

1 **PHD Thesis**

2

3 **Understanding Chinese Economic**
4 **Engagement in the Africa Continent**

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18 A thesis submitted in fulfilment of the University's requirements for
19 the Degree of Doctor of Philosophy.

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Declaration

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To the best of my knowledge, I confirm that the work in this thesis is my original work undertaken for the degree of AWARD in the faculty of BAL, De Montfort University. I confirm that no material of this thesis has been submitted for any other degree or qualification at any other university. I also declare that parts of this thesis have been submitted for publications and conferences.

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1 **Abstract:**

2 This thesis intends to investigate China's economic engagement in Africa, which has
3 been of great debates. Currently, China has become one of the most influential
4 partners of African countries, and China has been seeing an increasingly important
5 presence in the global financial market. Also, the global economic landscape has
6 changed dramatically on account of the fact that the emerging economies have been
7 driving global economic growth. Hence, it is impossible to investigate the global
8 economic landscape without considering the economic development and engagement
9 of emerging economies. Whereas, their economic engagement in the global market
10 has been also received a great deal of criticisms. For instance, researchers concern
11 that natural resources extraction is the primary objectives of China's economic
12 engagement in Africa where natural resources are abundant. Also, they doubt the
13 effectiveness of Chinese aid projects in the African regions. Therefore, this thesis aims
14 to empirically examine Chinese economic engagement in Africa, and thus test relevant
15 concerns about this engagement. Our first paper empirically investigates the nexus of
16 China's direct investment in and international trade with 54 African countries between
17 2003 and 2014 to estimate the extent to which Chinese investments affect its trade
18 with the continent, with the intention to shed light on the political motivation behind
19 these economic activities. Our overall findings suggest that Chinese investments are
20 correlated with more subsequent exports of consumption and processed goods from
21 China, an indicator of market-seeking motivation of the country's investment activities
22 in the continent.

23 In our second paper, we employ the georeferenced and subnational dataset on China's
24 aid projects, nighttime light intensity and local corruption collected by the
25 Afrobarometer surveys in order to estimate the effectiveness of China's aid projects in
26 Africa and test whether local corruption negatively affects this effectiveness. Our
27 empirical results demonstrate the promoting impact of Chinese aid projects on local

1 economic activities, and that this promoting effect is not negatively affected by local
2 corruption which is measured by two questions from Afrobarometer surveys. In
3 particular, the effectiveness of Chinese aid projects varies across African clusters with
4 different corruption level. In other words, Chinese aid projects are more likely to fuel
5 economic activities to a greater extent in more corrupted clusters, compared with less
6 corrupted clusters in Africa.

7 Our third paper empirically estimates the impact of China's aid projects on local
8 employment by using the subnational dataset on employment experiences of
9 individuals, in order to map out a picture of Chinese aid and its impact on local
10 employment in Africa. Using temporal-spatial estimate, we find that Chinese aid project
11 sites are always associated with more job opportunities for local citizens, and this result
12 is robust to using alternative tests. Furthermore, we use nighttime light intensity as a
13 proxy for local economic activity to test the possible mechanism through which Chinese
14 aid projects affect local employment. It is found that the employment-promoting effect
15 of Chinese projects is driven by the increase in economic activity.

16

17

18 **Keywords:** Chinese Economic Engagement; Africa; Nighttime Light;
19 Afrobarometer Surveys

20

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18 years of my PHD study, although I had been sometimes hesitant about my own
19 research, my persistence and courage overcame difficulties and enabled me to
20 obtain certain research results. Also, this four-year PHD studies also has
21 strengthened my exploration on academic research. There is no doubt that
22 what I have learned and mastered in my four-year PHD study will lead my
23 academic path to a bright and promising future.

24

25

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Chapter I

General Introduction

1.1 Introduction

Globalization broadening brought along a deepening of linkages between national economies into a worldwide market for goods, services and especially capital. We cannot ignore the impact of foreign direct investment, international trade and foreign aid on national economies, especially for the developing countries. Also, in the era of globalization, the global economic landscape has changed dramatically on account of the fact that the emerging economies have been driving global economic growth. Among them, the presence of China in the global market has been of a great deal of debates. In particular, a range of the discussions has centered on the economic involvement of China in Africa, as Africa has been one of China's major source of imports, its second largest overseas construction project contract market and its fourth largest investment destination (Dong and Fan, 2017). Does China's economic engagement in Africa aim to extract natural resources from the African countries? Are Chinese aid projects effective to the economic growth of the African countries? There are a large range of discussion on these questions.

In this thesis, we aim to estimate Chinese economic engagement in Africa through using various types of evidence, such as georeferenced data on China's aid projects and product-level dataset on the bilateral trade between China and the African countries. Through using various evidence, some concerns about Chinese economic engagement will be answered. For instance, the political consideration behind Chinese economic engagement will be tested through the dataset on China's direct investment in and international trade with 54 African countries between 2003 and 2014. The effectiveness of China's aid projects and how local corruption affects this effectiveness

1 will be estimated through a new dataset on georeferenced information of Chinese
2 development projects in Africa. Furthermore, the impact of China's aid projects on local
3 employment in Africa will be investigated by geo-matching the spatial dataset on
4 China's aid projects to subnational dataset on local employment in the African regions.
5 In order to do these investigations, relevant literatures are also been discussed in this
6 thesis. For instance, we use the nexus of foreign direct investment and international
7 trade to support our first research on the political consideration behind Chinese
8 economic engagement. The existing literature on the effectiveness of foreign aid is
9 investigated to support our second research on whether local corruption negatively
10 affects the effectiveness of China's aid projects in Africa. Similarly, relevant studies on
11 the relationship between foreign aid and employment is employed to test how China's
12 aid projects affect local employment in Africa.

