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At Africa's Expense? Disaggregating the Social Impact of Chinese Mining Operations

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Abstract

Qualitative studies and media reports suggest that the presence of Chinese oil or mining companies generates resentments among local extractive communities due to low wages, poor working conditions, environmental degradation, the employment of foreign labour, and perceived racial discrimination. At the same time, Chinese investment in the extractive sector appears to enhance local infrastructure. So far, these claims have not been empirically tested in a systematic way. Relying on novel data on the control-rights regimes of diamond, gold, and copper mines and geo-referenced information from Afrobarometer surveys, this paper examines whether Chinese-controlled mining promotes anti-Chinese sentiments among the local populations of sub-Saharan African countries. In addition, we test the effect of mining contractors' nationality on socio-economic indicators such as local employment rates and infrastructure levels. Our logistic regression analysis for the period 1997–2014 reveals that the effect of Chinese mining companies on African local development is ambiguous: while proximity to Chinese-operated mines is associated with anti-Chinese sentiments and unemployment, populations living close to Chinese mining areas enjoy better infrastructure, such as paved roads or piped water. Multilevel mixed-effects estimations using district-level data from the Demographic Health Survey for 20 sub-Saharan countries corroborate these findings.

Keywords: natural resources, Africa, China, mining, unemployment, infrastructure
JEL classification: O13, Q34, O55, L72, E24, O18

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Article Outline

1 Introduction

Over the past decade, Chinese companies have invested heavily in the resource sectors of many developing nations.[1] According to recent estimates, around half of China's total outbound investments in the years from 2005 to 2016 went into the energy and mining sectors of foreign countries. Of these investments in the resource sector, sub-Saharan countries attracted approximately one-third of the funds (Scissors 2017). Furthermore, since the beginning of the

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twenty-first century, China has quickly become Africa's biggest trading partner, with a trade volume of USD 172 billion in 2015 after a peak of USD 216 billion in 2014 (CARI 2017a). Driven by its hunger for resources and new markets, China now operates mining facilities in several sub-Saharan countries including Ghana, Namibia, South Africa, and Zambia. Some authors note that China even exclusively targets African economies with abundant natural resources when making investment decisions (Kolstad and Wiig 2011).

While they often bring much-needed capital and technology for the development of mining operations, Chinese activities often also cause discontent among local communities in host countries. Recent media reports cite manifold grievances that have prompted people to protest, not only in Africa but also in other world regions. In December 2016, for instance, security officials and violent protesters clashed over a Chinese copper exploration project in the jungles of Ecuador amid claims of indigenous communities being expelled from their ancestral homes (Reuters 2016c). Two months earlier local people had demonstrated against the pollution caused by truck transportation to a Chinese-run copper mine in Peru, which had already sparked lethal clashes in its project phase (The Guardian 2015; Reuters 2016b). In the same year in Myanmar, villagers' and monks' anger about land expropriations, lack of compensation, environmental damages, and the destruction of Buddhist sites resulted in the renewed outbreak of protests against a Chinese copper mine (A. R. C. Marshall 2012; Radio Free Asia 2016; Reuters 2016a).

In Africa, locals in Soamahamanina, Madagascar, repeatedly took to the streets in 2016 protesting against a Chinese-run gold-mining project that was allegedly destroying their farm land (Agence France-Presse 2016a, 2016b). In Zambia, Chinese-run copper mines have been accused of illegal safety practices, hostility to trade unions, and dangerously long shifts (D. Smith 2011). Moreover, the alleged loss of jobs to Chinese employees, who are ferried in project by project, is a key driver of protests around different mining regions in Nigeria, Namibia, and Zambia (Knaup 2010; Larmer 2017; Magistad 2011). African miners have also protested against bad payment and poor working conditions at Chinese-operated mines in Chad, Namibia, and Niger, among other countries (Ghosh 2013; Jamasmie 2013; Kabemba 2012; Reuters 2014; Shinn 2016).

Against the backdrop of such incidents, concerns about the negative environmental and socio-economic effects of Chinese companies abroad are widespread in the host regions (e.g., Armony and Velásquez 2015; Geerts, Xinwa, and Rossouw 2014). Western media coverage and the reports of environmental and human rights advocacy groups have further contributed to the widely held view that Chinese resource-extraction companies have, on balance, more detrimental effects on local development and more frequently violate labour and environmental standards than other mining operations.

However, various studies have shown that the picture is not so clear-cut. Particularly when it comes to the socio-economic and political effects, a closer look is needed. While Chinese mining companies have indeed neglected labour standards in Peru, a detailed qualita-

tive study has shown that enterprises from the United States have a similarly bad record (Irwin and Gallagher 2013; see also López and Quiroga 2015). At a macro level, evidence exists that the often-assumed negative effect of oil trade on a country's human rights situation is more severe in the case of high trade dependence on the United States rather than on China (Bader and Daxecker 2015). Moreover, other quantitative, country-level analyses report a positive effect of resource exports to China on the exporting countries' economic development (Meyersson, i Miquel, and Qian 2008; Su, Wei, and Tao 2016). In addition, qualitative research shows that Chinese investments in Africa's natural resource sector are often accompanied by large infrastructure projects. For example, Foster et al. (2008) draw attention to how some Chinese-financed infrastructure projects in Africa were accomplished in exchange for access to natural resources between 2001 and 2007. Contracted engineering projects included the building of highways and roads, housing and office buildings, sewerage, dams, electricity, and power plants. Countries such as Angola, Botswana, and Nigeria are among the largest recipients of Chinese infrastructure investments (Cheung et al. 2014).

Overall, Chinese companies' engagement in the resource sectors of developing countries seems to have both negative and positive effects on local development. Employing a disaggregated quantitative framework, this paper is the first systematic attempt to analyse whether Chinese mining companies indeed further anti-Chinese resentment among local mining communities and employ less local labour compared to other mineral-extraction firms. In addition, it examines whether communities located close to Chinese-controlled mining facilities profit from better infrastructure, as conventionally claimed. Combining novel data on the control rights of copper, diamond, and gold mines in sub-Saharan Africa with survey data from three Afrobarometer rounds, we test the effect of respondents' proximity to Chinese and non-Chinese controlled mines on local grievances and the provision of infrastructure for the period 1997–2015. Our logistic regressions show that the presence of Chinese mining firms generates resentment, particularly because of a perceived lack of job opportunities for the local population. Furthermore, our analysis corroborates the conventional wisdom: the presence of Chinese-controlled mines significantly increases the provision of piped water and roads within a 50 km buffer zone around Afrobarometer respondents. To check the robustness of these findings, we perform multilevel mixed-effects models using district-level data from the Demographic Health Survey (DHS).

The paper is organised as follows: The next section discusses relations between Chinese mining firms and local communities by highlighting common underlying grievances and stressing the Chinese role as a promoter of Africa's infrastructure. This discussion is followed by the empirical analysis of the link between the nationality of mine operators and local resentment and infrastructure provision. The conclusion highlights further areas for future research.

2 Mining Operations, Grievances, and the Risk of Communal Conflict: The Arguments

The existing literature discusses manifold reasons why (mining) projects operated abroad by multinational companies can lead to conflict within local communities (e.g. Calvano 2008; Wegenast and Schneider 2017). Mining-related grievances among the local population can particularly trigger social conflict. Besides their impact on the natural environment, extractive industries often have a detrimental effect on the social and economic order of local communities and destroy traditional ways of living.

