate that social infrastructure and basic services (such as healthcare, education, water, electricity) must be provided as a contractual obligation under revenue-sharing agreements. In Ghana, a considerable share of resource revenues must be channelled to development and environmental mitigation projects under the Mineral Development Fund or the Petroleum Revenue Management Law (Amoako-Tuffour & Ghanney, 2013; OECD, 2017). In Botswana, resource revenues are distributed according to a self-enforced budget rule, 'the budget index', which establishes a formula by which they are used to finance investment and regular spending on healthcare and education. Sao Tome and Príncipe passed the Oil Revenue Management Law to use oil revenues for development and poverty reduction.

Scholars show that regions may in fact profit from transfer schemes, using fiscal windfalls to promote human capital or develop local infrastructure. For Indonesia, Cust and Rusli (2014) conclude that the main regional economic gains accrue via transfers to, and spending by, local government. Mosley (2017) describes how resource-rich regions have profited from fiscal decentralisation in Ghana. Examining oil royalties within Brazilian municipalities, Caselli and Michaels (2013) provide evidence that oil revenues generated by Brazil's national oil company Petrobrás may increase education spending. Based on survey data and administrative reports, the authors conclude that although mayors use oil windfalls to finance public goods such as education, they also frequently divert these to patronage, rent sharing or embezzlement to improve their re-election chances.

Whether politicians employ oil windfalls to finance educational projects – instead of embezzlement, patronage or the provision of private goods – largely depends on the public

accountability of local institutions. In fact, a recent study by Khanna (2017) corroborates the assumption that NOCs may further countries' economic development in the presence of good economic and political institutions. Relying on a country-level panel-fixed-effects estimation, the author finds that given high institutional quality, state-controlled resource production promotes economic growth. Drawing on disaggregated data, we contend that NOCs encourage subnational educational provision, especially when local politicians are held accountable by sound institutions.

In addition to increasing fiscal transfers, NOCs may also promote public goods provision by pursuing non-commercial goals. Rather than focusing solely on efficiency gains and profit maximisation, state-owned resource-extraction companies are expected to contribute to local development and to enhancing public welfare (c.f. Marcel & Mitchell, 2006). The idea of state-owned enterprises as social actors has a long tradition in the social sciences (Evans, 1995; Kaldor, 1980; Schumpeter, 1942).

Governments often intervene in markets for legitimacy-enhancing purposes (c.f. Pickel, 2003). In embarking on so-called 'resource nationalism', they seek political support by pursuing particular social goals.[9] State interventions in the resource sectors are frequently justified as serving developmental purposes. Zimbabwe's former president Mugabe repeatedly proclaimed the nationalisation of the country's resources as a vehicle for more prosperous economic development, influencing similar debates in South Africa, Namibia and Nigeria (Andreasson, 2015; The Guardian, 2016).

Connected to the social view of state-owned enterprises as national development actors, a political perspective suggests that politicians running state-controlled companies will use these for political gains (La Porta & López-de-Silanes, 1999; Wilson, 2015). State ownership over

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[9] The term 'resource nationalism' is often used to describe government-led efforts to secure greater benefits from a country's resource stocks (c.f. Childs 2016).

resources allows political elites to precisely control where revenues flow (c.f. Victor, 2013). With politicians as principals, NOCs are required to pursue various non-commercial objectives that promote political support among voters.

State companies' concerns regarding the employment of workers living within oil-extraction areas are an example. According to Hartley and Medlock (2008), NOCs are more likely to favour excessive employment than private international oil companies (see also El-Katiri, 2014, p. 29). Applying stochastic frontier estimations, Eller et al. (2011, p. 638) assert 'government ownership tends to result in a larger workforce than necessary to meet purely commercial objectives'. Case studies confirm that regional unemployment rises after the privatisation of resource production (c.f. Mususa 2010).

When overseeing NOCs, politicians may also increase political support among voters by employing oil rents to provide public goods. El-Katiri (2014) stresses how the provision of public goods such as free healthcare and education serves survival-oriented motivations of political elites within oil-rich countries. As shown by Tordo et al. (2011), NOCs of several African countries fund a variety of public goods in extractive regions. Ghanaian president Akufo-Addo has recently announced that the country's mineral and oil revenues will be used to provide free secondary education (Da Costa, 2017). In Tanzania, extractive communities actively demanded revenue shares from local governments generated through state-owned oilfields to build schools (Kolumbia, 2017). South Africa's PetroSA provided US$300,000 in 2010 to finance a secondary school in the Eastern Cape region (Mamabolo, 2010). In Angola, the national oil company, Sonangol, spent US$2.5 million to repair a secondary school in the central Kwanza Sul Province in 2007 and US$1.2 million on a school in Benguela in 2016 (Government of Angola, 2007, Agência Angola Press, 2016). The Ghana National Petroleum Corporation (GNPC) is currently funding the construction of classrooms for a girl's senior high school in the Western Region (GNPC, 2016). Petroci, the state-owned oil company of the Ivory

Coast, funded the furnishings of secondary schools with US$180,000 in 2014 (Agence Ivoirienne de Presse, 2014).

Our third explanation for why resource-ownership patterns matter in explaining educational outcomes refers to the different time horizons faced by state-owned and privately controlled oil companies. Foreign resource extractors face particular uncertainty regarding the compliance of host governments with negotiated contracts, e.g. concerning the length of exploration licenses. They also fear major changes in the regulatory framework such as local shifts in legislation and outright expropriation by the state (see Guriev et al., 2011, p. 303-304; Lange & Kinyondo, 2016; Kennedy & Tiede, 2011).

Doubts about adherence to contractual obligations and property rights in many African, Asian or Latin American countries lead foreign firms to extract as many resources as quickly as possible (cf. Ludwig, 2012). In fact, industry surveys indicate that mining firms consider state interventions such as expropriations or tax increases the single greatest risk to their businesses (Ernst & Young, various years). Domestic state-owned companies, in contrast, may have longer time horizons and more incentives to develop better relationships with local communities and to provide public goods such as education.

Costello and Grainger (2015) confirm that resource-extracting firms facing weak property rights tend to pressure regulators to allow resource production at inefficiently high rates. Using panel data on global fisheries, they find that 'regulators are significantly more conservative in managing resources for which strong individual property rights have been assigned to firms' (Costello & Grainger, 2015, p. 1). In a similar vein, a formal model by Che and Qian (1998) suggests that – under insecure property rights – local government ownership increases local public goods provision.

In this section, we have argued that state-controlled resource production leads to higher levels of educational provision than resource extraction conducted by international enterprises. State-

owned firms often have a developmental mandate and are used by governments to increase political legitimacy. In addition, governments can count on higher revenues from state-controlled resource production. Finally, state-controlled resource companies do not fear expropriation or major changes in the regulatory framework, and should therefore be more inclined to invest in local development.

Research Design

Our hypothesis that state control of natural resource extraction improves local educational outcomes is tested with data from three sources. To operationalise local control structures, we draw on a new dataset containing field-level information on companies operating in 38 sub-Saharan countries between 1997 and 2015. To quantify educational outcomes, we employ panel data from the Demographic Health Survey (DHS) and cross-sectional data from round six of the Afrobarometer.

