Natural Resources and Institutional Quality: Drivers of Chinese Investments in Africa?

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Introduction

In recent decades, China's economic power and global influence have grown significantly, leading to a surge in outward investment (OI). This trend gained momentum after Deng Xiaoping's tour of South China in 1992, where he emphasized the importance of economic growth and opening up to the outside world (Xiaowen, 2001). In the years that followed, China began to implement a series of reforms that would transform its economy into a market-based system. One of the key policies introduced was the "Go Global" policy in 1999, which aimed to encourage Chinese companies to invest overseas and expand their global presence (Bellabona & Spigarelli, 2007). Since then, Chinese OI has consistently shown a positive trend (Macrotrends, 2023), with China being the leading foreign investor in 2020 according to a report released by China's Ministry of Commerce, accounting for 20.2 percent of the total global investment volume (Global Times, 2021). China's OI in Africa has particularly been on the rise in recent years, motivated by institutional, economic and political factors. According to data from the China Africa research initiative (2023), China's investment flows in Africa surged from US$ 75 million in 2003 to US$ 5 billion in 2021. This remarkable development has attracted the attention of scholars, journalists, and policymakers who seek to understand the underlying factors driving Chinese OI.

One important determinant of China’s OI is the presence of natural resources (Buckley et al., 2009; Kolstad & Wiig 2012; Mohan and Lampert, 2013; Sanfilippo, 2010; Tuman & Shirali, 2017). While there is a depth of literature already studying Chinese resource-seeking OI in Africa, there are few studies comparing the determinants of this sort of OI attraction across different types of natural resources. In most research, only a singular or limited amount of natural resources are included from which a claim is made for the overall effect of natural resources on Chinese OI. Furthermore, some researchers group together multiple natural resources into one variable, discarding possible implications of more granular analysis. We argue that exploiting the variation in the prevalence of natural resources across African nations can yield robust insights on China's OI at varying levels. Certain industries require specific natural resources, and the demand for these industry-specific resources varies depending on the performance of an array of natural resource intensive industries. For instance, if one industry is thriving while another is struggling, the demand for certain types of natural resources will increase, while the demand for others will decline. Therefore, we will examine how the varying prevalence of minerals across African countries affects Chinese OI into these regions. More specifically, we will individually investigate the effects of the aggregate mineral richness of a country, industry type, and individual minerals on Chinese OI, aiming to fill in the gap in the literature by focusing on how different natural resources, particularly minerals, may affect OI decisions in comparison to others. Additionally, Kolstad & Wiig (2012) found in their research that the availability of oil in African countries is only a driver of Chinese OI in combination with poor institutional quality. In our paper, we will research whether this effect is also present for other types of natural resources. Understanding these factors can help policymakers and investors better understand the dynamics of Chinese OI in Africa and develop strategies to maximize the benefits of this investment for African countries.

From looking both at the effects of different layers of minerals and looking at the interaction effect between institutional quality and minerals, our research question can be defined as follows: *How does the presence of various minerals across Africa affect Chinese outward investments into those regions, and how do institutional factors influence this relationship?*

To understand this complex threefold relation, between minerals, institutions and Chinese investments into Africa, we have conducted a negative binomial model, using data from 2000-2012. Using mineral-level data, we do not only find that mineral richness drives Chinese investments in general but we also have been able to pinpoint more clearly what specific minerals drive Chinese investments into Africa, such as gold and coal. Furthermore, our results suggest that lower levels of institutional quality amplify the positive effect that minerals have on the number of Chinese investments.

Literature Review

Theoretical Resource-Seeking Motives of OI

Outward investment (OI) is a primary mechanism by which firms seek to gain access to the world economy. The extensive body of literature on OI, which has emerged alongside the phenomenon of globalization over the past fifty years, seeks to unveil the increasingly nuanced determinants of OI for the benefit of decision-makers across all kinds of firms. The global market for natural resources is no exception to this area of study, and has received much attention from public and private entities alike. In this section, we explore China's interest in African natural resources by employing established theoretical frameworks widely used in previous literature to explain OI location choices. We propose two prominent theories of location strategy to explain this phenomenon—Dunning's eclectic paradigm and Institutional theory—which we will analyze individually in the subsequent paragraphs.

China’s interest in African natural resources can largely be explained by the location sub-paradigm of Dunning’s eclectic paradigm, which dictates that firms will concentrate their OI in locations that yield them a competitive advantage (Dunning, 2000). By choosing to invest in extraction projects located in Africa and its abundant reserves of natural resources, China gains a competitive advantage in controlling these resources (Mol, 2011). China's pursuit of African natural resources can be primarily attributed to the location advantages described by Dunning’s location sub-paradigm, as they fuel China’s competitive advantage by yielding them access to vital resources necessary for consolidating its status as a dominant power in global manufacturing.

In addition to Dunning’s eclectic paradigm, Institutional theory also offers profound insights into China's OI in African natural resource markets by emphasizing the role of institutional qualities in shaping firms' location decisions. According to this approach, Chinese firms may be more likely to invest in African countries where the institutional environment aligns with their interests and operations (Kostova et al., 2008). Factors such as regulatory frameworks, political stability, and cultural norms can all influence location choices for resource-seeking OI. Since Africa has unique institutional qualities that in many cases discourage investment from Western entities, China seeks to capitalize on this absence of Western presence by working with Africa’s institutions in ways that other global powers are unwilling (more on China’s relationship with African institutions in the next section). Institutional theory supplements Dunning’s location theory by helping to explain the factors driving Chinese OI in Africa's natural resource sector, highlighting the importance of host country institutional backgrounds in shaping investment decisions.

In the next section we will look at the previously researched determinants of Chinese OI Into Africa, investigating whether these theoretical foundations are held under the scrutiny of past empirical studies.

Chinese Investment Drivers in Africa

This section examines the factors that drive Chinese OI in Africa, specifically focusing on institutional and economic factors. Understanding the drivers behind Chinese OI in Africa is crucial for our research, as it helps to identify relevant control variables that could influence the relationship between Chinese OI and natural resources. By exploring these factors, we can gain insights into the motivations that drive Chinese investment in Africa.

Institutional Factors

As was discussed earlier in the section on location theory, political and institutional factors often play a large role in determining where firms decide to invest. The case of Chinese OI into Africa is no exception, with many studies finding that the state of politics and institutions in African countries can be a significant factor in attracting Chinese investors. For example, the Chinese government has been known to offer financial and political support to weaker African governments in exchange for access to their natural resources (Alden et al., 2008). In 2007, China signed a deal valued at $9 billion with the Democratic Republic of Congo (DRC) allowing Chinese state-owned firms to build infrastructure projects in the country, including roads and railways, in exchange for access to the DRC's copper and cobalt reserves (Bavier, 2009). Many argue that this support serves to provide Chinese firms with access to resources and markets that would otherwise be difficult to obtain, reducing China's dependence on other regions such as the Middle East and Latin America, and building diplomatic ties with African governments (Schiere & Rugamba, 2011; Brautigam, 2011). As many African countries have experienced political turmoil and instability since gaining independence, unlike Western nations, China has been able to establish partnerships with African countries without getting involved in their political affairs. This approach is characterized by China’s policy of non-interference in the internal affairs of other countries, which sets it apart from Western nations that often attach political conditions to their fundings (Chen et al., 2018). This political instability can result in frequent changes in government policies, regulations, and laws, which can significantly affect the investment climate (Kieh, 2009). On one hand, this can create uncertainty for foreign investors. On the other hand, according to Kolstad & Wiig (2012), Chinese investors tend to invest in countries with weak institutions and poor governance, as these countries are more willing to grant concessions and have less stringent regulations.