Surely, it is not only Chinese-led mining companies' activities that bear the risk of causing grievances that eventually lead to communal conflict. A recent literature survey of studies on the connection between extractive industries and poverty, for example, shows that industrial mining is generally more often linked with growing levels of poverty, whereas small-scale artisanal mining has an alleviating effect on poverty (Gamu, Le Billon, and Spiegel 2015). In fact, some quantitative studies exploring within-country evidence show that resource-producing regions are often characterised by poverty; underemployment; a neglect of public services such as health, education, security, or basic utilities; and reduced community well-being (see Deaton and Niman 2012; Jensen, Yang, and Muñoz 2012; Lawrie, Tonts, and Plummer 2011; Slack and Jensen 2004; Stedman, Parkins, and Beckley 2004; Tonts, Plummer, and Lawrie 2012). Regarding the effect of resource extraction on the demand for local jobs, Slack and Jensen (2004) find that workers in extractive industries within the US experience higher rates of underemployment compared to the employees of other major industrial sectors (see also Perdue and Pavela 2012). It is often argued that extractive activities promote economic enclaves with no linkages to other regions or economic sectors. An enclave economy is associated with a lack of production, of consumption, and of fiscal backward or forward linkages (c.f. Hirschman 1981).

However, several review articles provide mixed support for the existence of a local resource curse (c.f. Badeeb, Lean, and Clark 2017; Cust and Poelhekke 2015; Gamu et al. 2015; Marchand and Weber 2017; Ploeg and Poelhekke 2017). In fact, some studies also provide evidence of positive socio-economic effects of resource extraction via, for example, increases in local income and employment or the increased dynamism of small businesses (c.f. Cust and Poelhekke 2015). For instance, Aragón and Rud (2013) conducted an econometric study of the Yanacocha gold mine in Peru and found positive income levels for the local population living within 100 km of the mine. The authors assume that the mine's demand for local inputs (the so-called backward-linkage channel) explains these welfare effects. In a similar vein, Lippert (2014) finds that Zambians have benefited from mining in the Copper Belt region through mines' backward linkages. Employing survey data and a constituency-level panel, the author shows that an increase in local copper output improves measures of living standards. Similar results are reported by Loayza et al. (2013), who use variation in mining across Peruvian districts.

At the local level, mining operations may reduce poverty through various channels, including fiscal transfers, employment effects, the development of economic activities outside the mining sector, and extractive industries' investments in public goods, either as a side effect of mining operations or out of social-responsibility-related considerations (Gamu et al. 2015: 167–170). Studying how large-scale gold-mining affects local livelihoods and communities in Ghana, Mali, and Tanzania, Chuhan-Pole et al. (2017: xviii) conclude that "mining communities experience positive yet limited welfare benefits." The authors stress that mineral processing can also generate well-known negative externalities including environmental degradation, health risks, and social dislocations.

In addition to analyses of the relationship between resource extraction and socio-economic indicators such as poverty or unemployment, qualitative studies have investigated the impact of oil- or mining-related FDI on infrastructure networks (Farooki 2012). State-owned oil or mining enterprises in particular often pursue a wide range of non-commercial goals such as job creation or improving local social services or infrastructure by directly funding schools, hospitals, roads, electricity, or sanitation (Tordo, Tracy, and Arfaa 2011). Authors have also stressed the oil-for-infrastructure type of deals in which multinational mining or oil companies have helped improve basic infrastructure within African countries in exchange for access to important natural resources (Corkin 2012a; Ite 2005; Zafar 2007).

Above all, the impact of resource extraction on local well-being seems largely contingent on sociopolitical institutions and linkages with the rest of the economy (Havranek, Horvath, and Zeynalov 2016; Papyrakis 2017). This paper highlights one particular contextual variable that might moderate the effect of mining on local development: the nationality of mining companies. Particularly in the case of the causal linkages that are directly related to mining firms' active operations on the ground, there are reasons to assume that Chinese companies perform differently than Western enterprises in terms of local employment opportunities or the provision of infrastructure.

Disaggregated quantitative studies have shown that mining companies may bring about new job opportunities for the local population (Gamu et al. 2015; Kotsadam and Tolonen 2016).[2] When it comes to Chinese resource companies operating in developing countries, the employment effects are often reported to be non-existent. A common narrative is that Chinese companies bring in their own work force rather than hiring locally (G. Smith 2013: 178, 195; Zhao 2014: 1044).[3] This is partly due to China's own problem of domestic rural unem-

2 Particularly for poorer and low-skilled rural households, studies find that artisanal mining provides a more accessible alternative livelihood activity (Hilson, Amankwah, & Ofori-Sarpong, 2013; Spiegel, 2012). Large-scale industrial mining, in contrast, often has a smaller employment effect due to the lack of relevant skills among the local population. Nevertheless, a general effect is also evident in the latter case (Gamu, Le Billon, & Spiegel, 2015, p. 168).

3 This is a contested claim among academics since comparable and reliable data on workforce localisation by Chinese companies in developing countries are unavailable. The existing, isolated data varies considerably depending on the countries and industry sectors observed and thus leads to diverse and sometimes con-

ployment, for which providing jobs abroad for Chinese people is regarded as one solution (Zhao 2014: 1043). Other factors that might hamper the employment effects of Chinese companies are the frequently reported racism in the workplace, the poor working conditions, and the substandard safety records in Chinese-run extractive activities. This is particularly true in Africa and Latin America, and has led to very negative views of Chinese employers in various countries' resource sectors (Irwin and Gallagher 2013; Lee 2009; Sautman and Yan 2016: 2152). Other authors criticise the fact that the equally unsavoury practices of non-Chinese mining or oil firms in Africa are often overlooked (Asongu and Ssozi 2016; Mohan 2013).

The employment of Chinese labour rather than local workers in Chinese-sponsored projects in Ethiopia, Sudan, and Namibia has been criticised locally (Alden 2005), and according to Adisu et al. (2010), African labour has not benefited from Chinese investment. Following severe protests and riots among coal and copper miners in Zambia, President Michael Sata asked the Chinese government to improve workers' conditions and observe limits on how many foreign workers Chinese companies bring into the country (Magistad 2011). For this reason, we assume that mineral-extraction districts hosting Chinese companies have higher unemployment rates compared to districts in which minerals are extracted by non-Chinese firms.

In addition to questioning the direct employment effects of mines operated by Chinese companies, some argue that large Chinese-run projects in developing countries often operate as "enclaves" with poor integration in the host regions' economies, which in turn limits the communal welfare effects (Bräutigam 2009; Lee 2009; Mohan 2013). In general, mining can provide financial assets for state and private actors, not only for investments in the non-extractive industries of host economies but also for the establishment of higher-value mining-related industries such as processing and refinement facilities at a national scale. More importantly in the context of this study, industrial mining is also expected to generate positive effects on non-mining economic activities in the producing communities, creating many indirect jobs related to the mining operations, particularly in the service sector (Gamu et al. 2015: 169). The reality of Chinese activities in Africa, though, might be different, as illustrated by Mohan (2013: 1262) in the case of a Chinese dam project in Africa:

> The heavy trucks and equipment are all Chinese, so is the cooking oil, and so are the cigarettes that the Chinese workers smoke. There's even a small farm growing Chinese vegetables for the Chinese workers. Such enclaves are now common across much of Africa and other parts of the developing world […].

Similar observations have also been made by other studies, and also regarding the mining sector, calling into question the idea of a straightforward economic linkage effect of Chinese

trasting findings (e.g., Sanborn and Chonn, 2015: 28). Referring to the migration of Chinese workers to Africa, Mohan (2013: 1255) notes that "more empirical evidence on the levels of labor importation in relation to local labor market conditions" is needed.

extractive industries on host communities (e.g., G. Smith 2013). In contrast to traditional mining companies from Western countries, Chinese enterprises have not established long-term relationships with local firms and have thus not supported the development of suppliers (Fessehaie and Morris 2013).