Dependent Variables: Measuring the Socio-Economic Impact of Mining

The first dependent variable measuring educational attainment at the local level is constructed from 52 Demographic Health Surveys (DHS). These provide details on the socio-economic and health conditions of sampled households in a wide range of sub-Saharan countries (ICF International, 1996–2014). Since DHS sampling procedures ensure representativeness at both the national and subnational levels, the data is ideally suited for a cross-sectional assessment of local educational outcomes. To create a disaggregated dataset with a panel structure, we selected countries that underwent at least two survey waves between 1997 and 2015, for which the geo-location of respondents was available. Applying this benchmark, we could include 21

sub-Saharan countries. Eleven are represented by two survey rounds[10] and the remainder by three.[11]

For each district-year we compute the proportion of DHS respondents who report having completed secondary education.[12] We linearly interpolate the values for years in which DHS surveys were not conducted. Our reliance on secondary education is motivated by the higher opportunity costs of this form of schooling. While primary education is often compulsory in sub-Saharan countries, secondary education is less strictly enforced (Verspoor & SEIA, 2008). This may result in higher dropout rates in districts where employment alternatives requiring only low-skilled labour, e.g. in the extractive industries, are available. If state-controlled natural resource companies actively counter this through increased public goods provision, this should be visible in a higher percentage of the population attaining secondary education. We lag our independent variables by six years to factor in that it takes several years to build schools and typically four to complete secondary education.

The DHS does not convey the exact location of individual households that would enable their identification. The geo-location of a household is therefore combined with those of others by assigning it to the centroid point coordinate of the enumeration area (EA) or survey cluster the household sample belongs to. Because EAs are defined by separate national census bureaus, the size of survey clusters can vary between countries. In most cases each cluster hosts 200 to 300 households, of which between 20 and 30 are sampled.[13]

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[10] The countries covered by two survey rounds are Benin, Cameroon, DRC, Ethiopia, Ivory Coast, Liberia, Madagascar, Sierra Leone, Tanzania, Togo and Zambia.

[11] Countries with three survey rounds are Burkina Faso, Ghana, Guinea, Kenya, Namibia, Nigeria, Rwanda, Senegal, Uganda and Zimbabwe.

[12] 'Highest educational level attained' (hv106_01) is a categorical variable that indicates whether the respondent obtained no education or primary, secondary, or higher education.

[13] DHS uses two-stage cluster sampling which incorporates both probability proportional to size and equal probability systematic sampling.

The district information was assigned to the coordinates of each survey cluster using GIS software and spatial data from the Global Administrative Unit Layers (GAUL). GAUL features global geographic polygon layers with all districts in all countries of the world (EC-FAO Food Security Programme, 2008). Following the strategy of Fjelde and Østby (2014), the coordinates from DHS survey clusters were matched with district information from GAUL polygons using the software QGIS. The district information was then assigned to surveyed households by merging both with a designated DHS cluster identifier variable. This enabled us to compute mean values for the socio-economic variables per district and year.

As outlined previously, the effects of resource-control structures on public goods provision should be constrained to the immediate geographical surroundings of oilfields. Disaggregating DHS data to the district level enables us to assess the enclave-like nature of resource extraction. Nevertheless, we cannot rule out the possibility that the size of the district will influence our results, since countries such as Nigeria are composed of small districts, while those of the DRC, for instance, are rather large. To account for this factor, we also estimate the effect of ownership structures on educational outcomes using survey data from the Afrobarometer.[14]

The Afrobarometer records public attitudes and is one of the most comprehensive data sources on socio-economic development for more than 30 African countries. With this data, we can further disaggregate our level of analysis, since it allows us to calculate the distance of respondents to individual oilfields. National samples of the Afrobarometer comprise either 1,200 or 2,400 face-to-face interviews with randomly selected respondents older than 18 years. To guarantee representativeness, the Afrobarometer adopts a stratified, multi-stage area probability design. Stratification is based on the main subnational unit of government (state, province or region) and on urban and rural location. The smallest geographical unit for which reliable population data is available constitutes the primary sample unit (PSU), which is most

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[14] Afrobarometer data can be retrieved from http://www. afrobarometer.org.

often the EA. In every PSU, eight survey respondents are combined into one cluster. To account for household size and over- or under-sampling of the data, some national surveys are additionally weighted.

The sixth round of the Afrobarometer consists of 36 national surveys conducted between 2014 and 2015. We have deliberately chosen round six because our data on mining and oil control rights cover the period 1997–2015. We therefore take into account the fact that the effects of state-controlled natural resource extraction on educational outcomes should take a certain time to materialise. Our main dependent variable reflects whether individual respondents report having completed at least secondary education.[15]

We joined point coordinates from our oilfield-level dataset with the geo-location[16] of Afrobarometer respondents through spatial proximity using QGIS. To this end, we first calculated 25 km buffer zones around the centroids of the survey clusters, following the procedure by Knutsen et al. (2016). Information on the number and ownership of oilfields was added in the second step outlined below.

Independent Variables of Interest

The new dataset on oilfields uses information from Infomine (2013) and the U.S. Geological Survey (USGS). The first database provides details on the location, production and status of extraction facilities as well as the percentages controlled by participating companies. Data from the USGS and the relevant mining company's website was gathered to fill in missing information. Using these indications in combination with firm reports provided to us, we were able to code ownership structures of 606 oil and gas fields. Yearly observations from 1997 to

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[15] 'Education of respondent' (Q97) is based on the question: 'What is your highest level of education?'
[16] Geocodes are provided by AidData.

2015 depict the shares held by domestic private, domestic state-owned, private international and state-owned international natural resource companies.

The distribution of oilfields among countries is uneven. Nigeria is the country with by far the most oilfields (396). Ranking second and third are Angola with 57 and Gabon with 51. Countries with intermediate numbers are Kenya (24), Chad (14) and Cameroon (6). In addition, a larger number of countries have a relatively small number of oilfields, such as the DRC (three), Somalia (two) or Botswana (one).

To match the oil information to the district-level data structure, we followed a procedure akin to the construction of the dependent variables based on DHS indicators. The point coordinates of each oilfield were overlaid with GAUL polygons using GIS software. Each facility was thereby assigned to its host district. Every oilfield is dummy coded as majority controlled by domestic state-owned or international companies if the relevant company holds at least 66 per cent of the shares. The idea behind this threshold value is that a company's effects should prevail where its influence on decision-making in joint-venture boards could be decisive. The resulting variable sums up the number of oilfields per district-year that satisfy this criterion.

In the same fashion, we calculated the number oilfields in the 25 km buffer zones around Afrobarometer respondents. Since round six contains information from the years 2014 to 2015, we calculated mean control shares for each oilfield between 1997 and 2015 and then applied the threshold for majority control. Regressing these averages on respondents' educational status constitutes a suitable lag structure for our cross-sectional analysis. Figure 1 in the appendix illustrates the 25 km buffer zones for an excerpt of Nigeria. Since each EA is constituted of eight respondents, the buffers show the share of interviewees having completed at least secondary education. In addition, the figure depicts the location of oilfields operated by either international or state-owned companies.

Control Variables

We include several control variables in our regression models. In selecting these variables, we incorporate the reasoning of Ray (2003) or Achen (2005). We therefore only consider controls that are likely to influence the relationship between key explanatory variables and our dependent variable. For models based on DHS data, we account for confounding effects of wealth by including a variable indicating to which quintile of the national income distribution the population in a district belongs, on average. In addition, we compute the share of the population with access to electricity to control for the district level of infrastructure and local state capacity. We also use controls sourced from the PRIO-Grid 2.0 dataset. Since this dataset is based on quadratic grid cells, we convert the values to the district level by assigning to each district the mean value of all intersecting grid cells in a given year. We include indicators for population density[17] and coverage of urban areas in the models. Furthermore, we control for the level of democracy in the country by including the Polity 2 score for political regimes from the Polity project (Gurr et al., 1989).