Economic Factors

Despite the risks associated with investing in unstable political environments, the potential for high returns on investment in African economies is significant, given the robust growth and increasing opportunities in various sectors. According to Calderon et al. (2019), Africa's economy has grown at an average rate of 3.3% per year since 2010, which is faster than the global average, and in some countries like Ethiopia and Rwanda, the growth rate has been even higher, exceeding 6% annually. As African economies continue to grow, more people are moving out of poverty and into the middle class, which is creating new opportunities for consumer-focused businesses that Chinese firms can tap into. According to the African Development Bank (2019), Africa's middle class has grown by over 60% in the past decade, and is expected to continue to grow in the coming years. Furthermore, the low cost of labor in Africa is another economic factor driving Chinese OI in the region. African labor is cheaper than in China, making it an attractive destination for Chinese firms seeking to reduce their production costs. Additionally, the high unemployment rates in many African countries provide a large pool of potential workers for Chinese firms (Mohan and Lampert, 2013). Inflation is another important economic factor to consider when investing in African economies. High inflation rates can lead to economic instability and erode the value of investments over time Dornbusch & Reynoso, 1989). The effect of inflation on Chinese OI appears to be inconsistent in the literature, as evidenced by mixed findings across studies, with some showing a positive relationship, such as Buckley et al. (2009) and Sanfilippo (2010), while others finding no significant effect, such as Tuman & Shirali (2017).

The Relationship Between Chinese OI and Natural Resources

As stated in the previous section, there are a number of factors that determine China's OI in African countries. This section will elaborate further on the OI drivers that we focus on in our research, natural resources and institutional quality.

China's Hunger for Natural Resources in Africa

While China has large reserves of a variety of natural resources, its per capita basis for most natural resources is very low (Deng, 2004). Due to the rapid economic growth China has experienced in the last decades, the Chinese government has become increasingly worried about a shortage of natural resources restraining its growth. As a result, the Chinese government has put considerable effort into natural resource acquisition abroad by offering state aid and making natural resource acquisition a key government objective (Alon, 2010).

Africa's vast array of natural resources, including minerals, has long been a source of attraction for foreign investors. The continent is home to approximately 30% of the world's mineral reserves (Alden et al., 2008), making it a prime destination for Chinese firms seeking to secure critical inputs for their industries.

Previous Research on the Relationship Between Natural Resources and Chinese OI in Africa

There are multiple papers that have researched the effect of natural resources in African countries on China's OI, the majority of which having found a positive and significant relationship between natural resources and Chinese OI (Gold et al., 2020; Alon, 2010; Tuman and Shirali, 2017; Ramasamy et al., 2012). We argue that conclusions drawn on this relationship are falsely generalized in a significant portion of research in this area. For example, Sanfilippo (2010) states that he finds a positive and significant effect of natural resources on Chinese OI, but only includes oil as a natural resource in his research, neglecting other types of natural resources. Furthermore, a share of researchers have also grouped multiple natural resources together into one variable, which disallows for more granular analysis of each specific resource. For example, Alon (2010) aggregates agricultural, metals, and fuels exports of an

African country into one variable, and Gold et al. (2020) combine oil and minerals into one variable. Although these results are interesting in their own respects, we argue that the type of natural resources required for different industries vary significantly. Thus, the natural resources that are a driver for OI are dependent upon the industries in a country that require natural resource imports. With respect to China, there has been a change from mostly engaging in light manufacturing to more sophisticated products (Mathai et al., 2016). Hence, due to this engagement in new industries, imports of natural resources required for sophisticated products may now become more important relative to the natural resources required for light manufacturing.

We argue that researching natural resources more specifically by looking at different layers such as type level, industry level, and individual level will result in more profound results. In order to provide more elaborate insights into the effects of different types of natural resources, our research attempts to construct models at the aggregate, type, and individual levels for minerals. We will first look at the aggregate effect of mineral richness on Chinese OI. From here, we define our first hypothesis as follows:

H1: The degree of mineral richness in an African country is a driver of China's OI.

The Effect of Specific and Group-Level Minerals on Chinese OI into African Countries

After looking at the aggregate effect of mineral richness as a driver for Chinese OI, we will dive deeper into mineral groups on the industry level and thereafter will investigate the effect of the individual minerals which are included in each industry level.

We will investigate the effect of minerals on Chinese OI in three industries that are relevant to China's imports, namely the battery sector, the semiconductor sector and the fossil-fuel sector. For each industry, we test the robustness of the results by regressing the industry related minerals, both on an aggregate and individual level, on Chinese OI. We do this by adding the individual mineral dummies to the different models, by industry.

The Battery Sector

As one of the fastest growing and largest manufacturing hubs for the worldwide "green transition," it is becoming increasingly important for China to acquire minerals required for renewable energy production in order to keep up with demand. The manufacturing of batteries is an important component of China's renewable industry since they produce 77% of all batteries worldwide Bloomberg (2022).

The largest battery types that China manufactures are the lithium nickel cobalt manganese oxide (NCM) and lithium iron phosphate (LFP) batteries, as well as lithium-ion batteries (Feng et al., 2022). For this reason, we included lithium, cobalt, manganese, graphite, iron, and phosphate in our regression. From here, our second hypothesis is formulated as follows.

H2: The presence of battery-related minerals increases the amount of OI from China into African Countries.

The Fossil-Fuel Sector

While China is the largest investor in renewable energy, they keep investing heavily in fossil-fuels in order to keep their economy running and their citizens warm. Especially since their coal supply and power rationing shortages in 2021 which resulted in energy security becoming a main short-term policy priority for the Chinese government. In turn, this resulted in a significant boom in fossil-fuel mining (IEA, 2023).

Since petroleum, coal, and gas are the largest contributors in China's fossil-fuel sector, we will look at these natural resources in our model. From here, our third hypothesis is described as follows:

H3: The presence of fossil fuel-related minerals increases the amount of OI from China into African Countries.

The Semiconductor Sector

According to GlobalData thematic research, China will become the world leader in semiconductor manufacturing (Williams, 2022). However, China has to find a way to become more self-sufficient since China consumes 40% of all chips made worldwide while they only manufacture 12% of worldwide production. The acquisition of the minerals required for semiconductor manufacturing is therefore of great importance for China.