An additional factor which might lead to fewer welfare effects in communities hosting Chinese mining projects relates to low wages. With Chinese companies bringing higher-skilled labour from home, local recruitment often concentrates on low-skill and low-paid work, which limits potential wage spillovers (e.g., Mohan 2013; G. Smith 2013; Zhao 2014). Moreover, some studies argue that Chinese state-owned enterprises' short-term strategies favour cost efficiency, which might also have a dampening effect on paid wages (Haglund 2009). However, the absence of reliable and comparable figures makes it impossible to substantiate such claims. Some case studies show that while Chinese mining companies in Zambia indeed pay low wages, this also holds true for companies from other countries (Sautman and Yan 2014: 1089). In Peru, some Chinese mining companies are reported to pay above the average while others do not (González-Vicente 2013: 53, 59–60; Sanborn and Chonn 2015: 18–19). Nevertheless, the media and non-governmental organisations regularly point to widespread wage-related grievances among employees of Chinese mining facilities in sub-Saharan Africa, which in turn lead to strikes and protests. For the reasons outlined above, we assume that – compared to other mineral-extraction companies – Chinese firms do produce fewer linkages to other economic sectors and thus generate fewer employment opportunities.

Finally, several studies argue that mining operations can have a positive impact on the socio-economic development of producing communities since they entail the provision of public goods such as infrastructure. The public goods can result directly from the operation of mining facilities – for instance, access roads or water and electricity systems. Here it is important, however, that companies link such infrastructure with the local villages and also deliberately adhere to the needs of the local population. On the other hand, the public goods can also be the product of corporate social responsibility (CSR) initiatives by extractive industries and can include health care, sanitation, and education (Gamu et al. 2015: 169–170).

A common view surrounding Sino–African relations is that Chinese state-owned companies contribute to the development of Africa's infrastructure networks. Assuming that China's focus in Africa is geared towards resource-abundant countries such as Angola, Nigeria, Sudan, and Zambia, Corkin et al. (2008: 3) note that "[c]onstruction and infrastructure is possibly the sector in which China has made its largest commercial footprint in Africa." Oil and minerals have been used to secure Chinese credits. In many cases, these loans are then tied to infrastructure construction to be carried out by Chinese companies or to the employment of Chinese inputs and labour (Ancharaz 2009: 622; Bräutigam 2009: 275; Corkin et al. 2008). Due to their low capital costs, low profitability margins, and different risk profiles, state-owned Chinese companies often also have a competitive advantage in providing cost-efficient infrastructure to African states over international competitors in competitive bidding processes

(Chen, Goldstein, and Orr 2009; Chen and Orr 2009; Corkin 2012b; Corkin et al. 2008; Zafar 2007).4 Such resources-for-infrastructure deals are often viewed as a method with which China secures a broad range of natural resources, from oil to minerals (Cheung, de Haan, Qian, and Yu 2012).

The main principle behind these deals is the exchange of future resource extraction for immediate loans for the development of infrastructure. One the one hand, the resource-for-infrastructure swaps can be for a single purpose. For instance, dam building and the construction of a power plant in the Republic of Congo and Sudan, respectively, have been financed in return for prospective oil production with loans channelled through Chinese banks and the work carried out exclusively by Chinese construction firms. On the other hand, the swaps can have multiple purposes (e.g. transport infrastructure, education, health, energy, agriculture, and water). These also involve lines of credit from Chinese financial institutions and favour Chinese inputs but in several cases also allow for competitive international bidding processes and/or the involvement of target countries' companies (Konijn 2014: 8, 11–12). Given the diversity of these deals, the assessment of their impact on economic development also varies (Alves 2013a; Konijn 2014). A common view is that while China has become a "critical partner in bridging Africa's infrastructure gap," mainly through the provision of loans, many challenges still prevail: limited backward linkages in host economies, a lack of transparency, and poor environmental and social records (e.g. Alves 2013a, 2013b).[5] In this paper, we test whether the presence of Chinese mining companies is indeed associated with increased local infrastructure.

3 Empirical Strategy and Data

To test whether the presence of Chinese mining companies leads to anti-Chinese resentment, a lack of employment opportunities, and more infrastructure provision at the local level, we draw on a new dataset containing mine-level information on operating companies in 38 sub-Saharan countries between 1997 and 2015. To quantify attitudes towards China as well as employment and infrastructure outcomes, we employ rounds 4, 5, and 6 of the Afrobarometer as well as panel data from the Demographic Health Survey (DHS).

3.1 Dependent Variables: Measuring the Socio-Economic Impact of Chinese Mining

The Afrobarometer surveys public attitudes and is one of the most comprehensive data sources on the socio-economic development of more than 30 African countries.[6] The Afro-

4 Data on Chinese construction firms' mode of entry to Africa show that in approximately half the cases they have won projects through international tenders (C. Chen, Goldstein and Orr, 2009: 80).

5 According to recent estimates, nearly one-third of Chinese loans to Africa, equivalent to USD 30 billion, went to the transport sector in the years between 2000 and 2015 (CARI 2017b).

6 Afrobarometer data can be retrieved from: <www. afrobarometer.org>.

barometer's national samples comprise either 1,200 or 2,400 face-to-face interviews with randomly selected respondents older than 18 years. To guarantee representativeness, the Afrobarometer uses a stratified, multi-stage area probability design. Stratification is based on the main subnational unit of government (state, province, or region) and urban and rural location. The smallest geographic unit for which reliable population data is available constitutes the primary sample unit (PSU). 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.

Afrobarometer has recently provided subnational geocoded data for all rounds. We joined point coordinates from our mine-level dataset with the geo-location of Afrobarometer respondents through spatial proximity with QGIS. To this end, we first calculated 50 km buffer zones around the centroids of the survey clusters following the procedure outlined by Knutsen et al. (2017). Information on the number and ownership of mines was added in a second step, which is outlined below.

In our empirical analysis, we rely on rounds 4, 5, and 6 of Afrobarometer for different reasons.[7] Given that Chinese investments in Africa's mining sector mainly started in the early part of this century and our data on mines' control rights cover the period 1997–2015, it makes little theoretical sense to employ earlier rounds of Afrobarometer to measure our dependent variables.[8] In addition, rounds 4 and 6 contain information on respondents' attitudes towards China that are valuable for testing our hypotheses. In round 6, surveyed respondents were asked about their evaluation of China's economic and political influence on their country and what factors contribute most to negative images of China within their states.[9] Round 4 asked whether people believe that China helps their country.[10] Using this information, we generated three dummy variables measuring respondents' perceptions on China. These variables take the value "1" when respondents think that China has a very or somewhat negative influence on their country, when they believe that China has a negative image because it takes jobs from their countries, or when they report that the negative Chinese image is mainly driven by China's extraction of resources from Africa.

Besides measuring attitudes on Sino–African relations, the Afrobarometer rounds assessed here also contain information on the employment status of respondents and their access to infrastructure. Making use of this data, we create three more dependent variables. First, we assess whether respondents report being unemployed or not. We then evaluate the provision of local basic infrastructure by considering, second, whether respondents have access to piped water and, third, whether roads in the primary sample unit are paved or tarred.

7 Round 5 of the Afrobarometer consists of 34 national surveys conducted between 2011 and 2013.

8 Round 3 was conducted in 2005. Round 4 is composed of 20 national surveys recorded between 2008 and 2009, and round 6 covers 36 countries for the years 2014–2015.