For our models based on Afrobarometer data, we include a dichotomous measure depicting whether the EA is located in a rural or an urban area. Moreover, we use indicators that show respondent's views on criminality, wealth, democracy, and local corruption. To reflect the influences of discriminatory policies, we incorporate an indicator conveying individual perceptions of unfair group treatment by the government. Finally, we also enclose controls for the level of infrastructure and state capacity proxied by the quality of roads and sanitation.

Estimation Technique and Results

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[17] Population density is measured by the quotient between the variables 'pop_gpw_sum' (Center for International Earth Science Information Network (CIESIN) & Centro Internacional de Agricultura Tropical (CIAT), 2005) and 'landarea' (Weidmann, Kuse, & Gleditsch, 2010) from the PRIO-Grid dataset.

To estimate the effects of resource-control rights on mean levels of secondary education among district populations, we draw on a multilevel framework. Multilevel statistical models are specifically designed for hierarchical data structures, and therefore well suited for our analysis, since they allow us to account for the fact that individual districts are nested within countries (Hox et al., 2010). The main advantage is that heterogeneity among lower-level units of analysis can be modelled as a function of higher-level units by implementing random effects at the different levels. With a two-level mixed-effects approach we are therefore able to allow for non-independence of educational outcomes between districts located within the same country. More precisely, we estimate a random-intercept model, whereby each country has its own mean population share of those who have completed secondary education.

In addition, we ensure the robustness of our results by estimating fixed-effects models and models with different lag structures from DHS data that are relegated to the appendix. Due to the binary nature of the dependent variables from Afrobarometer, we employ logistic regressions to analyse the effects of oil control rights on the educational attainment of respondents in the buffer zones. We thereby control for country-specific effects by including country dummies.

Table 1 reports estimates of multilevel models for the effect of oil control rights on secondary education with a six-year lag structure over the period 1997–2015. Compared to all districts within our sample, districts with oilfields controlled by the state have higher population shares enjoying secondary education. In contrast, districts where oil extraction is undertaken predominantly by international companies show lower secondary education attainment levels (see Model 1). Model 2 compares the effect of control structures only between and within districts in which oil is actually extracted. A direct comparison between oil-extracting districts further illustrates the negative impact of internationally controlled extraction.

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Table 1 about here

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Table 2 depicts logistic regression results with country dummies estimated from cross-sectional data of round six from Afrobarometer. The positive effect of state-controlled hydrocarbon production on education found by our multilevel estimations on pooled times-series, cross-sectional data is corroborated by this alternative research design. Model 1 shows that the presence of state-owned oil companies within a distance of 25 km of a respondent significantly increases respondents' likelihood of having enjoyed at least secondary education. In contrast, internationally controlled oilfields in respondents' vicinity show no effect on secondary school attainment. When only respondents living in the proximity of oilfields are considered by our estimation (Model 2), we observe that – compared to state-controlled fields – international oil production significantly reduces the likelihood of a respondent reporting having completed at least secondary schooling. Figure 2 in the appendix illustrates the effect of oil ownership on secondary education estimated in Model 2 of Table 2. It plots the predicted probabilities of a respondent having completed secondary education contingent on his/her proximity to state- or internationally controlled oilfields.[18]

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Table 2 about here

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[18] The control variables are held at their means.

Models 3 and 4 show additional results using Afrobarometer data. We estimate the effects of hydrocarbon control rights on the probability that survey respondents report having no formal schooling (i.e. having not completed primary education).[19] Again, we find that whether oilfields are operated by international or state-owned enterprises matters in explaining educational outcomes. The more state-controlled oilfields within a 25 km radius of respondents, the less they report not having any formal schooling (Model 3). In contrast, internationally controlled oil production appears to increase respondents' chance of having no formal education when only hydrocarbon-producing buffer zones are considered (see Model 4). Figure 3 in the appendix plots the predicted probabilities estimated in Model 4. All in all, we find robust evidence that oil in the hands of the state – rather than oil controlled by international companies – has the potential to promote education at the local level.

The control variables are largely in line with our expectations. For the DHS data, we find that higher wealth increases secondary education attainment. In the full sample, urban districts and districts with more electricity also exhibit a higher proportion of secondary school attainment, while this share is smaller in densely populated districts. The level of democracy, measured at the country level, is likewise positive and significant in the all-district sample.

Regarding our models based on Afrobarometer data, some of the control variables behave in a more surprising manner. It appears conceivable that wealthy respondents and those living in urban buffer zones have a higher probability of attaining secondary education – and therefore also a lower probability of not completing primary education – if the full sample is considered. Buffers with higher state capacity as proxied through an indicator for sanitation and the quality of roads, and buffers perceived as having less discrimination, also show better educational

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[19] The indicator is also based on question Q97: 'What is your highest level of education?' It equals 1 if respondents answered 'No formal schooling' (item 0), 'Informal schooling only' (item 1), or 'Some primary schooling' (item 2).

attainment. Yet, the result that democracy decreases the probability of respondents having completed secondary education and increases the probability of them not completing primary schooling while corruption has the opposite effects is rather unexpected and, at first sight, counterintuitive. However, there is convincing empirical evidence that it is the stock of democracy – and not the level – that brings about social welfare (Gerring et al., 2012). Young democracies like those in sub-Saharan Africa seem to overprovide targeted transfers to narrow groups of voters. Public spending in these countries goes to middle- and upper-income groups, e.g. in the form of higher education (Keefer, 2007; Ross, 2006). The indicator for crime is not significant.

As noted above, we conducted several robustness checks to determine the sensitivity of the results derived from DHS data. The corresponding tables are relegated to supplemental files in the web appendix. In Table A1 we estimate the regressions with fixed-effects models instead of the multilevel technique. As models 1 and 2 show, the essential evidence remains unchanged. The effects of state-owned oilfields even outstrip previous results, since they remain positive and significant irrespective of whether we focus on all or solely oil-producing districts, whereas those for international oilfields are insignificant.

In Table A2 we test whether our results are affected by the chosen lag structure. For this purpose, we re-estimate all models, lagging our main independent variables of interest by four, five and seven years. We thereby compare only districts with oil production. In addition, we assess whether our findings are driven by our estimation technique, by alternating multilevel and fixed-effects models. Again, we find substantial support for our hypothesis that state-controlled oil production increases secondary education among the local population. The coefficient for the number of state-controlled oilfields is positive and significant in most of the models.

One possible concern is that our results are driven by endogeneity. Theoretically, one might assume that the state will tend to control oil production in regions inhabited by a better-educated population. It can thus ensure qualified labour (e.g. technicians, engineers, administrators) to operate its oilfields. At the same time, international companies would be relegated to areas with a lower human capital stock. To rule out this possibility, we make use of the time dynamics in our DHS data and regress the number of fields controlled by the state or by international firms on districts' past year levels of secondary education using fixed effects. The results displayed in Table 3 below indicate that secondary education attainment predicts the presence of International Oil Companies (IOCs) but not NOCS in the full sample (Model 1). When only oil-producing districts are considered (Model 2), we observe that neither company type seems to choose their operational locations based on the local human capital stock. Thus, it is unlikely that our results are driven by self-selection bias.

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Table 3 about here

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Testing Causal Mechanisms

As outlined in the theoretical section, we maintain that state-owned oil companies generate more direct public revenue and pursue non-commercial goals, thereby providing more public goods than multinational oil firms. In addition, we claim that international companies may face the threat of being expropriated and thus have reduced incentives to invest in local development.