Since the semiconductor industry consists of a variety of products and producing mechanisms, there is also a significant number of minerals required for semiconductor production. We aggregated minerals by looking at the mineral imports of the largest semiconductor manufacturer in the world, SMIC, from Africa which are tantalum, tin, tungsten, gold (SMIC, 2020). Additionally, we added some of the most common minerals required for semiconductor manufacturing in general, namely silicon, tungsten, geranium, cobalt, gallium, copper and arsenic (Mulroy, 2019 (*Future Semiconductor Legislation Needs to Support Critical Mineral Projects*, 2023)). From here, our fourth hypothesis is described as follows:

H4: The presence of semiconductor-related minerals increases the amount of OI from China into African countries.

The Interaction Between Minerals and Institutional Quality for Chinese OI

Besides looking at minerals on its own, we argue it is relevant to research the interaction effect between minerals and institutions. Kolstad and Wiig (2012) found in their research that the abundance of oil on its own was insignificant as a driver of Chinese OI. However, when creating an interaction variable between oil and institutional quality, the interaction effect coefficient became significant and negative indicating that oil is only a significant driver for Chinese OI in combination with poor institutional quality.

The argumentation Kolstad and Wiig (2012) provide on why China could prefer to invest in countries with low institutional quality is multifold. First, they argue that most Chinese companies that invest in OI are state-owned and therefore not only look for profit maximization but also political interest. Countries with poor institutions may be more interesting for China since it can be easier to put political pressure on these countries. Second, they argue that China possesses competitive advantages in countries with poor institutions since China is experienced in navigating complex patron-client relationships and personal and institutional favors in relatively opaque and difficult business environments and in dealing with burdensome regulations and navigating around opaque political constraints.

In order to test whether this same relationship holds for the minerals in our dataset, we define our fifth and last hypothesis as follows:

H5: A lower level of institutional quality positively moderates the effect of minerals on Chinese OI into African countries, both on a general and industry level.

Data and Methodology

Dataset Construction

The initial dataset provided by the university did not contain all the data needed to investigate the research question thoroughly. Therefore we used data from multiple sources to construct a repeated cross sectional dataset to be able to answer our research question. This newly constructed dataset is more extensive than the commonly used data in the literature since it uses dummies for each individual mineral present per country. Commonly used aggregates of minerals will also be used to show the differences in outcomes with the literature.

Dependent Variable

The dependent variable is the number of Chinese projects in the mining and mining related sectors in African countries, constructed with the 'Commercial Chinese Development Finance' dataset (China.aiddata.org, 2023a). This dataset contains data on 616 Chinese projects in Africa ranging from the year 2000 to 2012. The data includes multiple variables about projects in different sectors on country and year level. The term 'projects' is used to describe any form of investment from the Chinese government or Chinese companies. This can be, amongst others, a loan, a grant or Outward Foreign Direct Investment (OFDI). The different types are aggregated into one variable, thus there is no distinction between the types of projects, only that it originates from China. This decision was made in order to investigate the total interest of China into African countries. Next to that, mining and mining related sectors relate to the following specific sectors: Industry, Mining, Construction; Energy Generation and Supply, and Transport and Storage. This decision was made in order to capture the potential spillover of Chinese investments into the related sectors. The mining industry needs a good infrastructure in order to function appropriately. By using these specifications we were able to maintain 195 from the original 616 projects, as can be seen in table 2. Whereas constricting the research into OFDI and the 'Industry, Mining, Construction' sector would lead to maintaining only 108 projects.

Explanatory Variables

The aforementioned dataset does not contain data about minerals and mines per country. To construct the necessary dataset with both information about the number of mines and information about the different minerals present per country, we had to manually gather and combine data. For this, we used data sources from the United States Geological Survey (Eros & Candelario-Quintana, 2006; United States Geological Survey, 2012).

For the number of different minerals per country, we used USGS data per African country between the year 2000 and 2012 (United States Geological Survey, 2012). Especially for minerals crucial for constructing lithium ion batteries, we constructed our own dataset by manually gathering the data per country between the years mentioned above. This was necessary because most of the time only countries that produced large quantities were mentioned. The smaller amounts were added and put in the 'other countries' category. By manually checking we could separate what was produced in which country. We looked at lithium, cobalt, manganese, graphite and nickel because those are the minerals necessary for the production of lithium-ion batteries. Next to that, we looked at fossil fuels and the minerals used within the semiconductor industry. For the number of mines, we used the 'U.S. Geological Survey Open-File Report 2006-1135' (Eros & Candelario-Quintana, 2006). This report uses a freely accessible dataset containing data about different mines in Africa at country level, including what minerals are extracted per mine. By combining both datasets we were able to construct dummies for all minerals present per country.

Control Variables

Other databases are used to add appropriate control variables to our database. Data from the 'Institutional and economic data' (China.aiddata.org, 2023b) is used to control for the political and economic situation within the African countries. Next to that, the Global data lab database (Smits & Permanyer, 2019) is used to control human development per country. Finally, the World Bank database was used to gain information about unemployment (International Labour Organisation, 2012). All control variables are on a country-year level ranging from the year 2000 to 2012 and are described in table 1 and the descriptive statistics in table 2.

Variable	**Explanation**	**Source**
NP	Number of projects within the mining and mining related sectors	CCDF
M	The number of unique minerals	USGS
No.Mi	Number of unique mines	USGS
FF	An aggregation of fossil fuels or a dummy for each fuel type (coal, petroleum and natural gas)	USGS
SCM	An aggregation or dummies of minerals for the semiconductor industry (silicon, gold, tin, tungsten, tantalum, geranium, cobalt, copper and arsenic)	USGS
BM	An aggregation or dummies of minerals used for the production of lithium-ion batteries (lithium, cobalt, manganese, graphite, nickel, iron and phosphate)	USGS
RQ	Regulatory quality: Measures market friendliness of policies and regulations	IE

PS	Political stability: Measures the perception of the likelihood a government will be put out of power	IE
RoL	Rule of Law: Measures the extent to which the basic rules for a fair economic environment can be established and the protection of property rights is enforced	IE
VaA	Voice and Accountability: Measures the political process and rights of citizens, including the independence of the media	IE
GE	Government Effectiveness: Measures to what extend a government is able to provide public goods and implement good policies	IE
Pol	Political situation, indicating the level of democracy and autocracy where a more positive number indicates more democratic aspects and vice versa.	IE
I	Inflation	IE
T	Trade as a percentage of gross domestic product, used as proxy for trade openness of a country	IE
G	Gross domestic product in dollars	IE
Gg	Gross domestic product growth in percentages	IE
L	Landmass in square kilometers	IE
AMR	Absolute mineral rents; Mineral rents as percentage of GDP times GDP	IE
HDI	Human Development Index; measured in life expectancy at birth, years of schooling (age >25) and expected years of schooling for children, logarithm of gross national income per capita	GDL
HE	Household electricity as a percentage of total households, used as proxy for infrastructure	GDL
Ur	The percentage of people living in an urban area	GDL
P	The percentage of household with a phone, as proxy for infrastructure	GDL
Un	Unemployment as a percentage of the total labor force	WB

Table 1 definitions: IE: Institutional and economic data, CCDF: Commercial Chinese Development Finance, WB: World Bank, GDL: Global data lab, USGS: United States Geological Survey