9 Items Q81B and Q81D, respectively.

10 Item Q98H.

To check the robustness of our results, we rely on socio-economic variables from 52 Democratic and Health Surveys (DHS) containing district-level data on national household surveys in 21 sub-Saharan countries during the period 1996–2014. To create a disaggregated dataset with a panel structure, we focused on countries that underwent at least two survey waves within this period of analysis and for which the geo-location of respondents was available. Applying these benchmarks, we were able to include 21 sub-Saharan countries. Three survey rounds were available for a total of 10 countries,[11] while two rounds were available for the remaining states.[12]

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).[13] 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 two socio-economic variables per district and year: the percentage of unemployment and the share of respondents with access to public drinking water taps.

3.2 Independent Variables of Interest

The new dataset on mineral deposits 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 companies' websites was gathered to fill in missing information. Using these indications in combination with the firm reports provided, we were able to code the ownership structures of 328 gold mines, 125 diamond mines, and 85 copper mines. Yearly observations from 1997 to 2015 depict the shares held by private domestic, state-owned domestic, private international, and state-owned international natural resource companies.

The distribution of natural resource mines appears to be quite uneven among countries. South Africa hosts as many as 146 gold mines, followed by Zimbabwe with 62. Other countries have a maximum of 25 (Ghana) and a minimum of one (e.g. Zambia). South Africa is also the country with the most diamond mines (70), with other countries harbouring 14 at the most (Angola) or at least one (e.g. Cameroon). When it comes to copper mines, the Democratic Republic of Congo ranks at the top with 39 and is followed by Zambia with 20. Other

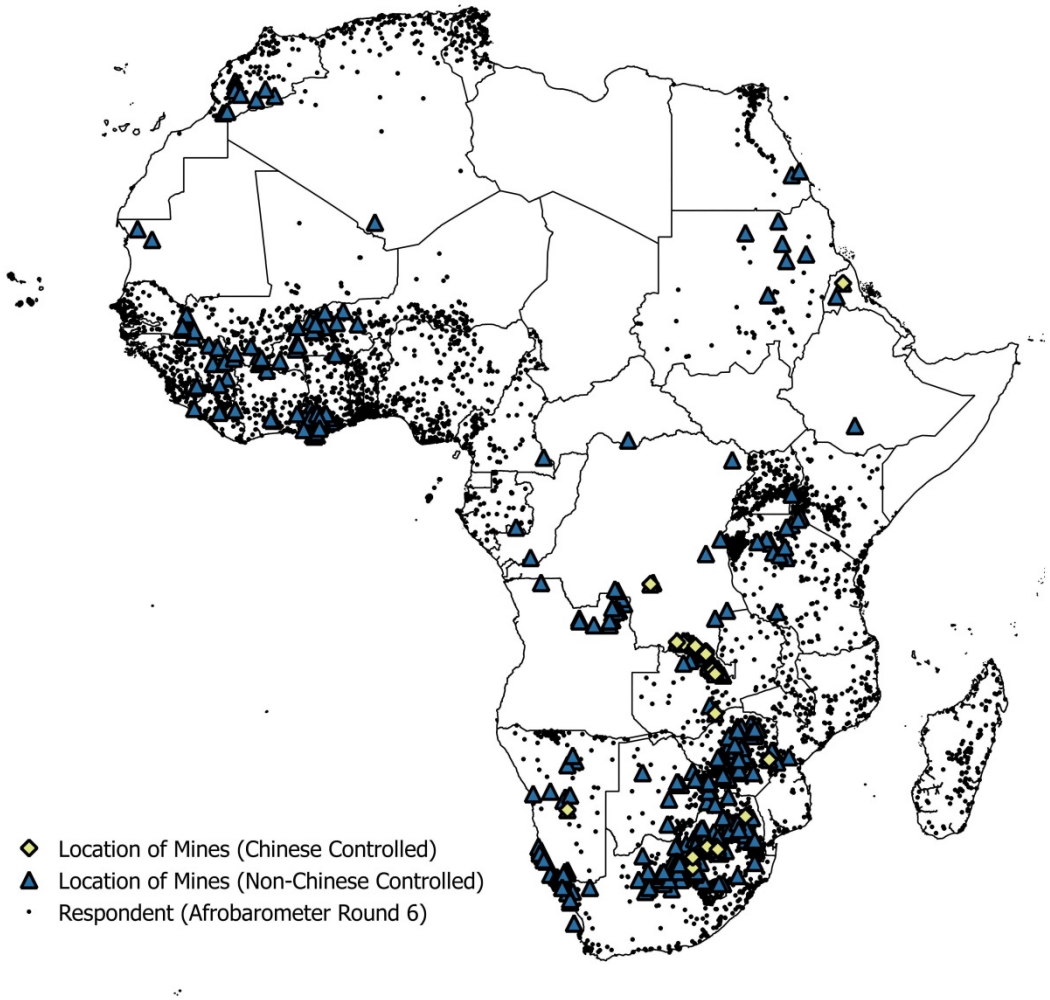
11 Countries with three survey rounds include Burkina Faso, Ghana, Guinea, Kenya, Namibia, Nigeria, Rwanda, Senegal, Uganda, and Zimbabwe.

12 The countries covered by the two survey rounds are: Benin, Cameroon, Democratic Republic of Congo, Ethiopia, Ivory Coast, Liberia, Madagascar, Sierra Leone, Tanzania, Togo, and Zambia.

13 GAUL features global geographic polygon layers with all districts in all countries of the world (EC-FAO Food Security Programme 2008).

countries have as many as nine (Botswana) or only one (e.g. Angola). Map 1 below shows the location of Chinese-controlled and non-Chinese-controlled mines as well as the respondents of Afrobarometer's round 6. Our estimations exploit respondents' proximity to mines in order to estimate the effect of the Chinese presence on our different dependent variables.[14]

Figure 1. Location of Chinese-Controlled and Non-Chinese-Controlled Mines and Afrobarometer (Round 6) Respondents



A look at the spatial distribution of Chinese mineral companies reveals a concentration in four host countries: Zambia, Zimbabwe, South Africa, and the Democratic Republic of Congo. The highest number of mineral mines with Chinese ownership can be found in South Africa, which hosts as many as 20. The Democratic Republic of Congo is home to 12 mines of this type and is closely followed by Zambia with 10. The data also reveals a sharp rise in Chinese-controlled mines from 2006 onwards within these countries.

14 Note that mining locations overlap and therefore not all Chinese-controlled mines are visible.

Every mine is dummy coded as majority controlled by Chinese companies if Chinese firms hold at least 66 per cent of the shares. The idea behind this threshold value is that a companies' effects should prevail where its influence on the decision-making of joint-venture boards could be decisive. The resulting variables summarise the number of mines that are predominantly controlled by Chinese investors versus the number of mines operated predominantly by non-Chinese enterprises. Making use of the latitude and longitude coordinates that were collected during the coding phase, we calculated the number of Chinese-controlled versus non-Chinese-controlled mines in 50 km buffer zones around Afrobarometer respondents. Since rounds 4, 5, and 6 of Afrobarometer were surveyed in 2008, 2011–2013, and 2016, respectively, we calculated mean control shares for each mine for the corresponding periods: 1997–2008, 1997–2011, and 1997–2015.

To match the mining information to the district-level data structure, we followed a procedure akin to that employed for the construction of the dependent variables from DHS indicators. The point coordinates of each mine were overlaid with GAUL polygons using GIS software. Each facility was thereby assigned to its hosting district. As a result, we were able to obtain the number of mines controlled predominantly by Chinese or non-Chinese operators for each district-year.