To explore the variation in the quality of local institutions, we test these mechanisms using a subsampling strategy.

According to our argumentation, politicians may employ oil revenues to finance public services such as education in an attempt to increase political support from their local constituency. We thereby assume that governments of oil-rich regions should use oil royalties to provide public goods – rather than diverting these to patronage or embezzlement – particularly when they are held accountable by sound local institutions. To test this claim, we proxy the quality of local political institutions by drawing on respondents' opinions about local governments' responsiveness. We thereby estimate the effects of our oil-ownership variables on respondents' likelihood of having completed at least secondary education (or having no formal schooling) using an all-unit sample as well as a subsample containing only those respondents reporting that local councillors listen to the needs of the local population.[20]

We also claim that international investors within Africa's extractive industry may be less inclined to provide education due to more limited time horizons. IOCs fear expropriation or non-compliance with negotiated contractual terms, particularly in insecure legal environments. To measure the degree of legal uncertainty, we assess whether respondents report that, in their countries, the president often ignores the law.[21] Again, we make use of a subsampling strategy by comparing an all-unit sample with a sample containing only respondents reporting that their president frequently disrespects the law.

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[20] The indicator is based on question (Q59B): 'How much of the time do you think the following try their best to listen to what people like you have to say: local government councilors?'

[21] The indicator is based on question (Q45C): 'Does the president ignore the courts and laws of the country?'

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Table 4 about here

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As models 1 and 2 of Table 4 show, the negative effect of state-controlled oilfields on respondents' risk of having no formal schooling is particularly strong where there are responsive local institutions. Comparing the odds ratios of models 1 and 2, our results indicate that while respondents' likelihood of having no formal education decreases by approximately 30 per cent with each additional state-controlled oilfield in their neighbourhood in the all-unit sample (Model 1), this risk is 67 per cent lower when local governments reportedly listen to needs of the population (Model 2). The subsampling exercise also corroborates our hypothesis that IOCs neglect the provision of public goods when facing limited time horizons. While the impact of internationally controlled fields on the lack of formal schooling is insignificant in the all-unit sample, the risk of a respondent reporting not having completed primary education increases by 72 per cent with each oilfield controlled by multinational companies when presidents appear not to respect the law (Model 3).

Similar results are obtained when the likelihood of respondents having enjoyed at least secondary education is employed as the dependent variable. Under responsive local institutions as depicted in Model 5, respondents are 53 per cent more likely to have completed at least secondary schooling with each additional state-controlled oilfield in their neighbourhood (for the all-unit sample as shown by Model 4, there is a rather moderate increase of 12 per cent). Note, however, that the proximity to IOCs does not seem to affect respondents' likelihood of having enjoyed at least secondary education under a president that ignores the law (Model 6).

Conclusion

Most of quantitative studies find evidence of an educational resource curse. Does natural resource extraction truly lead to the neglect of education? By performing a disaggregated analysis of sub-Saharan African countries, we show that the resource-education nexus is essentially contingent on control-rights regimes within extractive industries. While state-controlled oil production appears to further local educational levels, the extraction of oil by international companies has either no significant or detrimental effects on regional educational attainment.

Our results using survey data from DHS indicate that populations in African districts hosting more oilfields operated by state-owned oil companies exhibit higher shares of secondary schooling. In contrast, each additional internationally controlled hydrocarbon field reduces this proportion. Further disaggregating our unit of analysis to 25 km buffer zones around Afrobarometer survey respondents corroborates this picture. Respondents living close to state-controlled hydrocarbon production are more likely to complete secondary schooling and face a lower risk of not enjoying any formal education. Respondents living close to fields operated by international oil companies, on the contrary, often fare less well in terms of educational attainment. These results are robust to different model specifications and estimation techniques.

Three major mechanisms may explain our findings. Natural resources in the hands of the state generate more direct public revenue that can be used for the provision of public goods. Furthermore, state-owned resource-extraction companies pursue non-commercial goals. They may serve developmental purposes and allow politicians to buy political consent, e.g. by promoting local education. Finally, national oil companies face no expropriation threat and thus have longer time horizons. In exploring variation in local institutions, we find evidence that the presence of NOCs seems to further schooling, particularly under political institutions that promote accountability. Under responsive institutions, local politicians are more likely to

employ oil revenues to increase public welfare rather than embarking on rent-seeking, embezzlement or patronage. Our analysis also lends some support to the claim that IOCs neglect the provision of public goods in unsecure legal environments due to the threat of expropriation.

While we present evidence of particular causal mechanisms, more research is needed to test the plausibility of the proposed channels. Our findings demonstrate that natural resource extraction does not inevitably lead to poorer educational records. Even if resource booms may lower individuals' incentives to accumulate human capital, as has been argued by various authors (c.f. Ahlerup et al., 2016; Kumar, 2017), the provision of education by state-owned resource-extraction companies, among other mechanisms, seems to be able to outdo this effect. Thus, our research shows the importance of considering the institutional context when analysing the resource curse theory. In particular, researchers should pay more attention to natural resource control-rights regimes. The article shows that general recommendations to privatise Africa's resource sector in order to promote social welfare (i.e. Hodges, 1995, p. 1305) appear to be rather simplistic.

References

Agence Ivoirienne de Presse. (2014). Dix écoles de Yamoussoukro équipées de tables-bancs d'une valeur de 100 millions. *Abidjan.* Retrieved at http://news.abidjan.net/h/508286.html (accessed October 26, 2017).

Agência Angola Press. (2016). Sonangol and BP Angola fund school rehabilitation in Benguela. Retrieved at http://www.angop.ao/angola/en_us/noticias/educacao/2016/7/34/Sonangol-and-Angola-fund-school-rehabilitation-Benguela,62d68e7c-1990-4062-8107-9d50cd9fe637.html (accessed October 26, 2017).

Achen, C. (2005). Let 's Put Garbage-Can Regressions and Garbage-Can Probits Where They Belong. *Conflict Management and Peace Science,* 22, 4, 327 –339.

Ahlerup, P; Baskaran, T., & Bigsten, A. (2016). *Gold mining and education: a long-run resource curse in Africa?* (Working Papers in Economics No. 666). University of Gothenburg.

Amoako-Tuffour, J., and M. Ghanney (2013). Ghana's Petroleum Revenue Management Law: A Social Contract for Good Economic Governance and Possible Challenges. In K. Appiah- Adu (ed.), *Governance of the Petroleum Sector in an Emerging Developing Economy*. Farnham: Gower Publishing.

Aragón, F., & Rud, J. (2013). Natural resources and local communities: evidence from a Peruvian gold mine. *American Economic Journal: Economic Policy,* 5, 2, 1–25.

Arezki, R., Ramey, V.A., & Sheng, L., (2015). *News shocks in open economies: evidence from giant oil discoveries* (Working Papers No. 153). OxCarre, University of Oxford, Oxford.

Andersen, J. J., & Ross, M. (2014). The Big Oil Change: A Closer Look at the Haber-Menaldo Analysis. *Comparative Political Studies,* 47, 7, 993–1021.

Andreasson, S. (2015). Varieties of resource nationalism in sub-Saharan Africa's energy and mineral markets. *The Extractive Industries and Society*, 2, 2, 310–319.

Badeeb, R. A., Hooi H. L., & Clark, J. (2017). The evolution of the natural resource curse thesis. A critical literature survey. *Resources Policy,* 51, 123–134.