Table 1: Variable definitions

Descriptive Statistics

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of projects	292	1.092	1.211	0	8
Battery minerals	259	1.71	1.649	0	6
Semiconductor minerals	259	1.66	1.431	0	5
Fossil fuels	259	0.772	0.811	0	3
Unique mines	259	25.023	41.807	1	204
Unique minerals	259	9.911	7.963	1	36
Regulatory Quality	254	-0.664	0.666	-2.661	898
GDP	257	3,35E+10	7,47E+10	4,67E+08	4,61E+11
Inflation	257	21.535	164.038	-16.376	2.630.123
Unemployment (% of total workforce)	265	8.006	6.503	0.6	23.8
Trade Openness	257	74.289	32.519	27.014	209.891
GDP growth	257	5.298	4.845	-17.669	33.736
Access to Phone (% of households)	249	38.614	25.176	0.01	91
Human Development Index	285	0.498	0.101	0.268	0.755
Urban population (% of total)	257	36.722	16.164	4.32	83.3
Access to Electricity (% of households)	257	35.086	25.764	0.01	99.9
Land Area (Size)	260	658609.31	584273.32	2030	2376000

Table 2: Descriptive statistics

Most interesting is that this table shows that countries can have 0 to up to 8 projects in the mining and mining related sectors. Interesting to see is that no country has all 7 battery minerals, with a maximum of 6, and no country has all 9 semiconductor minerals, with a maximum of 5. But there are countries that have all fossil fuels.

Tabulation of year and number of projects

	Number of projects									
Year	0	1	2	3	4	5	6	7	8	Total
2000	6	5	0	1	0	0	0	0	0	12
2001	2	4	1	0	0	0	0	0	0	7
2002	6	3	2	0	0	0	0	0	0	11
2003	3	8	0	1	0	1	0	0	0	13
2004	7	10	3	2	0	0	0	0	0	22
2005	11	9	4	1	1	0	0	0	0	26
2006	6	11	4	5	0	0	2	0	0	28
2007	8	13	10	1	0	1	0	0	0	33
2008	12	11	7	1	0	0	0	0	0	31
2009	8	12	5	0	1	0	0	1	1	28
2010	7	15	2	2	1	0	1	0	0	28
2011	13	17	3	0	0	0	0	0	0	33
2012	8	4	7	0	1	0	0	0	0	20
Total	97	122	48	14	4	2	3	1	1	292

Table 3: Tabulation of year and number of projects
This table shows the distribution of projects over the years. With an increase in the number of projects since 2003 and its peaks of 33 projects in 2007 and 2011. Most years have at least one project in the mining and mining related sectors, resulting in 195 projects. Also, every time periode has multiple projects unrelated to the mining sector.

Variable Operationalisation

Dependent Variable

Number of Projects

For the number of projects variable, we first looked at all projects in every country for every year, thus regardless of the sector. Then, for every country-year combination that has a project, we counted the number of projects concerning the mining and mining related sectors. Therefore, a zero for number of projects means that the country-year combination has projects in other sectors but no project in mining or mining related sectors, as can be seen in table 3.

Main Explanatory Variables

Natural Resources

The USGS mines database contains data about more than 1500 mines of which some were closed. The reason for the closedown of a mine was not given but could for example be due to conflict in the area or the depletion of the targeted resource. Therefore, we excluded the closed mines when creating the dummies for the natural resources in order to establish a conservative measure of the presence of resources. For every natural resource that is present within the cleaned USGS mines data, we made a dummy, resulting in 114 dummies. The dummy describes the presence of each resource within each county. Moreover, the data we used did not contain year level data and was published in 2006. Therefore we did not include year level data, thus assuming the presence of the resource does not vary per year.

Also, for the dummies within each aggregation described below, we manually search the USGS database for all 59 countries and 18 resources between the year 2000 and 2012 to complete our dataset. Thus, if a mineral was found in for example 2010, the dummy indicates that the mineral was also present in every year between 2000 and 2012. Thus again assuming the presence of the resource does not vary per year. The correlation between the dummies can be seen in table A5.

Unique Minerals

This variable indicates the resource richness of a country with the count of different minerals per country. If within a country a mineral is mined in multiple places, this mineral is still counted as one. Thus, this variable does not distinguish on the absolute amounts a mineral is mined, but on the number of different minerals that are present within a country.

Battery Minerals

The variable battery minerals is an aggregation of the following seven mineral dummies: lithium, cobalt, manganese, graphite, nickel, iron and phosphate. These minerals are used in the production of different types of lithium-ion batteries. The research is not restricted to one specific lithium-ion battery, because China produces different types. Therefore the minerals are aggregated into one variable.

Fossil Fuel

The variable fossil fuel is an aggregation of the following three types of fuel dummies: coal, petroleum and natural gas.

Semiconductor Minerals

The variable semiconductor minerals is an aggregation of the following nine mineral dummies: silicon, gold, tin, tungsten, tantalum, geranium, cobalt, copper and arsenic. We chose these minerals for a couple of reasons. Firstly because these minerals are known to be important for the semiconductor industry. However, this is not an exhaustive list of all important minerals. The chosen minerals are specified as conflict minerals, known to come from conflicted areas such as African countries (TSMC, 2020; SMIC, 2020). Therefore we know these minerals are being mined in Africa to be used in the semiconductor industry. Also, the data used comes from between the year 2000 and 2012, a period in which not all minerals used for the industry are known to exist in these countries. Therefore, we have limited data on the presence of these minerals. For example, boron is an important mineral that does not show up in the data and can therefore not be used.

Number of Mines

The ‘number of mines’ variable is a count of the number of mines per country. This will be used in the robustness check instead of the number of unique minerals to control for the level of the mining industry per country.

Absolute Mineral Rents

The variable ‘Absolute minerals rents’ is a construction of the mineral rent as a percentage of GDP times the GDP per country. This absolute measure is created to be able to compare the absolute gains between countries. The variable is presented per 100.000 dollars for a better interpretation of the numbers.

Regulatory Quality

This variable is used to assess the local political attractiveness for foreign investments. Among the different measures for institutional quality, this measure has direct consequences on investments since it captures the market friendliness of policies and regulations. Since this measure is highly correlated with other measures, as can be seen in table A6 in the appendix, they are not used in the regression but as robustness checks.

Control Variables

The other variables in table 1 are used as control variables, commonly used in the literature (Kolstad & Wiig, 2012; Tuman & Shirali, 2017). Those variables control for economic situations and human development. The correlation between the variables can be seen in table A4.

Model

The Negative Binomial regression with robust standard errors is used to answer the research question because. This method is chosen because we found evidence of overdispersion in the dependent variable. The variance was 1.34 times bigger than the mean. Next to that, robust standard errors are used to control for heteroscedasticity.

Before we ran the statistical test, we log transformed the variables GDP and Absolute mineral rents because of skewed data. And the variables inflation and unique mines were log transformed because they contained outliers. Next to that, year fixed effects are added to control for possible unobserved time related factors such as the effect of the global economic crisis from 2008.