3.3 Control Variables

To minimise potential problems stemming from omitted variable bias, we selected control variables that might jointly influence a mine's control-rights structure and our dependent variables. When assessing how the proximity of Chinese-operated mines impacts respondents' attitudes towards China, we mainly control for individuals' socio-economic status, including whether they have attained at least secondary education (*secondary schooling or above*), regard themselves as economically better off compared to the rest of the country (*personal wealth*), are currently unemployed (*unemployed*), or belong to an ethnic group that experiences discrimination (*discriminated group*). In addition, we include several neighbourhood characteristics and indicators of institutional quality in our models. *Crime* is a dummy variable indicating whether respondents feel unsafe walking in their neighbourhood, and *urban* indicates whether respondents live in an urban area. *Democracy* measures the perceived level of democracy within the respondents' country.[15] Finally, we account for local state capacity by including a dummy variable in which respondents report that government manages the provision of water and sanitation services sufficiently well (*sanitation*).

When estimating the effect of mines' property rights on unemployment, we employ the same controls as described above and add a proxy for the level of local corruption. The variable *local corruption* takes the value "1" when respondents indicate that most or all local government councillors are corrupt and "0" otherwise. We expect local corruption, personal

15 This variable ranges from 1 ("not a democracy") to 4 ("a full democracy").

wealth, educational level, and local state capacity (proxied by access to sanitation) to be negatively linked to unemployment. In contrast, respondents living in unsafe areas and belonging to groups that are discriminated against should have an increased risk of being unemployed. Whether democracies reduce unemployment levels is unclear (c.f. Fishman 2010). The effect of an urban residence on unemployment is also not clear-cut. While cities might offer more job opportunities, respondents living in rural areas are likely to be self-employed in the agricultural sector.

The control variables described above are also important determinants of infrastructure provision. Areas in which respondents are richer, more educated, employed, and not ethnically discriminated against should have better access to paved roads or piped water.[16] Urban residence and increased state capacity should also promote basic local infrastructure. In contrast, regions characterised by higher criminality and local corruption are likely to suffer from reduced infrastructure provision.

As previously noted, we check the robustness of our results by using alternative district-level survey data. Unfortunately, not all control variables described above are available from the Demographic Health Survey. When estimating the effect of Chinese-operated mines on unemployment levels and access to public drinking water taps with DHS information, we rely on the following control variables: economic wealth, level of secondary schooling attained, percentage of the population with access to electricity (as a proxy for local state capacity), share of the population living in urban areas, districts' population density, and the country's level of democracy.[17]

4 Estimation Technique and Empirical Findings

Given that our described dependent variables from Afrobarometer have binary outcomes, we employ logistic regression to estimate the effect of mining control rights on perceptions of Chinese presence in Africa, unemployment, and infrastructure provision. In particular, we estimate how the number of Chinese-controlled versus non-Chinese-controlled mines within a 50 km buffer zone around respondents affects these respondents' likelihood of showing anti-Chinese resentment, being unemployed, or having access to paved roads or public water taps. We control for country-specific effects by including country dummies.

Maps 2 and 3 illustrate the research design employed. Drawing on round 6 from Afrobarometer, the maps show the location of mines predominantly operated by Chinese or non-Chinese companies and the location of respondents (with their corresponding 50 km buffer

16 When piped water is used as dependent variable, access to electricity is used as a proxy of local state capacity instead of access to sanitation.

17 The level of democracy is measured using the Polity 2 score for political regimes from the Polity project (Gurr 1989; M. G. Marshall, Gurr, and Jaggers 2016). All other variables described were taken from the DHS rounds included.

zone). In addition, they depict whether a respondent has access to paved or tarred roads and whether he or she is unemployed. The results from the logistic estimations described below reveal that there is a systematic variation in the dependent variables analysed that can be explained by mining companies' nationalities.

Figure 2. Location of Chinese-Controlled versus Non-Chinese-Controlled Mines and Respondents' Access to Roads (Afrobarometer Round 6)

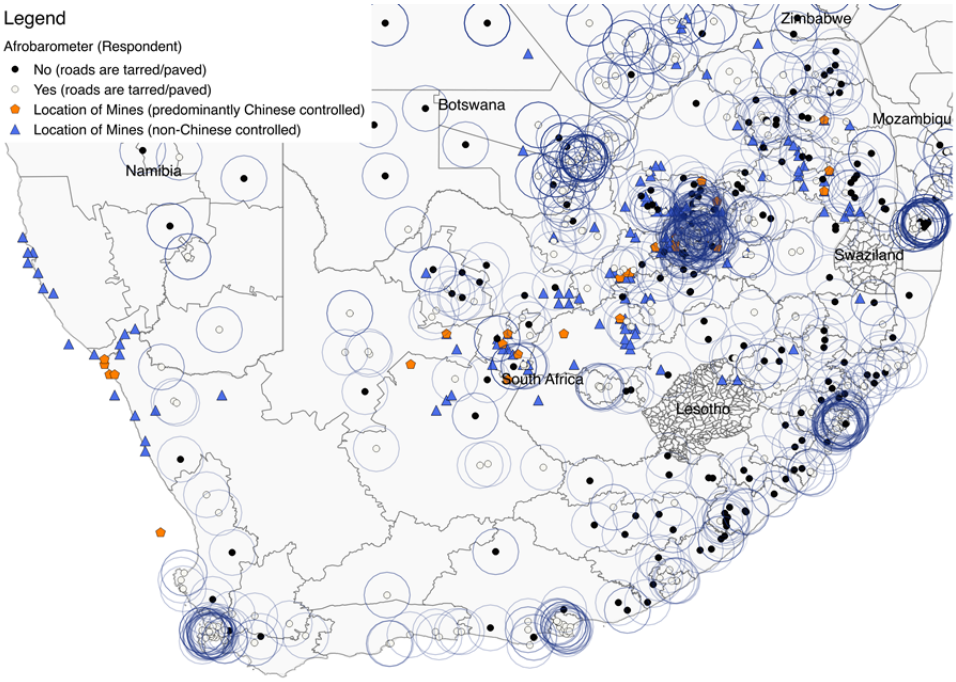


Figure 3. Location of Chinese-Controlled versus Non-Chinese-Controlled Mines and Respondents' Employment Status (Afrobarometer Round 6)

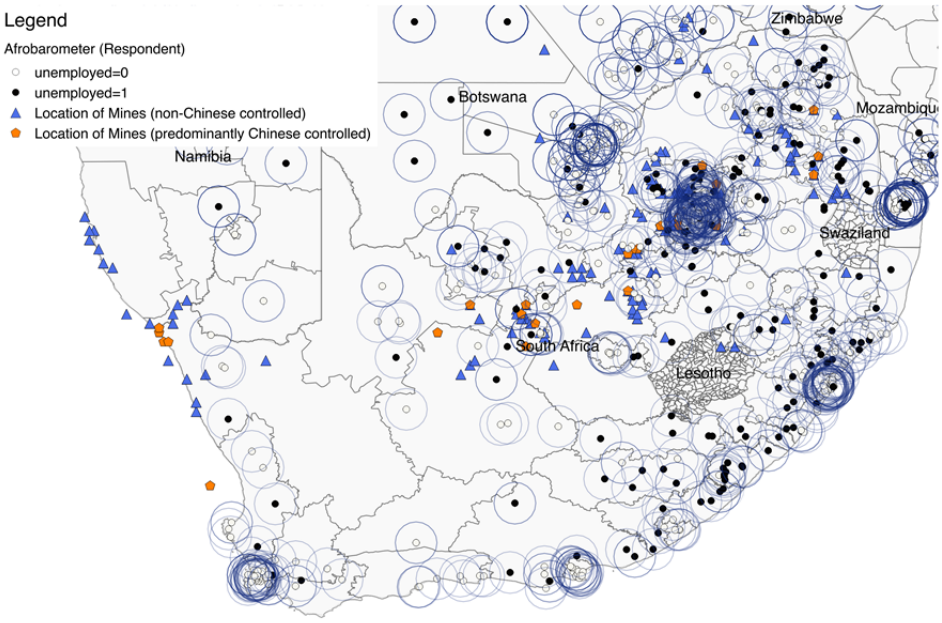


Table 1 reports the effect of mines' control rights on respondents' perceptions of the Chinese presence in their country. Models 1 and 2 test whether respondents living close to a Chinese-operated mine are more likely to state that China's political and economic influence on their country is negative. Proximity to Chinese-controlled mining seems not to influence respondents' image of China when mineral-producing and non-mineral-producing units are included (model 1). When only respondents living within a 50 km radius of a mine are included in the sample, the logistic estimations reveal that – compared to individuals living close to mines operated by other nations – respondents in the proximity of a Chinese-controlled mine think that China has a negative impact on their country. In order to explore possible motives for this negative perception, the remaining models test whether respondents think that China is taking away jobs or natural resources from their countries. As becomes evident, interviewees believe that the Chinese presence goes hand in hand with a loss of local jobs. This finding applies to an all-unit sample as well as to a restricted mineral-producing sample (models 3 and 4). In contrast, concerns about Chinese resource-grabbing seem to be non-existent (models 5 and 6).