Bauer, A., Gankhuyag,U., Halling, S., Manley D., & Venugopal, V. (2016). Natural Resource Revenue Sharing. Manuscript, Natural Resource Governance Institute. Retrieved at https://resourcegovernance.org/analysis-tools/publications/natural-resource-revenue-sharing (accessed October 11, 2017).

BenYishay, A., Rotberg, R., Wells, J., Lv, Z., Goodman, S., Kovacevic, L., Runfola, D. 2017. Geocoding Afrobarometer Rounds 1-6: Methodology & Data Quality. AidData. Retrieved at http://docs.aiddata.org/ad4/pdfs/geocodingafrobarometer.pdf (accessed December 11, 2017).

Berman, N., Couttenier, M., Rohner D., & Thoenig, M. (2015). *This mine is mine! How minerals fuel conflicts in Africa* (Working Papers Series No. 5409). CESifo.

Birdsall, N., Pinckney, T., & Sabot, R. (2001). Natural resources, human capital and growth. In R. Auty (Ed.), *Resource abundance and economic development* (pp. 57–75). Oxford: Oxford University Press.

Black, D., McKinnish, T., & Sanders, S. (2005). The Economic Impact Of The Coal Boom And Bust. *The Economic Journal,* 115, 503, S. 449–476.

Blanco, L., & Grier R. (2012). Natural resource dependence and the accumulation of physical and human capital in Latin America. *Resource Policy,* 37, 281–295.

Bulte, E., Damania, R., & Deacon, R. (2005). Resource intensity, institutions, and development. *World Development,* 33, 1029–1044.

Childs, J. (2016). Geography and resource nationalism: A critical review and reframing. *The Extractive Industries and Society,* 3, 539–546.

Che, J., & Qian Y. (1998). Insecure Property Rights and Ownership of Firms. *The Quarterly Journal of Economics,* 113, 2, 467-496.

Costello, C., & Grainger, C. (2015). *Property rights, regulatory capture, and exploitation of natural resources* (Working Papers No. 20859, January). National Bureau of Economic Research.

Cust, James and Ridwan D. Rusli. 2014. The economic spillovers from resource extraction: a partial resource blessing at the subnational level? Rep. 2014/02, EGC.

Da Costa, K. (2017). Ghana to finance free senior secondary education with oil money. *Daily Trust*. Retrieved at https://www.dailytrust.com.ng/ghana-to-finance-free-senior-secondary-education-with-oil-money.html (accessed October 26, 2017).

Daniele, V. (2011). Natural Resources and the 'Quality' of Economic Development. *The Journal of Development Studies,* 47, 4, 545-573.

Deaton, B., & Niman, E., (2012). An empirical examination of the relationship between mining employment and poverty in the Appalachian region*. Applied Economics,* 44, 3, 303–312.

EC-FAO Food Security Programme (2008), The Global Administrative Unit Layers (GAUL),

GAUL/Doc 01.

Edwards, R. B. (2016). Mining away the Preston curve. *World Development,* 78, 22–36.

El-Katiri, L. (2014). The Guardian State and its Economic Development Model. *The Journal of Development Studies,* 50, 1, 22-34.

Eller, S. L., Peter R. H., & Kenneth B. M. III. (2011). Empirical evidence on the operational efficiency of National Oil Companies. *Empirical Economics,* 40, 623–643.

Ernst & Young. (various years). *Business risks facing mining and metals*. London: Ernst & Young.

Evans, P. (1995). *Embedded autonomy: States and industrial transformation*. Princeton, NJ: Princeton University Press.

Fjelde, H., & Østby, G. (2014). Socioeconomic Inequality and Communal Conflict: A Disaggregated Analysis of Sub-Saharan Africa, 1990–2008*. International Interactions,* 40, 5, 737–762.

Friedman, T. (2006). The First Law of Petropolitics. *Foreign Policy,* 154, 28–36.

Gamu, J., Le Billon, P., & Spiegel, S. (2015). Extractive industries and poverty: A review of recent findings and linkage mechanisms. *The Extractive Industries and Society,* 2, 162–176.

Gerring, J., Strom C. T., & Rodrigo, A. (2012). Democracy and Human Development. *Journal of Politics,* 74, 1, 1–17.

GNPC. (2016). CSR – Education. Retrieved at http://www.gnpcghana.com/education.html (accessed October 2016, 2017).

Guriev, S., Kolotilin, A., & Konstantin, S. (2011). Determinants of Nationalization in the Oil Sector: A Theory and Evidence from Panel Data. *The Journal of Law, Economics and Organization,* 27, 2, 301–323.

Government of Angola. (2007). Angola: Sonangol spends over USD 2 million in school repair. *Reliefweb*. Retrieved at https://reliefweb.int/report/angola/angola-sonangol-spends-over-usd-2-million-school-repair (accessed October 26, 2017).

Gurr, T.R., Jaggers, K., & Moore, W. (1989). *Polity II Handbook*. Boulder: University of Colorado Press.

Gylfason, T. (2001). Natural resources, education, and economic development. *European Economic Review,* 45, 847–859.

Gylfason, T., & Zoega, G. (2006). Natural resources and economic growth: The role of investment. *World Economy,* 29, 8, 1091–1115.

Gylfason, T., & Zoega, G. (2002). *Inequality and Economic Growth: Do Natural Resources Matter?* (Working Papers No. 712, April). CESinfo.

Hartley, P. R., & Medlock, K. B. (2008). A model of the operation and development of a national oil company. *Energy Economics,* 30, 5, 2459–2485.

Havranek, T., Horvath, R., & Zeynalov, A. (2016). Natural Resources and Economic Growth: A Meta-Analysis. *World Development,* 88, 134–151.

Herb, M. (2005). No Representation without Taxation? Rents, Development, and Democracy. *Comparative Politics,* 37, 3, 297–316.

Hinojosa, L., Bebbington, A., & Barrientos, A. (2012). Social policy and state revenues in mineral-rich contexts. In K. Hujo (Ed.), *Mineral rents and the financing of social policy. Opportunities and challenges*, pp. 91-121. New York: Palgrave Macmillan.

Hodges, C. A. (1995). Mineral resources, environmental issues, and land use. *Science,* 268, 1305-1312.

Hox, J. J., Moerbeek, M., & van de Schoot, R. (2010). *Multilevel Analysis: Techniques and Application*. New York: Routledge.

ICF International. (1996-2014). Demographic and Health Surveys (various) [Datasets]. Calverton, Maryland: ICF International, 2014.

Infomine. (2013). Mine sites: Major mining operations around the world. Retrieved at http://www.infomine.com/minesite/ (accessed August 20, 2013).

Isham, J., Woodcock, M., Pritchett, L., & Busby, G. (2005). The varieties of resource experience: natural resource export structures and the political economy of economic growth. *World Bank Economic Review,* 19, 141–174.

James, A. (2015). *Is education really underfunded in resource-rich economies? Evidence from a panel of U.S. states* (Working Papers No. 2015-01) ALA.

Jensen, L., Yang, T.-C., & Munoz, P. (2012). Natural resource dependence: implications for children's schooling and work in Chile. *Society & Natural Resources*, 25, 1–3, 3–21.

Kaldor, N. (1980). Public or private enterprise—The issue to be considered. In W. J. Baumol (Ed.), *Public and private enterprises in a mixed economy* (pp. 1–12). New York: St. Martin's.

Karl, T. L. (1997). *The Paradox of Plenty: Oil Booms and Petro-States*. Berkeley: University of California Press.