Hypothesis 1

$$NP = M_i\beta_1 + AMR_{i,t}\beta_2 + (M_i \times AMR_{i,t})\beta_3 + I_{i,t}\gamma_4 + T_{i,t}\gamma_5 + Un_{i,t}\gamma_6 + HDI_{i,t}\gamma_7 + HE_{i,t}\gamma_8 + Ur_{i,t}\gamma_9 + G_{i,t}\gamma_{10} + Gg_{i,t}\gamma_{11} + L_{i,t}\gamma_{12} + P_{i,t}\gamma_{13} + RQ_{i,t}\gamma_{14} + \alpha_t + \varepsilon_{i,t}$$

Hypothesis 2, 3 and 4

$$NP = IM_i\beta_1 + I_{i,t}\gamma_2 + T_{i,t}\gamma_3 + Un_{i,t}\gamma_4 + HDI_{i,t}\gamma_5 + HE_{i,t}\gamma_6 + Ur_{i,t}\gamma_7 + G_{i,t}\gamma_8 + Gg_{i,t}\gamma_9 + L_{i,t}\gamma_{10} + P_{i,t}\gamma_{11} + RQ_{i,t}\gamma_{12} + \alpha_t + \varepsilon_{i,t}$$

Hypothesis 5

$$NP = M_i\beta_1 + RQ_{i,t}\beta_2 + (RQ_{i,t} \times M_i)\beta_3 + I_{i,t}\gamma_4 + T_{i,t}\gamma_5 + Un_{i,t}\gamma_6 + HDI_{i,t}\gamma_7 + HE_{i,t}\gamma_8 + Ur_{i,t}\gamma_9 + G_{i,t}\gamma_{10} + Gg_{i,t}\gamma_{11} + L_{i,t}\gamma_{12} + P_{i,t}\gamma_{13} + \alpha_t + \varepsilon_{i,t}$$

IM denotes the industry minerals, these are the aggregated minerals used in the lithium-ion battery (BM) production, in semiconductor (SCM) production or fossil fuels (FF). Also, α_t denotes the year fixed effects ranging from the year 2000 to 2012.

Results

VARIABLES	(1) #Chinese Investments	(2) #Chinese Investments	(3) #Chinese Investments	(4) #Chinese Investments	(5) #Chinese Investments
No. Unique Minerals	0.117**				-0.00521
	(0.0148)				(0.639)
Absolute Mineral Rents	0.0734				
	(0.101)				
No. Unique Minerals X AMR	-0.00804**				
	(0.0158)				
No. Battery Minerals		0.0425			
		(0.352)			
No. Semiconductor Minerals			0.00819		
			(0.870)		
No. Fossil Fuel Minerals				-0.0163	
				(0.886)	
No. Unique Minerals X Regulatory Quality					-0.0312***
					(0.00465)
Regulatory Quality	-0.281**	-0.394***	-0.418***	-0.423***	0.229
	(0.0420)	(0.00502)	(0.00407)	(0.00589)	(0.366)
GDP	0.164	0.133	0.150	0.166	0.203*
	(0.157)	(0.188)	(0.152)	(0.139)	(0.0770)
Inflation	0.0863	0.118	0.104	0.103	0.101
	(0.252)	(0.140)	(0.185)	(0.185)	(0.156)
Unemployment	0.0377**	0.0199	0.0174	0.0166	0.0366**
	(0.0247)	(0.163)	(0.203)	(0.267)	(0.0259)
Trade Openness	0.000960	-0.00238	-0.00213	-0.00210	-0.00221
	(0.748)	(0.346)	(0.401)	(0.403)	(0.397)
GDP_Growth	-0.00628	-0.00338	-0.00605	-0.00687	-0.00366
	(0.688)	(0.830)	(0.707)	(0.670)	(0.805)
Access to Phone (% of households)	-0.0128*	-0.00961	-0.00967	-0.00991	-0.0110
	(0.0778)	(0.223)	(0.231)	(0.206)	(0.119)
Human Development Index	1.079	2.120	2.551	2.687	0.322
	(0.574)	(0.227)	(0.142)	(0.136)	(0.866)
Urban Population (% of total)	0.00292	-0.000484	-0.000604	-0.000301	0.00739
	(0.792)	(0.952)	(0.941)	(0.972)	(0.393)
Access to Electricity (% of households)	0.000727	0.00141	0.00125	0.000666	-0.00122
	(0.926)	(0.849)	(0.871)	(0.934)	(0.864)
Land Area (Size)	1.43e-07	2.14e-07	2.12e-07	2.09e-07	1.95e-07
	(0.441)	(0.183)	(0.177)	(0.174)	(0.220)
Constant	-6.890**	-5.021**	-5.461**	-5.825**	-5.786**
	(0.0196)	(0.0270)	(0.0198)	(0.0249)	(0.0192)
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	199	213	213	213	213

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Baseline Regressions

Table 4 shows the results of the baseline regressions to test the five main hypotheses. Model 1 tests hypothesis 1 and shows that the number of unique minerals that is present in a country has a positive effect on the number of Chinese mining-related investments, statistically significant at 1% significance level, ceteris paribus. This coefficient translates to an increase of

1.1 investments for an increase of 1 in the amount of unique minerals in a country, ceteris paribus. Furthermore, the model shows us a negative coefficient for the interaction effect between the number of unique minerals and the absolute mineral rents generated, statistically significant at 5% significance level, ceteris paribus. This entails that for a certain amount of minerals present in a country, higher mineral rents generated by the African country makes the country a less attractive investment destination. A possible explanation for this could be that minerals are already being extracted at a larger scale, implying more competition for the investor in this country, discouraging investment.
In the following models, 2-4, the different industry-related mineral aggregates have been regressed on the number of investments, testing hypotheses 2-4. No statistically significant coefficients are reported here, not allowing us to confirm the hypothesized effects that these industry-related mineral aggregates are drivers of Chinese OI. In model 5, where we test hypothesis 5, we do find a strongly statistically significant negative coefficient, at 1%, for the interaction term between the amount of minerals present and institutional quality, proxied by regulatory quality. This effect is in line with our hypothesis that a lower level of institutional quality positively moderates the effect of minerals on Chinese OI into African countries, at least on a general level. The interpretation of the coefficient of the interaction effect is tricky as the two individual components are not statistically significant. However the negative coefficient of the interaction term alone implies that the positive effect of an increase in the number of minerals present, increases with a worsening of the institutional quality.

To add to the robustness of these results and to create a more in-depth analysis into the effects of more specific minerals on Chinese investments into Africa, we have run several more regressions that are presented in Tables A1, A2 and A3. Table A1 presents the individual effects of the minerals that are present in the aforementioned industry aggregates. None of the battery-related minerals have statistically significant effects, which could possibly be explained by the fact that the growing importance of batteries is a trend of the past few years, with the data ranging from 2000 to 2012. The presences of gold and coal, however, do turn out to be drivers of Chinese investments into Africa. Interestingly enough, germanium and natural gas discourages investors according to the results. The former is not in line with previous research, however, the occurrence of germanium in the data is very limited, potentially leading to some bias. The unattractiveness of African natural gas for Chinese investors can partly be explained by the fact that China imports the majority of its gas from Russia already.
Table A2 shows the robustness of the result found in model 5 of Table 2, with different combinations of mineral variables being interacted with different institutional quality proxies. We find that the positive effect of an extra mineral being present, on investments is also amplified at lower levels of institutional quality when different proxies are used for institutional quality, such as ‘Voice and Accountability‘ and ‘Rule of Law’, significant at a level of 1%, ceteris paribus.
Table A3 shows the interactions between the different industry-related mineral aggregates and institutional quality. For model 1 another proxy was used, to prevent an unknown methodological error from occurring. Nevertheless, this proxy is also deemed sufficiently relevant for institutional quality. From models 1 and 2 we can conclude that the positive effect of the presence of an extra battery- or semiconductor-related mineral on the number of Chinese investments, increases with lower levels of institutional quality, significant at 1%, ceteris paribus.