Table 1. Effect of Chinese versus Non-Chinese Mines within 50 km of Respondent on Perception of China (Afrobarometer Round 6)

	(1)	(2)	(3)	(4)	(5)	(6)
	(All units)	(Mining units)	(All units)	(Mining units)	(All units)	(Mining units)
VARIABLES	China has negative role	China has negative role	China takes jobs	China takes jobs	China takes resources	China takes resources
nr. chinese mines	0.0338	0.0720**	0.149***	0.133***	0.0136	0.00891
	(0.0268)	(0.0335)	(0.0286)	(0.0340)	(0.0403)	(0.0502)
nr. non-chinese mines	0.0116	-0.00512	-0.0392***	-0.0148	0.0125	0.00279
	(0.00752)	(0.0109)	(0.0120)	(0.0149)	(0.0115)	(0.0156)
living conditions	0.0236	-0.0669	0.0235	0.00754	0.0359	-0.0417
	(0.0343)	(0.0782)	(0.0339)	(0.0952)	(0.0387)	(0.0914)
secondary education	0.0619*	0.130*	0.0831**	0.165	0.107***	0.0580
	(0.0343)	(0.0785)	(0.0352)	(0.100)	(0.0395)	(0.0942)
urban	-0.00721	0.00983	0.193***	0.358***	-0.129***	0.0719
	(0.0430)	(0.110)	(0.0410)	(0.132)	(0.0468)	(0.135)
unemployed	0.0362	0.0540	-0.000677	-0.0497	-0.0122	-0.0746
	(0.0330)	(0.0751)	(0.0337)	(0.0936)	(0.0378)	(0.0896)
crime	0.0757**	0.217**	0.0645*	0.0390	-0.0825*	-0.280***
	(0.0372)	(0.0872)	(0.0389)	(0.106)	(0.0442)	(0.108)
democracy	-0.430***	-0.568***	-0.0465	-0.176*	-0.161***	-0.158*
	(0.0325)	(0.0760)	(0.0331)	(0.0947)	(0.0371)	(0.0874)
discriminated group	0.390***	0.425***	-0.0979**	0.0685	0.0178	0.314***
	(0.0398)	(0.0966)	(0.0430)	(0.131)	(0.0477)	(0.109)
state capacity	-0.196***	-0.436***	0.0145	-0.0482	-0.118***	-0.272***
	(0.0328)	(0.0808)	(0.0325)	(0.0955)	(0.0380)	(0.0980)
Constant	-0.153	-1.708***	-0.830***	-0.586**	-2.727***	-4.322***
	(0.102)	(0.347)	(0.104)	(0.266)	(0.200)	(1.010)
Observations	33,155	4,619	32,246	4,624	32,246	4,624
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R-squared	0.124	0.146	0.0286	0.0455	0.129	0.200

Note: Logistic regressions with country dummies and negative perception of China as dependent variable. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

To substantiate these findings, we rely on round 4 of Afrobarometer, which asked whether individuals think that China helps their country. As shown in Table 2, respondents living close to a Chinese-operated mine are less likely to indicate that China is helpful (both when compared across all units and among mineral-producing buffer zones only).

Table 2. Effect of Chinese versus Non-Chinese Mines within 50 km of Respondent on Perception of China Helping The Country (Afrobarometer Round 4)

	(1)	(2)
	(All units)	(Mining units)
VARIABLES		
nr. chinese mines	-0.164**	-0.148**
	(0.0654)	(0.0715)
nr. non-chinese mines	0.0129	0.0115
	(0.00836)	(0.0111)
secondary education	0.238***	0.122
	(0.0564)	(0.120)
living conditions	0.224***	0.381***
	(0.0606)	(0.128)
urban	0.0831	-0.181
	(0.0712)	(0.164)
unemployed	-0.170***	-0.0931
	(0.0548)	(0.118)
crime	0.0316	0.00199
	(0.0592)	(0.127)
democracy	0.214***	0.0534
	(0.0529)	(0.122)
discriminated group	-0.219***	0.0972
	(0.0571)	(0.141)
state capacity	0.266***	0.466***
	(0.0541)	(0.121)
Constant	2.916***	2.754***
	(0.204)	(0.419)
Observations	15,470	2,797
Prob > chi2	0.0000	0.0000
Pseudo R-squared	0.0870	0.0806

Note: Logistic regressions with country dummies and China perceived as helpful as dependent variable. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Our findings corroborate the conventional wisdom frequently voiced in the media: Chinese resource extraction generates resentment among the local population. In particular, the feared lack of job opportunities for the local population seems to trigger grievances. But are these perceptions warranted when compared with objective output indicators? To determine whether the reported fears are justifiable, we analyse whether proximity to a mine operated by Chinese companies in fact increases respondents' risk of being unemployed. Table 3 below shows the effect of mines' control rights on unemployment risk using the three rounds of Afrobarometer. While non-Chinese mining significantly reduces interviewees' risk of reporting unemployment across almost all models, proximity to mines controlled by Chinese investors does not lower the unemployment risk. Thus, we find positive evidence for the claim that Chinese companies employ less local labour and/or promote enclave economies.

When we consider the all-unit samples (models 1, 3, and 5), we find that the control variables are largely in line with our expectations: respondents who enjoy better economic conditions compared to the rest of the country and have completed at least secondary education have a reduced risked of unemployment through all models. Urban areas and regions with higher state capacity (as proxied by access to sanitation) also consistently reduce the unemployment risk. The remaining variables have no robust effect across all models.

Table 3. Effect of Chinese versus Non-Chinese Mines within 50 km of Respondent on Unemployment Status (Afrobarometer Data)