Keefer, P. (2007). Clientelism, Credibility, and the Policy Choices of Young Democracies. *American Journal of Political Science,* 51, 4, 804–821.

Kennedy, R., & Tiede, L. (2011). Nationalization in the oil sector: A political economy perspective. Annual Meeting of the International Studies Association Annual Conference, 16 March 2011, Montreal, Canada. Retrieved at http://www.allacademic.com/meta/p502504_index.html (accessed August 3, 2015).

Knutsen, C. H., Kotsadam, A., Olsen, E. H., & Wig, T. (2016). Mining and Local Corruption in Africa. *American Journal of Political Science*, 61, 2, 320-334

Kolumbia, L. (2017). Tanzania: Lack of Transparency in Natural Gas Production Seen As a Hurdle. *The Citizen.* Retrieved at http://allafrica.com/stories/201706020117.html (accessed October 26, 2017).

Kotsadam, A., & Tolonen, A. (2013). *Mineral mining and female employment* (Research Papers No. 114). OxCarre, University of Oxford.

Koubi, V., Spilker, G., Böhmelt, T., & Bernauer, T. (2014). Do natural resources matter for interstate and intrastate armed conflict? *Journal of Peace Research,* 51, 2, 227–243.

Kumar, A. (2017). Impact of oil booms and busts on human capital investment in the USA. *Empirical Economics*, advanced online publication.

La Porta, R., & López-de-Silanes, F. (1999) The benefits of privatization: Evidence from Mexico. *Quarterly Journal of Economics,* 114, 4, 1193–1242.

Lange, S., & Kinyondo A. (2016). Resource nationalism and local content in Tanzania: Experiences from mining and consequences for the petroleum sector. *The Extractive Industries and Society,* 3, 1095–1104.

Loayza, N., Teran, N., & Rigolini, J. (2013). *Poverty, inequality, and the local natural resource curse* (Discussion Papers No. 7226). IZA.

Ludwig, M. (2012). *The visible hand: National oil companies, oil supply and the emergence of the hotelling rent* (Discussion Papers 2012/11, July). WWZ, University of Basel.

Luciani, G. (1987). Allocation vs. Production State. In *The Rentier State*, edited by H. Beblawi and G. Luciani. London: Croom Helm.

Luong, P. J., & Weinthal, E. (2006). Rethinking the Resource Curse. Ownership Structure, Institutional Capacity, and Domestic Constraints. *Annual Review of Political Science,* 9, 1, 241–263.

Mahdavi, P. (2011). State Ownership and the Resource Curse: A New Dataset on Nationalizations in the Oil Industry. Retrieved at http://ssrn.com/abstract=1916590 (accessed October 16, 2016).

Mahdavy, H. (1970). The Patterns and Problems of Economic Development in Rentier States: The Case of Iran. In *Studies in Economic History of the Middle East*, edited by M. A. Cook. London: Oxford University Press.

Mamabolo, R. (2010). Villagers in Nqamakwe benefit from PetroSA's R4m school building project. *PetroSA Press Releases*. Retrieved at http://www.petrosa.co.za/PressReleases/Pages/Mthawelanga-Launch.aspx (accessed October 26, 2017).

Marcel, V., & Mitchell, J. V. (2006*). Oil Titans: National Oil Companies in the Middle East*. Washington, DC: Brookings Institution Press.

Marchand, J., & Weber, J. (2017). Local Labor Markets and Natural Resources: A Synthesis of the Literature. *Journal of Economic Surveys*, advanced online publication.

Mares, D. R. (2010). *Resource nationalism and energy security in Latin America: Implications for global oil supplies*. Taxas, Huston: Rice University.

Mikesell, R. F. (1997) Explaining the resource curse with special reference to mineral-exporting countries. *Resource Policy,* 23, 4, 191–199.

Miller, G. J. (2005). The political evolution of principal-agent models. *Annual Review of Political Science,* 8, 1, 203–225.

Mommer, B. (2002). *Global Oil and the Nation State*. New York: Oxford University Press.

Morrison, K. (2008). Oil, Nontax Revenue, and the Redistributional Foundations of Regime Stability. *International Organization,* 63, 107–138.

Mosley, P. (2017). *Fiscal Policy and the Natural Resource Curse: How to Escape from the Poverty Trap*. London: Routledge.

Mususa, P. (2010). 'Getting by': life on the Copperbelt after the privatisation of the Zambia Consolidated Copper Mines. *Social Dynamics,* 36, 2, 380–394.

Newell, R. G., & Raimi, D. (2015). *Oil and Gas Revenue Allocation to Local Governments in Eight States* (Working Papers No. 21615, NBER).

NNPC. (2017). Special focus on NNPC's National Quiz Competition. *NNPC Public Relations.* Retrieved at http://www.nnpcgroup.com/PublicRelations/NNPCinthenews/tabid/92/articleType/ArticleView/articleId/191/Special-focus-on-NNPCs-National-Quiz-Competition.aspx (accessed October 26, 2017).

Norman, C. S. (2009). Rule of law and the resource curse: abundance versus intensity. *Environmental and Resource Economics,* 43, 183–207.

OECD. (2017). *Resource Revenue Earmarking: Comparative Analysis and Lessons Learned*. Paris: OECD.

Pickel, A. (2003). Explaining, and explaining with, economic nationalism. *Nations and Nationalism,* 9, 1, 105–127.

Ray, J. L. (2003). Explaining Interstate Conflict and War: What Should Be Controlled for? *Conflict Management and Peace Science,* 20, 2, 1–31.

Ross, M. L. (2015). What Have We Learned about the Resource Curse? *Annual Review of Political Science,* 18, 239–59.

Ross, M. L. (2012). *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations*. Princeton, NJ: Princeton University Press.

Ross, M. L. (2006). Is Democracy Good for the Poor? *American Journal of Political Science,* 50, 4, 860–874.

Schumpeter, J. (1942)*. Capitalism, Socialism, and Democracy*. New York: Harper and Row.

The Guardian (2016). Robert Mugabe to nationalise Zimbabwe's diamond industry. President says operations must come under state control because existing miners have 'robbed' country of its wealth. Retrieved at https://www.theguardian.com/world/2016/mar/03/robert-mugabe-to-nationalise-zimbabwes-diamond-industry (accessed November 15, 2017).

Tordo, S., Tracy, B.S. & Arfaa, N. 2011). National Oil Companies and Value Creation. World Bank Working Paper Nr. 218.

Tsui, K. K. (2011). More oil, less democracy? Evidence from worldwide crude oil discoveries. *The Economic Journal,* 121, 89–115.

Van der Ploeg, F., & Poelhekke, S. (2017). The Impact of Natural Resources: Survey of Recent Quantitative Evidence. *The Journal of Development Studies,* 53, 2, 205-216.

Verspoor, A., & SEIA. (2008). At the Crossroads: Challenges for Secondary Education in Africa. *World Bank's Africa Human Development Series.* Washington, DC: World Bank.

Vicente, P.R. (2010). Does oil corrupt? Evidence from a natural experiment in West Africa. *Journal of Development Economics,* 92, 28–38.

Victor, D. G. (2013). National Oil Companies and the Future of the Oil Industry. *Annual Review of Resource Economics,* 5, 445–462.

Weber, J., Burnett, W., & Xiarchos, I. (2016). Broadening benefits from natural resource extraction: housing values and taxation of natural gas wells as property. *Journal of Policy Analysis and Management,* 35, 3, 587–614.