Limitations

While our research provides valuable insights into the relationship between Chinese OI into African natural resources, our findings are subject to limitations that should be considered when evaluating our results.

Starting with data limitations, our dataset includes entries of different types of OI that may have varying effects. For example, there are FDI investments as well as development finance aid investments that we analyze homogeneously. Therefore, this research can only conclude about the broad sense of China's interest in African countries. Furthermore, our data is somewhat outdated being from the years 2000-2012. This inhibits our ability to observe recent trends and changes in OI over time, which could influence our results and conclusions. Having access to data from more recent years would have allowed us to better understand the evolution of Chinese OI into Africa and its relationship with natural resources. We also did not fully exploit the extent of variables at our disposal. For instance, we had specific location information that could have been transformed into a distance measure to provide further insights into the spatial dynamics of OI decisions, and the influence of proximity to natural resources. Measures like this could provide more robust findings and should be considered in future research.

As for model specification, our research employs a dummy variable to indicate whether a certain country has a given mineral or not, rather than utilizing total production of that mineral per country. Furthermore, we used a dummy for whether an investment was made or not, discarding the magnitude of each investment made. Having this data to utilize in our analysis would provide an influx of heterogeneity that we could exploit in our model, allowing for deeper insights. As a final point, we used aggregated count data for the Chinese investments, rather than exploiting investment-level information. While our decision to use the count data model allows us to affirmatively answer our hypotheses, it limits our ability to distinguish between different types of investments, hence leaving some exploitable heterogeneity on the table. Further research should also consider employing a conditional logistic regression model to investigate how exploiting investment level observations can draw more robust findings.

Another possible limitation in our study is the problem of endogeneity, which could drive bias in our estimates if not addressed correctly. Due to the exogenous nature of our main independent variables related to natural resources, we are largely unconcerned with the possibility of bias in this respect. Reserves of minerals and oil in the ground are present regardless of previous OI investments, making reverse causality an unlikely culprit of potential bias. One component of our model that may be problematic are the institutional factors that we interact with the various natural resources. If this were the case, it would mean that inflows of OI into these regions could cause the development of institutions to facilitate the economic activity stimulated by these OI's, in which case endogeneity would be present in our model. We argue that since institutions normally do not change in a short period of time, i.e. the same year of an FDI investment, it is very unlikely that any particular FDI would influence a significant change in the institutional landscape of a country.

Despite these limitations, our study contributes to the understanding of the factors driving Chinese OI in Africa's various mineral supplies and provides a foundation for future research to build upon. Further studies could address these limitations by incorporating additional data sources, utilizing more variables, and implementing models that consider the different types of investments and their potential effects on the relationship between Chinese OI and natural resources in Africa.

Conclusion

This paper has researched the effect of minerals in African countries on Chinese OI and investigates whether institutional quality moderates this relationship. We first researched the effects of overall mineral richness and industry level minerals (battery industry, fuel industry, and semiconductor industry) on Chinese OI. We found that overall mineral richness has a positive and significant effect on Chinese OI but we did not find a significant effect for each industry in the first place. However, when creating interaction variables between all industries and institutional quality, we found a negative and significant coefficient. This result is in line with the research of Kolstad and Wiig (2012) indicating that institutional quality is a moderator of minerals where a lower level of institutional quality results in a higher amount of natural resource extraction. Additionally, our results suggest that institutional quality is an important driver for natural resource-oriented OI. With respect to individual minerals, we find a positive and significant relationship for gold and coal and a negative and significant relationship for germanium and natural gas.

Our findings strengthen our argument that research in this field should not aggregate natural resources into one variable or generalize findings based upon investigating one type of natural resource since the effect of different natural resources on China’s OI differs for various types of natural resources.

References

African Development Bank, Monga, C., Shimeles, A., & Woldemichael, A. (2019). Creating decent jobs: Strategies, policies and instruments. African Development Bank Group.

Alden, C., Large, D., & Soares de Oliveira, R. (2008). China returns to Africa: A rising power and a continent embrace. Columbia University Press.

Alon T.M. (2010). Institutional Analysis and the Determinants of Chinese FDI https://www.emerald.com/insight/content/doi/10.1108/1525383X201000013/full/pdf?title=institutional-analysis-and-the-determinants-of-chinese-fdi

Bavier, J. (2009). Congo to push forward with $9 bln Chinese contract. https://www.reuters.com/article/congo-democratic-china-imf-idUSLN34513920090323

Bellabona, P., & Spigarelli, F. (2007). Moving from open door to go global: China goes on the world stage. International Journal of Chinese Culture and Management, 1(1), 93-107.

Bloomberg. (2023). The battle to break China's battery-making supremacy, in five charts | Insights. (2022, December 1).
https://www.bloomberg.com/professional/blog/the-battle-to-break-chinas-battery-making-supremacy-in-five-charts/

Bräutigam, D. (2011). Chinese development aid in Africa: What, where, why, and how much?. Where, Why, and How Much.

Brown, D. E. (2012). Hidden Dragon, Crouching Lion: How China's advance in Africa is underestimated and Africa's potential underappreciated. Strategic Studies Institute, US Army War College.

Buckley, P. J., Clegg, L. J., Cross, A. R., Liu, X., Voss, H., & Zheng, P. (2009). The determinants of Chinese outward foreign direct investment. Journal of International Business Studies, 40(2), 353.

Calderon, C., Kambou, G., Korman, V., Kubota, M., & Canales, C. C. (2019). Africa's pulse, No. 19, April 2019: An analysis of issues shaping Africa's economic future. World Bank Publications.

Center for Global Development. (2020). Chinese Global Development Footprint: An Updated Visual Dataset.

Chen, Z., Matousek, R., & Wanke, P. (2018). Chinese bank efficiency during the global financial crisis: A combined approach using satisficing DEA and Support Vector Machines☆. The North American Journal of Economics and Finance, 43, 71-86.

China.aiddata.org. (2023a). Commercial Chinese Development Finance [Dataset]. Bas Karreman. https://canvas.eur.nl/courses/39779/files/77677827?module_item_id=949741

China.aiddata.org. (2023b). Institutional and economic data [Dataset]. Bas Karreman. https://canvas.eur.nl/courses/39779/files/77677827?module_item_id=949741

China Africa research initiative. (2023). Data: Chinese Investment in Africa. http://www.sais-cari.org/chinese-investment-in-africa#:~:text=Chinese%20FDI%20in%20Africa%20Data%20Overview&text=Flows%20surged%20from%20US%24%2075,Bank%20of%20China%20(ICBC).