	Round 4		Round 5		Round 6	
	(1)	(2)	(3)	(4)	(5)	(6)
	(All units)	(Mining units)	(All units)	(Mining units)	(All units)	(Mining units)
VARIABLES						
nr. chinese mines	0.0279	0.0873*	-0.00587	-0.00647	0.0334	-0.00732
	(0.0486)	(0.0510)	(0.0261)	(0.0302)	(0.0224)	(0.0265)
nr. non-chinese mines	-0.0210***	-0.0249***	-0.0196***	-0.0241***	-0.0150**	-0.0112
	(0.00681)	(0.00881)	(0.00644)	(0.00821)	(0.00707)	(0.00892)
living conditions	-0.226***	-0.0816	-0.186***	-0.209***	-0.234***	-0.239***
	(0.0386)	(0.0858)	(0.0275)	(0.0692)	(0.0266)	(0.0663)
secondary education	-0.930***	-0.707***	-0.834***	-0.980***	-0.578***	-0.591***
	(0.0377)	(0.0883)	(0.0278)	(0.0740)	(0.0273)	(0.0704)
urban	-0.354***	-0.181	-0.286***	-0.147*	-0.259***	-0.151*
	(0.0486)	(0.114)	(0.0265)	(0.0762)	(0.0315)	(0.0885)
crime	0.0441	0.144	0.0614**	0.0250	-0.0738**	-0.0403
	(0.0394)	(0.0899)	(0.0286)	(0.0765)	(0.0307)	(0.0766)
democracy	0.0508	0.0120	-0.00480	0.00602	0.0293	0.0701
	(0.0366)	(0.0904)	(0.00471)	(0.0128)	(0.0261)	(0.0671)
discriminated group	-0.0105	-0.00113	-0.00292	0.0389	0.106***	0.210**
	(0.0405)	(0.103)	(0.0349)	(0.0936)	(0.0332)	(0.0881)
state capacity	-0.0755**	-0.161*	-0.113***	-0.175***	-0.0108	-0.0245
	(0.0351)	(0.0839)	(0.0255)	(0.0677)	(0.0257)	(0.0685)
local corruption	-0.0315	0.0138	-0.0794***	-0.0222	-0.00496	0.00109
	(0.0364)	(0.0863)	(0.0264)	(0.0673)	(0.0258)	(0.0647)
Constant	1.565***	1.133***	1.928***	1.865***	0.886***	0.791***
	(0.0940)	(0.203)	(0.0877)	(0.244)	(0.0946)	(0.225)
Observations	18,489	3,114	34,548	5,026	32,913	4,912
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R-squared	0.106	0.0995	0.0929	0.110	0.101	0.0999

Note: Logistic regressions with country dummies and unemployed as dependent variable.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

While Chinese investors seem to promote resentments due to the lack of employment opportunities for the local population, do they further the provision of infrastructure, as commonly asserted in the qualitative literature? Tables 4 and 5 show the effect of mining control rights on access to paved or tarred roads and piped water. Indeed, Chinese mining companies increase respondents' access to both infrastructure variables across all models. When we directly

compare the effect of Chinese versus non-Chinese mining companies by only considering mining units, we observe that non-Chinese firms are associated with significantly fewer roads within the 50 km buffer zone around respondents (models 4 and 6 of Table 4). While non-Chinese companies also seem to increase access to piped water, this effect is considerably lower than the outcome reported for Chinese enterprises (models 4 and 6 of Table 5).

Four control variables have a consistent effect on both dependent variables. Firstly, buffer zones where the population is economically better off and more educated show increased access to roads and piped water. Secondly, urban areas and higher state capacity also further the provision of infrastructure. Thirdly, buffers characterised by higher unemployment have fewer paved or tarred roads. Finally, and surprisingly, higher levels of democracy also seem to reduce road infrastructure. However, there is convincing empirical evidence that only the stock of democracy – and not the level – is conducive to social welfare (Gerring, Thacker, and Alfaro 2012).

Table 4. Effect of Chinese versus Non-Chinese Mines within 50 km of Respondent on Road Infrastructure (Afrobarometer Data)

	Round 4		Round 5		Round 6	
	(1)	(2)	(3)	(4)	(5)	(6)
	(All units)	(Mining units)	(All units)	(Mining units)	(All units)	(Mining units)
VARIABLES						
nr. chinese mines	0.272***	0.240***	0.128***	0.218***	0.411***	0.444***
	(0.0564)	(0.0628)	(0.0307)	(0.0383)	(0.0344)	(0.0429)
nr. non-chinese mines	0.0305***	0.00450	-0.0115	-0.0569***	0.00112	-0.0366***
	(0.00912)	(0.0105)	(0.00717)	(0.0106)	(0.00825)	(0.0106)
living conditions	0.353***	0.405***	0.0694**	0.153*	0.166***	0.263***
	(0.0383)	(0.0910)	(0.0311)	(0.0860)	(0.0296)	(0.0744)
secondary education	0.638***	0.774***	0.376***	0.472***	0.580***	0.936***
	(0.0380)	(0.0911)	(0.0324)	(0.0886)	(0.0305)	(0.0782)
urban	0.253***	-0.0965	2.047***	2.822***	0.0252	0.148
	(0.0473)	(0.127)	(0.0304)	(0.100)	(0.0351)	(0.0981)
unemployed	-0.212***	-0.193**	-0.130***	-0.417***	-0.138***	-0.172**
	(0.0358)	(0.0899)	(0.0305)	(0.0880)	(0.0289)	(0.0732)
crime	0.00911	-0.113	0.0184	-0.116	0.146***	0.0860
	(0.0389)	(0.0968)	(0.0320)	(0.0980)	(0.0331)	(0.0842)
democracy	-0.141***	-0.00436	-0.0165***	-0.0157	-0.195***	-0.373***
	(0.0361)	(0.0977)	(0.00518)	(0.0152)	(0.0283)	(0.0749)
discriminated group	0.0435	-0.0983	0.0149	0.0175	0.0439	-0.124
	(0.0400)	(0.108)	(0.0394)	(0.111)	(0.0360)	(0.0998)
state capacity	0.157***	-0.0635	0.178***	0.0500	0.377***	0.333***
	(0.0346)	(0.0885)	(0.0292)	(0.0851)	(0.0285)	(0.0777)
local corruption	0.127***	0.0884	0.0116	0.181**	0.107***	0.194***
	(0.0360)	(0.0927)	(0.0297)	(0.0827)	(0.0283)	(0.0727)
Constant	-0.873***	0.0118	-1.267***	3.247***	1.787***	2.370***
	(0.0900)	(0.219)	(0.0908)	(0.538)	(0.146)	(0.421)
Observations	18,489	3,028	33,530	5,001	31,930	4,690
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R-squared	0.124	0.200	0.287	0.398	0.231	0.201

Note: Logistic regressions with country dummies and paved roads as dependent variable.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Effect of Chinese versus Non-Chinese Mines within 50 km of Respondent on Water Infrastructure (Afrobarometer Data)

	Round 4		Round 5		Round 6	
	(1)	(2)	(3)	(4)	(5)	(6)
	(All units)	(Mining units)	(All units)	(Mining units)	(All units)	(Mining units)
VARIABLES						
nr. chinese mines	0.291***	0.335***	0.279***	0.286***	0.214***	0.216***
	(0.0703)	(0.0763)	(0.0634)	(0.0822)	(0.0512)	(0.0681)
nr. non-chinese mines	0.0498***	0.0215	0.00160	0.0387**	0.0957***	0.0661**
	(0.0165)	(0.0162)	(0.00907)	(0.0155)	(0.0239)	(0.0262)
living conditions	0.382***	0.318***	0.116***	0.0938	0.128***	0.331***
	(0.0461)	(0.118)	(0.0351)	(0.0955)	(0.0333)	(0.0952)
secondary education	0.560***	0.390***	0.209***	0.106	0.516***	0.699***
	(0.0476)	(0.119)	(0.0377)	(0.0981)	(0.0361)	(0.0991)
urban	0.313***	0.297*	1.878***	2.699***	0.0922**	0.593***
	(0.0630)	(0.169)	(0.0376)	(0.111)	(0.0413)	(0.132)
unemployed	-0.0631	-0.313***	-0.129***	-0.193**	-0.00314	-0.269***
	(0.0438)	(0.119)	(0.0342)	(0.0958)	(0.0327)	(0.0916)
crime	0.0683	-0.107	-0.000324	-0.135	0.0532	0.159
	(0.0472)	(0.117)	(0.0362)	(0.106)	(0.0378)	(0.109)
democracy	-0.0192	0.193	0.0140**	-0.0311*	0.0102	-0.272***
	(0.0431)	(0.119)	(0.00587)	(0.0176)	(0.0323)	(0.0942)
discriminated group	-0.154***	-0.124	-0.129***	-0.00309	-0.0582	-0.278**
	(0.0482)	(0.141)	(0.0441)	(0.132)	(0.0408)	(0.127)
state capacity	2.906***	2.992***	1.993***	3.047***	3.005***	3.673***
	(0.0543)	(0.144)	(0.0456)	(0.168)	(0.0432)	(0.154)
local corruption	-0.0498	-0.0196	0.0957***	0.00699	0.0618*	0.272***
	(0.0429)	(0.112)	(0.0331)	(0.0929)	(0.0319)	(0.0922)
Constant	-1.167***	0.0278	0.112	-3.362***	0.0310	-0.220
	(0.102)	(0.341)	(0.110)	(0.377)	(0.213)	(0.391)
Observations	18,631	3,142	34,018	4,833	31,990	4,874
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R-squared	0.381	0.430	0.412	0.506	0.361	0.442