Wegenast, T. (2015). Oil, Natural Gas, and Intrastate Conflict. Does Ownership Matter? *International Interactions,* 42, 1, 31–55.

Wilson, J. D. (2015). Understanding resource nationalism: economic dynamics and political institutions. *Contemporary Politics,* 21, 4, 399-416.

Wolf, C. O. H. (2009). Overview of the Political and Economic Arguments in Favor of and Against the Establishment of a NOC (June 30, 2009). Retrieved at https://ssrn.com/abstract=1514623 or http://dx.doi.org/10.2139/ssrn.1514623 (accessed April 12, 2017).

Weidmann, N., B., Kuse, D., & Gleditsch, K. S. (2010). The Geography of the International System: The CShapes Dataset. *International Interactions*, 36, 1, 186-106.

Tables

TABLE I. Effects of number of state- versus internationally controlled oilfields on secondary education using DHS data

	(1) All districts	(2) Oil-producing districts
VARIABLES		
nr. state oilfields$_{(t-6)}$	0.0249***	0.00393
	(0.00345)	(0.00354)
nr. international oilfields$_{(t-6)}$	-0.0215***	-0.0151**
	(0.00542)	(0.00641)
wealth index	0.0811***	0.0651***
	(0.00165)	(0.0144)
population density	-1.29e-05***	-1.80e-06
	(3.87e-06)	(1.15e-05)
urban	0.00552***	0.00755
	(0.000685)	(0.0163)
electricity	0.0582***	-0.0569
	(0.00572)	(0.0416)
Country-level variable		
democracy	0.0129***	-0.00727
	(0.000780)	(0.00864)
Constant	-0.0586**	0.0923
	(0.0256)	(0.0638)
Random effects		
Ln_sd(cons)	-2.159***	1.988***
	(0.155)	(0.307)
Ln_sd(residual)	-2.263***	2.403***
	(0.00600)	(0.0398)
Observations	13,899	325
Number of groups	21	8

NOTE: Two-level mixed-effects models with random intercept and mean levels of secondary education among district populations as dependent variable. Standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

TABLE II. Effect of state- versus internationally controlled oilfields within 25 km of respondent on secondary schooling and no education using Afrobarometer data round six

	(1) All districts	(2) Oil-producing districts	(3) All districts	(4) Oil-producing districts
VARIABLES	secondary education	secondary education	incomplete primary education	incomplete primary education
nr. state oilfields	0.114***	0.0290	-0.349***	-0.271*
	(0.0271)	(0.0301)	(0.127)	(0.163)
nr. international oilfields	-0.0259	-0.210***	0.163	0.534**
	(0.0556)	(0.0686)	(0.111)	(0.233)
wealth status	0.193***	-0.201	-0.0816**	-0.366
	(0.0288)	(0.157)	(0.0317)	(0.236)
urban	0.135***	0.397	-0.0957***	-0.406
	(0.0334)	(0.269)	(0.0349)	(0.363)
crime	-0.0239	0.00884	0.00293	0.300
	(0.0318)	(0.163)	(0.0350)	(0.223)
local corruption	0.135***	0.0731	-0.155***	-0.0967
	(0.0268)	(0.141)	(0.0297)	(0.197)
discriminated group	-0.150***	0.322*	0.170***	-0.326
	(0.0344)	(0.192)	(0.0382)	(0.369)
sanitation	0.164***	0.234	-0.198***	-0.381*
	(0.0267)	(0.146)	(0.0297)	(0.197)
road maintenance	0.620***	0.137	-0.695***	-0.669**
	(0.0298)	(0.177)	(0.0322)	(0.268)
democracy	-0.168***	0.116	0.133***	-0.282
	(0.0272)	(0.148)	(0.0300)	(0.211)
Constant	-0.829***	-0.348	-0.660***	-3.914***
	(0.0987)	(0.395)	(0.120)	(1.120)
Observations	33,287	1,153	33,287	1,153

NOTE: Logistic regressions with country dummies and completed secondary education and incomplete primary education as dependent variable. Standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table III. Effect of secondary education on number of oilfields per district using DHS data

VARIABLES	(1) All districts nr. international oilfields	(2) All districts nr. state oilfields	(3) Oil-producing districts nr. international oilfields	(4) Oil-producing districts nr. state oilfields
Secondary education	0.0202**	-0.00152	0.418	-0.0746
	(0.00920)	(0.00226)	(0.359)	(0.111)
Constant	0.0115***	0.0133***	0.657***	0.651***
	(0.00221)	(0.000542)	(0.111)	(0.0343)
Observations	25,128	25,128	517	517
R-squared	0.000	0.000	0.003	0.001
Number of adm2_code	1,470	1,470	38	38

NOTE: Fixed-effects regressions with number of oilfields as dependent variable. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

TABLE IV. Effect of state- versus internationally controlled oilfields within 25 km of respondent on primary and secondary education attainment using Afrobarometer data round six and subsampling strategy

VARIABLES	(1) All buffers incomplete primary education	(2) Buffers with responsive local council incomplete primary education	(3) Buffers with legal uncertainty incomplete primary education	(4) All buffers secondary education or above	(5) Buffers with responsive local council secondary education or above	(6) Buffers with legal uncertainty secondary education or above
nr. state oilfields	-0.351***	-1.116**	-0.745***	0.115***	0.424**	0.0421
	(0.121)	(0.437)	(0.272)	(0.0270)	(0.205)	(0.0631)
nr. international oilfields	0.138	0.199	0.542***	-0.00822	-0.0454	-0.111
	(0.107)	(0.267)	(0.142)	(0.0559)	(0.170)	(0.0889)
wealth status	-0.0279	-0.0692	0.00903	0.158***	0.299***	0.0362
	(0.0288)	(0.0594)	(0.0622)	(0.0275)	(0.0603)	(0.0558)
urban	-0.0958***	-0.0859	-0.211***	0.130***	0.177**	0.322***
	(0.0319)	(0.0669)	(0.0687)	(0.0322)	(0.0706)	(0.0668)
crime	0.0160	0.187***	-0.0193	-0.0287	-0.156**	-0.00679
	(0.0320)	(0.0700)	(0.0600)	(0.0305)	(0.0712)	(0.0521)
local corruption	-0.178***	-0.236***	-0.0624	0.174***	0.218***	0.106**
	(0.0271)	(0.0617)	(0.0536)	(0.0256)	(0.0614)	(0.0473)
discriminated group	0.145***	0.182**	0.0771	-0.131***	-0.249***	-0.187***
	(0.0351)	(0.0781)	(0.0630)	(0.0331)	(0.0805)	(0.0543)
sanitation	-0.214***	-0.130**	-0.154***	0.160***	0.103*	0.136***
	(0.0271)	(0.0575)	(0.0575)	(0.0256)	(0.0586)	(0.0496)
road maintenance	-0.678***	-0.638***	-0.787***	0.640***	0.696***	0.529***
	(0.0298)	(0.0634)	(0.0601)	(0.0287)	(0.0650)	(0.0530)
Constant	-0.461***	-1.034***	-0.613***	-0.982***	-0.662***	-0.857***
	(0.110)	(0.290)	(0.198)	(0.0946)	(0.221)	(0.160)
Observations	36,941	8,171	9,807	36,941	8,171	9,816

NOTE: Logistic regressions with country dummies and primary and secondary education as dependent variables. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