Deng, P. 2004. Outward investment by Chinese MNCs: Motivations and implications Business Horizons. 47(3): 8-16.

Dornbusch, R., & Reynoso, A. (1989). Financial factors in economic development.

Dunning, John H. (2000). The Eclectic Paradigm as an Envelope for Economic and Business Theories of MNE Activity. International Business Review, vol. 9, no. 2, pp. 163–190.

Dwivedi, S. & Wischer, G. (2023). Future Semiconductor Legislation Needs to Support Critical Mineral Projects. Retrieved from https://www.realclearenergy.org/articles/2023/02/21/future_semiconductor_legislation_needs_to_support_critical_mineral_projects_883074.html

Eros, J. M., & Candelario-Quintana, L. (2006). U.S. Geological Survey Open-File Report 2006-1135 (1.0) [Dataset]. United States Geological Survey. https://pubs.usgs.gov/of/2006/1135/

European Think-tank Network on China (ETNC). (2019). Mapping Chinese Investment in Europe: An Overview of the ETNC's China Investment Database. Retrieved from https://etnc.info/reports

Feng, T., Guo, W., Meng, Z., & Lang, W. (2022). Life cycle assessment of lithium nickel cobalt manganese oxide batteries and lithium iron phosphate batteries for electric vehicles in China. 12.

Fuje. H. & Yao, J. (2022). Africa's Rapid Economic Growth Hasn't Fully Closed Income Gaps. Retrieved from https://www.imf.org/en/Blogs/Articles/2022/09/20/africas-rapid-economic-growth-hasnt-fully-closed-income-gaps

Global Times. (2021). China ranks No.1 globally in outward OI for the first time. https://www.globaltimes.cn/page/202109/1235451.shtml

Kafilah, G., Rasiah, R., & Muhammad, M. (2020). Export determinants of China's FDI in Africa: empirical evidence from oil/minerals exporting African countries. Romanian Journal of Economic

Forecasting, 23(3).

IEA. (2023). World Energy Investment 2022: Overview and key findings. iea.org. https://www.iea.org/reports/world-energy-investment-2022/overview-and-key-findings

International Labour Organization. (2012). ILO Modelled Estimates and Projections database [Dataset].The World Bank. https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=ZG

Kieh Jr, G. K. (2009). The state and political instability in Africa. Journal of developing societies, 25(1), 1-25.

Kolstad, I., & Wiig, A. (2012). What determines Chinese outward FDI?. Journal of world business, 47(1), 26-34.

Kostova, Tatiana, et al. (2008) Institutional Theory in the Study of Multinational Corporations: A Critique and New Directions. Academy of Management Review, vol. 33, no. 4, pp. 994–1006.

Macrotrends. (2023). China Foreign Direct Investment 1979-2023. https://www.macrotrends.net/countries/CHN/china/foreign-direct-investment

Mathai, K., Gottlieb, G., Hee Hong, G., Eun Jung, S., Schmittmann, J., & Yu, J. (2016). China's Changing Trade and the Implications for the CLMV Economies. IMF, 84.

Mohan, G., & Lampert, B. (2013). Negotiating china: reinserting African agency into china–Africa relations. African Affairs, 112(446), 92-110.

Mol, Arthur P.J. (2011). China's Ascent and Africa's Environment. Global Environmental Change, vol. 21, no. 3, 2011, pp. 785–794.

Mulroy, S. (2019). Mining the Elements Used in Semiconductors. AZoMining.com. Retrieved April 13, 2023, from https://www.azomining.com/Article.aspx?ArticleID=1532

OECD. (2002). Foreign Direct Investment and the Environment Lessons from the Mining Sector.

https://www.oecd.org/investment/investmentfordevelopment/44320363.pdf

Ramasamy, B., Yeung, M. and Laforet, S. (2012), "China's outward foreign direct investment: Location choice and firm ownership", Journal of World Business, Vol. 47 No. 1, pp. 17-25.

Sanfilippo, M. (2010). Chinese FDI to Africa: what is the nexus with foreign economic cooperation?. African Development Review, 22, 599-614.

Schiere, R., & Rugamba, A. (2011). Chinese infrastructure investments and African integration.

SMIC. (2020). The Policy Statement on Responsible Sourcing of Minerals. Retrieved April 10, 2023, from https://www.smics.com/en/site/responsibility_products

Smits, J., & Permanyer, I. (2019). Subnational HDI Database (7.0) [Dataset]. Global Data Lab. https://globaldatalab.org/shdi/

Suzuki, S. (2011). Why does China participate in intrusive peacekeeping? Understanding paternalistic Chinese discourses on development and intervention. International Peacekeeping, 18(3), 271-285.
https://blogs.lse.ac.uk/africaatlse/2017/04/07/book-review-the-rise-of-africas-middle-class-myths-realities-and-critical-engagements-by-henning-melbered/

TSMC. (2020). TSMC Conflict Minerals Report (EX-1.01 2 d875479dex101.htm EX-1.01). U.S. Securities and Exchange Commission. Retrieved April 10, 2023, from https://www.sec.gov/Archives/edgar/data/1046179/000119312520151976/d875479dex101.htm

Tuman, J. P., & Shirali, M. (2017). The political economy of Chinese foreign direct investment in developing areas. Foreign Policy Analysis, 13(1), 154-167.

United States Geological Survey. (2012). Minerals Yearbook Area Reports: International - Africa and the Middle East (Volume 3) [Dataset].
https://www.usgs.gov/centers/national-minerals-information-center/africa-and-middle-east#ao

Williams, L. (2022, July 25). China to lead global semiconductor growth by 2030. Investment Monitor.
https://www.investmentmonitor.ai/features/china-lead-global-semiconductor-growth-2030/

Xiaowen, T. (2001). Deng Xiaoping's Nanxun: impact on China's regional development. The Nanxun Legacy and China's Development in the Post-Deng Era (Singapore: Singapore University Press, 2001), 75-92.

Appendix

VARIABLES	(1) #Chinese Investments	(2) #Chinese Investments	(3) #Chinese Investments
Silicon		-0.423	
		(0.274)	
Tungsten		-0.465	
		(0.343)	
Tantalum		0.176	
		(0.516)	
Gold		0.408**	
		(0.0161)	
Tin		0.485	
		(0.151)	
Arsenic		-0.0581	
		(0.918)	
Germanium		-1.603**	
		(0.0125)	
Cobalt		-0.272	
		(0.352)	
Copper	-0.286	0.302	
	(0.237)	(0.166)	
Lithium	0.169		
	(0.269)		
Nickel	0.399		
	(0.121)		
Graphite	-0.0888		
	(0.679)		
Manganese	0.173		
	(0.332)		
Phosphate	0.101		
	(0.742)		
Iron	-0.191		
	(0.594)		
Petroleum			-0.0596
			(0.777)
Natural Gas			-0.550**
			(0.0390)
Coal			0.353**
			(0.0393)
Constant	-8.046**	-5.520**	-5.929**
	(0.0138)	(0.0266)	(0.0127)
Year-Fixed Effects	Yes	Yes	Yes
Control Variables	Present	Present	Present
Observations	213	213	213