Note: Logistic regressions with country dummies and piped water as dependent variable.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

As a robustness check, we assess the effect of Chinese versus non-Chinese mining companies on unemployment levels and the provision of infrastructure, relying on district-level data taken from the Demographic Health Survey. We thereby 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 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 employment or infrastructure 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 unem-

ployment or access to public drinking water taps. Through this strategy we are able to exploit the panel structure of our dataset and thus variation for the same district over time.

Table 6 below largely corroborates our previous findings. The two-level mixed-effects estimations reveal that only the presence of non-Chinese mining operations reduces the level of unemployment within districts (models 1 and 2). When the effect of companies' nationality is directly compared by including only mineral-producing districts, Chinese mining firms are positively linked to unemployment shares (model 2). Regarding the provision of infrastructure, model 4 shows that – compared to Chinese-owned companies – other mining firms correspond with reduced provision of public drinking water taps.

Table 6. Effect of Chinese versus Non-Chinese Mines within District on Unemployment and Access to Public Drinking Water (DHS Data)

	(1)	(2)	(3)	(4)
	(All units)	(Mining units)	(All units)	(Mining units)
VARIABLES	unemployed	unemployed	drinking water	drinking water
nr. chinese mines	0.0167	0.0233***	-0.0431	-0.0259
	(0.0138)	(0.00903)	(0.0293)	(0.0276)
nr. non-chinese mines	-0.0153***	-0.00804**	-0.0131*	-0.00901**
	(0.00512)	(0.00324)	(0.00753)	(0.00435)
wealth index	0.00814	-0.0573	0.0239**	0.0496
	(0.0104)	(0.0448)	(0.0102)	(0.0376)
population density	-2.67e-05	-0.000157	-2.08e-05	-0.000236***
	(2.18e-05)	(0.000171)	(2.60e-05)	(8.37e-05)
secondary education	-0.0264	0.304***	0.00660	0.133
	(0.0560)	(0.111)	(0.0317)	(0.107)
urban	0.0468	0.190***	0.131***	0.0600
	(0.0327)	(0.0714)	(0.0398)	(0.132)
state capacity	-0.0259	0.0197	0.00412	-0.0904
	(0.0436)	(0.103)	(0.0534)	(0.162)
Constant	0.233***	0.263**	0.0540	-0.0380
	(0.0451)	(0.119)	(0.0341)	(0.120)
Country-level variable				
democracy	0.00386	0.0101	-0.00342*	-0.00293
	(0.00482)	(0.00710)	(0.00175)	(0.00248)
Random effects				
Ln_sd(cons)	-2.068***	-2.116***	-2.733***	-3.110***
	(0.155)	(0.227)	(0.119)	(0.213)
Ln_sd(residual)	-1.846***	-2.050***	-1.769***	-2.051***
	(0.0555)	(0.126)	(0.0809)	(0.104)
Observations	20,679	880	20,679	880
Number of groups	21	16	21	16
Wald chi2	62.43	1675.33	49.84	389.71
Prob > chi2	0.0000	0.0000	0.0000	0.0000

Note: Two-level mixed-effects models with random intercept and mean levels of unemployment and access to public tap with drinking water among district-populations as dependent variable.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

As an additional robustness check, we re-estimate all the models presented, changing the threshold value for defining a predominantly Chinese-controlled mine to 51 per cent or above (instead of 66 per cent as employed above). The results remain qualitatively identical. Furthermore, some scholars argue that the key issue determining the national and local socio-economic impact of mining investments is not whether or not a company is Chinese, but rather the host country's regulatory framework and implementation (Irwin and Gallagher 2013; Mohan and Lampert 2013; Tan-Mullins and Mohan 2013). Although we control for the level of democracy and local state capacity in our models, one potential concern is that our findings are driven by the assumption that Chinese investments in Africa's extractive industries only really started at the beginning of the twenty-first century and are biased towards institutionally weaker states.

Contrary to the view that Chinese firms are mostly present in countries from which Western governments have shied away, China's engagement is not limited to countries with, for instance, inadequate rule of law. Rather, recent findings suggest that Chinese investment is not concentrated in countries with poor rule of law and the biggest recipient is South Africa (Chen, Dollar, and Tang 2015). Cheung et al. (2014) also find that host-country characteristics such as corruption or political instability are hardly related to the number of Chinese engineering projects in the country (see also Asongu and Ssozi 2016: 38–39).

5 Conclusion

Media reports and qualitative case studies suggest that Chinese-controlled resource production in particular leads to local grievances in developing countries. According to some authors, the activity of Chinese mining operators does not encourage forward or backward linkages to host regions' economies – for example, because they predominantly employ Chinese labour (e.g., Bräutigam 2009; Lee 2009). At the same time, Chinese investment in Africa's resource-extraction sector is believed to promote the provision of local infrastructure (Foster, Butterfield, Chen, and Pushak 2009).

This paper represents an initial attempt to examine these claims in a quantitative and comparative way. Our findings partly substantiate the conflict-enhancing effect of Chinese mine operators at the local level. Relying on three rounds of Afrobarometer, our results show that individuals living close to a Chinese-operated mine have a more negative image of China compared to respondents living in the vicinity of non-Chinese mining operations. In particular, the perception that Chinese investors are taking jobs from African citizens seems to fuel local resentments.

Our analysis further reveals that these perceptions may be legitimate. While proximity to non-Chinese mining companies significantly reduces individuals' risk of facing unemployment, Chinese-operated mines do not improve the local population's employment opportunities. Two-level mixed-effects estimations using information from the Demographic Health

Survey substantiate these findings: districts hosting Chinese-controlled mineral production show higher unemployment rates.

Nonetheless, we also find evidence that China's presence in Africa might contribute to local development by enhancing infrastructure networks. We show that – in line with conventional wisdom – Chinese investments in Africa's extractive industries are linked to better roads and increased access to piped water within the resource-extraction regions. This effect is also observable at the district level: the populations of districts hosting Chinese-operated mines enjoy better access to drinking water.

Our findings raise several questions that warrant future research. While our analysis shows that Chinese mining operations do not generate job opportunities for the local population, the precise mechanisms behind this association remain unclear. Further quantitative and qualitative analyses should, for example, examine the extent to which Chinese investments produce linkages to other economic sectors or regions. Given that perceptions of China within Africa's local extractive communities are rather negative, studies on whether multinational Chinese companies are increasingly addressing resource-related grievances (e.g. by adopting corporate social responsibility practices) seem particularly warranted. Furthermore, it remains unclear to what degree Chinese investment in infrastructure really helps African countries or is rather an instrument to secure natural resources and expand Chinese business interests (c.f. Alves 2013a). Finally, we need to assess the conditions under which African host countries are likely to profit from Sino–African commercial relations.

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