FIGURE 1. Oil ownership and share of secondary education within buffer zones using Afrobarometer round six
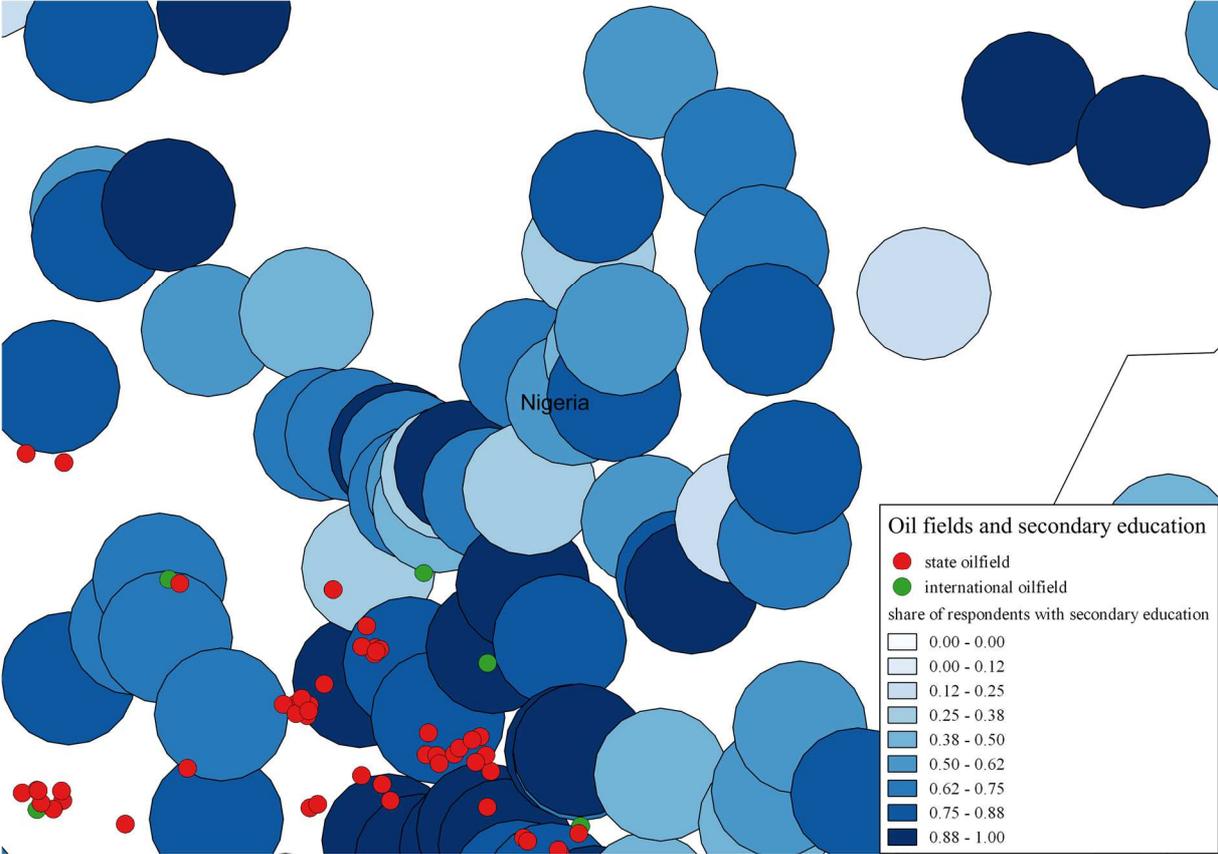
FIGURE 2. Conditional effect of state- versus international oil companies on secondary education for oil-producing subsample
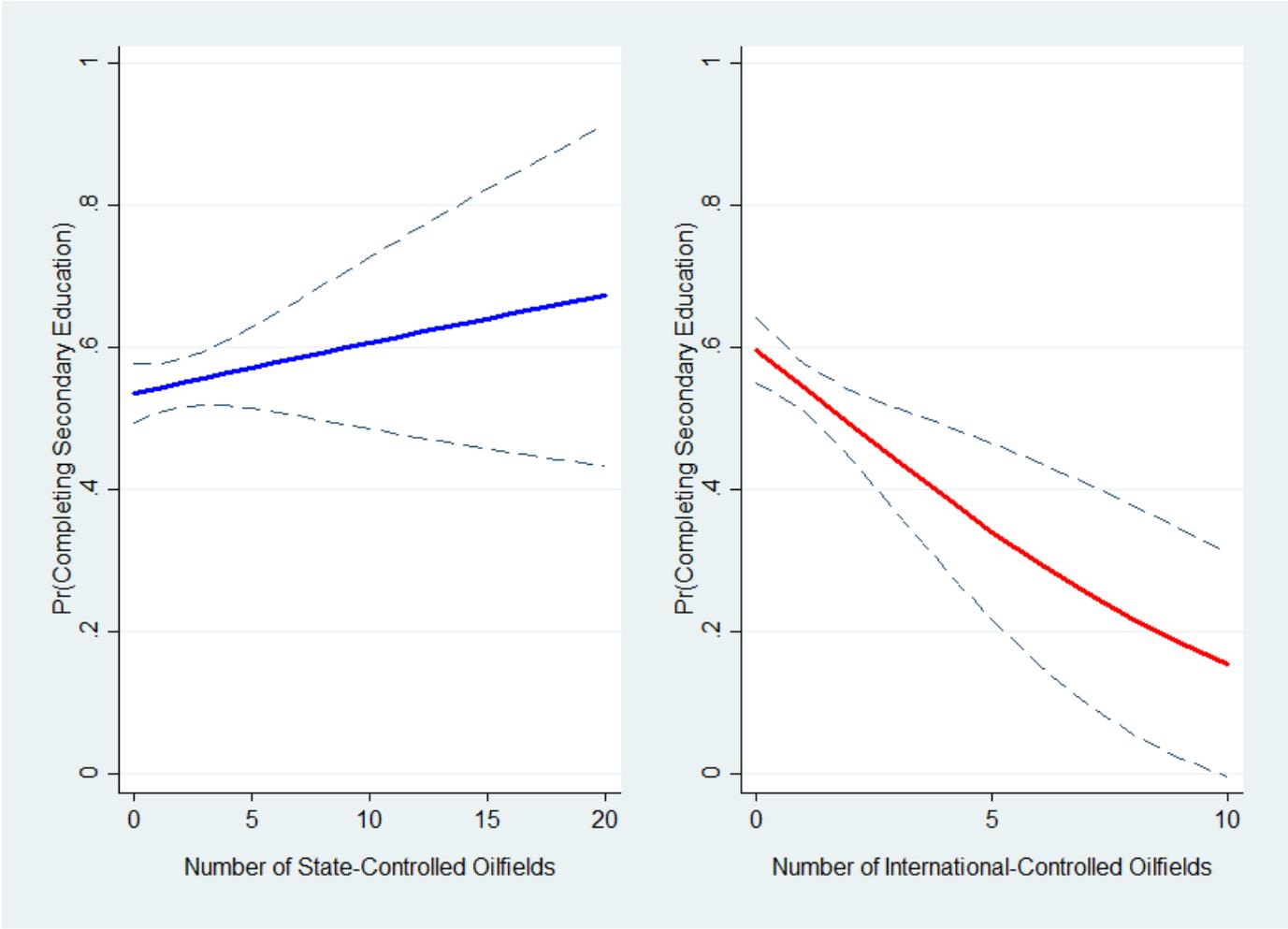
FIGURE 3. Conditional effect of state- versus international oil companies on no formal education for oil-producing subsample