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A1: Robustness of regression results concerning industry aggregates, using mineral-specific effects

VARIABLES	(1) #Chinese Investments	(2) #Chinese Investments	(3) #Chinese Investments
No. Unique Minerals	-0.0105	0.00267	
	(0.383)	(0.805)	
Rule of Law	0.142		
	(0.495)		
No. Unique Minerals X Rule of Law	-0.0350***		
	(0.00279)		
Voice and Accountability		0.224	
		(0.235)	
No. Unique Mines X Voice and Accountability		-0.0357***	
		(0.000776)	
No. Unique Mines			0.0318
			(0.764)
Regulatory Quality			0.155
			(0.658)
No. Unique Mines X Regulatory Quality			-0.152*
			(0.0883)
Constant	-5.065**	-5.729**	-4.735**
	(0.0403)	(0.0215)	(0.0475)
Year-Fixed Effects	Yes	Yes	Yes
Control Variables	Present	Present	Present
Observations	213	213	213

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2: Robustness of regression results regarding the interaction effect between different institutional quality proxies and different mineral variables

VARIABLES	(1) #Chinese Investments	(2) #Chinese Investments	(3) #Chinese Investments
No. Battery Minerals	-0.0300		
	(0.635)		
Voice and Accountability	0.0622		
	(0.742)		
No. Unique Minerals X Voice and Accountability	-0.137**		
	(0.0199)		
No. Semiconductor Minerals		-0.159*	
		(0.0529)	
Regulatory Quality		0.129	-0.213
		(0.635)	(0.341)
No. Semiconductor Minerals X Regulatory Quality		-0.197**	
		(0.0191)	
No. Fossil Fuel Minerals			-0.173
			(0.310)
No. Fossil Fuel Minerals X Regulatory Quality			-0.201
			(0.199)
Constant	-5.746**	-6.622***	-6.758**
	(0.0122)	(0.00507)	(0.0189)
Year-Fixed Effects	Yes	Yes	Yes
Control Variables	Present	Present	Present
Observations	213	213	213

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3: Robustness of regression results regarding the interaction effect between institutional quality and different mineral variables

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Number of projects	1.000																
(2) Battery minerals	0.186	1.000															
(3) Semiconductor minerals	0.176	0.668	1.000														
(4) Fossil fuels	0.199	0.379	0.26	1.000													
(5) Unique mines	0.167	0.607	0.545	0.457	1.000												
(6) Unique minerals	0.231	0.632	0.669	0.488	0.873	1.000											
(7) Regulatory Quality	-0.167	-0.005	-0.028	0.177	0.314	0.217	1.000										
(8) GDP	0.119	0.36	0.321	0.568	0.779	0.626	0.311	1.000									
(9) Inflation	0.178	-0.045	0.075	0.113	-0.008	0.03	-0.066	0.118	1.000								
(10) Unemployment	0.073	0.091	0.122	-0.012	0.402	0.255	0.313	0.285	-0.042	1.000							
(11) Trade openness	-0.12	-0.03	-0.209	-0.267	-0.123	-0.201	-0.129	-0.18	-0.033	0.336	1.000						
(12) GDP growth	-0.016	-0.172	-0.018	0.089	-0.109	-0.124	0.128	0.009	0.12	-0.127	-0.095	1.000					
(13) Access to Phone (% of households)	-0.019	0.154	0.049	0.077	0.289	0.233	0.379	0.383	-0.075	0.455	0.17	-0.033	1.000				
(14) Human Development Index	0.049	0.263	0.141	0.264	0.477	0.425	0.506	0.416	-0.023	0.648	0.205	-0.067	0.729	1.000			
(15) Urban population (% of total)	0.054	0.201	-0.059	0.16	0.349	0.146	0.186	0.293	-0.062	0.642	0.289	-0.161	0.508	0.675	1.000		
(16) Access to Elcetricity (% of households)	0.109	0.287	0.036	0.323	0.512	0.403	0.319	0.51	-0.011	0.523	0.074	-0.154	0.605	0.776	0.787	1.000	
(17) Land Area (Size)	0.308	0.16	0.303	0.342	0.311	0.289	-0.07	0.309	0.041	0.062	-0.266	0.122	-0.114	-0.117	0.016	-0.003	1.000

Table A4: Correlation of important variables

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) Cobalt	1.000																	
(2) Lithium	-0.008	1.000																
(3) Nickel	0.819	0.041	1.000															
(4) Graphite	0.414	0.06	0.449	1.000														
(5) Manganese	0.055	0.086	0.221	-0.165	1.000													
(6) Phosphate	0.224	0.101	0.253	0.127	0.017	1.000												
(7) Iron	0.204	0.089	0.233	0.114	0.155	0.729	1.000											
(8) Silicon	0.302	-0.108	0.321	-0.101	0.285	0.532	0.516	1.000										
(9) Tungsten	0.183	-0.126	-0.073	-0.118	-0.199	-0.106	-0.11	-0.057	1.000									
(10) Tantalum	-0.142	0.318	-0.249	-0.049	-0.039	-0.19	0.086	-0.101	0.221	1.000								
(11) Gold	0.231	0.36	0.332	0.103	0.118	0.122	0.091	0.162	-0.08	-0.004	1.000							
(12) Tin	0.186	0.293	0.067	0.147	-0.073	0.187	0.487	-0.087	0.274	0.534	0.054	1.000						
(13) Arsenic	-0.102	0.287	-0.096	-0.064	0.181	-0.058	-0.06	-0.031	-0.036	0.306	0.103	-0.055	1.000					
(14) Germanium	0.211	0.315	-0.106	-0.071	-0.119	-0.064	-0.066	-0.034	-0.04	0.336	0.113	0.39	-0.022	1.000				
(15) Copper	0.615	0.187	0.551	0.409	0.104	0.485	0.462	0.362	-0.156	-0.027	0.448	0.192	0.231	0.253	1.000			
(16) Petroleum	-0.062	-0.023	-0.123	-0.24	0.295	0.118	0.322	0.292	-0.194	-0.007	0.101	0.077	-0.106	0.204	-0.007	1.000		
(17) Natural gas	0.091	-0.177	0.113	0.471	-0.031	-0.15	0.179	-0.08	-0.093	0.344	-0.138	0.21	-0.051	-0.056	0.16	-0.022	1.000	
(18) Coal	0.456	-0.079	0.502	0.51	0.15	0.284	0.499	0.342	-0.165	0.063	0.119	0.266	-0.09	-0.099	0.601	-0.098	0.562	1.000

Table A5: Correlation of mineral dummies

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Government Effectiveness	1.000					
(2)Political Stability	0.686	1.000				
(3) Rule of Law	0.914	0.794	1.000			
(4) Regulatory Quality	0.884	0.686	0.897	1.000		
(5) Voice and Accountability	0.807	0.742	0.856	0.847	1.000	
(6) Polity	0.52	0.447	0.568	0.58	0.801	1.000

Table A6: Correlation of institutional measures