13 **1.2 Background of Study**

14 The global economic landscape has changed dramatically on account of the fact that
15 the emerging economies have been driving global economic growth. Undoubtedly,
16 new sources of development finance have emerged and the development cooperation
17 arena has seen continued diversification of actors, instruments and impacts. In this
18 process, the dominance of aid from traditional Western donors has been declining,
19 with a sharp increase in development finance from non-Western donors (Xu et al,
20 2020). Definitely, these changing circumstances call for a renewed focus on the
21 implications and challenges of development cooperation, and for an understanding of
22 the implications of the rise of new actors and financial flows in particular. Therefore,
23 there is a need for a broader view when analyzing the impacts of aid, incorporating
24 questions traditionally not studied within the aid framework.

25 The emergence of China as the second most influential global power has generated a
26 large variety of debates on the causes and implications of its global economic

1 engagement (Abdullah and Daud, 2020; Clement, 2019; Liang, 2012; Buckley et al.,
2 2016; Leslie, 2016). Among them, a range of the discussions has centered on the
3 economic involvement of China in Africa, as Africa has been one of China's major
4 source of imports, its second largest overseas construction project contract market and
5 its fourth largest investment destination (Dong and Fan, 2017). Apart from pure
6 economic considerations, China's global policies, not surprisingly, can also affect
7 these activities (Buckley et al., 2016; Liang, 2012). Hence, a great deal of attention has
8 been paid to these policies that extend China's global reach.

9 The economic ties between China and African countries could be dated back to the
10 beginning of the last century, and have been much closer since the implementation of
11 China's "Go Global" policy and the first Summit of the Forum on China-Africa
12 Cooperation (FOCAC) in 2000. China's OFDI and overseas trade in Africa have
13 undergone remarkable shifts. Meanwhile, China's aid projects have also been seeing
14 an increase in their quantity and types implemented in Africa.

15 Whereas, with the increasingly important presence of China in Africa, there are a great
16 deal of concerns about Chinese economic engagement in Africa. Some studies have
17 criticized Chinese MNEs' investment as being a way that extracts the natural resources
18 in African countries, given the abundance of natural resources in this continent (Lin et
19 al., 2018; Nuetah and Xin, 2019). They also claim that economic activities are
20 entangled with the political considerations, especially for China which is a typical
21 socialist and transition economy with the phenomenon of soft budget constraints.
22 However, most of their claims were discussed based on the evidence of one single
23 China's economic activity in Africa. For instance, Lin et al (2018) test the importance
24 of natural resources by employing the evidence of China's OFDI in the African
25 continent. Also, Eisanmen (2012) investigate the causes of consequences of China-
26 Africa trade pattern by using the evidence of China's overseas trade with African
27 countries. Hence, to the author's knowledge, few studies have investigated the political

1 considerations behind China's economic engagement through the lens of the FDI-
2 Trade nexus in this resource-rich continent. Obviously, our empirical results will offer
3 valuable insights into the knowledge about China's role in the African continent.

4 Moreover, in our second paper, we turn our attention to China's aid projects in Africa
5 and its effectiveness through using a new georeferenced dataset on China's aid
6 projects. Unlike the ODA donors, the Chinese government does not release detailed
7 project-level financial information about its foreign aid activities. This lack of
8 transparency also has made evaluation of Chinese aid difficult. As a result, China's aid
9 to Africa is the subject of much speculation. Some praises could be also seen for
10 Chinese aid on the account of the fact that Chinese development projects have been
11 centered on the infrastructure development of developing countries, as well as that the
12 "non-interference policy" by Chinese government, which is quite different from Western
13 donors, has reduce the administrative burden associated with development projects in
14 developing countries.

15 However, Chinese aid effectiveness could be also described as something of a
16 paradox. Some scholars hold a pessimistic attitude toward this emerging donor in
17 Africa continent. For instance, The Economist (2017) doubted Chinese aid
18 effectiveness in Africa because of the repeated mistakes which was also conducted
19 by Western donors at the beginning period of their investment in Africa. Moreover,
20 critics claim that Beijing uses their development finances to create alliances with the
21 leaders of developing countries, to secure commercial advantages for their domestic
22 firms, and to prop up corrupt and undemocratic regimes in order to gain access to their
23 nature resources endowments. Therefore, in the midst of the controversy of Chinese
24 aid effectiveness and the debate on corruption, it is necessary to analyze Chinese aid
25 effectiveness with the consideration of local corruption in the African continent. This
26 research differs from the existing studies in that it studies how local corruption affects
27 the effectiveness of China's aid projects through using the corruption experiences of
28 African citizens rather than using the national-level estimates in corruption and foreign

1 aid. Certainly, this research contributes to the emerging studies on using spatial and
2 subnational dataset to examine the economic questions related to international
3 economic involvement.

4 Regarding our third research on China's aid projects, we put our focus on whether
5 China's aid projects fuel local employment in Africa. African countries have been
6 seeing a remarkable improvement in their economy. However, looking at their
7 employment rate, poverty and high unemployment rate are still serious. Hence, some
8 researchers doubt the impact of foreign aid and argue that foreign aid is
9 partly responsible for the slow pace of employment growth and poverty reduction on
10 the account of the fact that donor attention over the past decades has not focused on
11 the impact of their international strategies and investment on job growth. Among them,
12 the impact of China's aid projects on local employment in Africa has been heated
13 discussed. On the one hand, some praise China's "no-interference" principles which
14 suggest that China's international economic activities do not impose any political
15 conditions in recipient countries. Hence, they argue that the economic improvement
16 associated with China's global economic engagement should not be unignorable. On
17 the other hand, some observers express concerns—that Chinese companies prefer to
18 bring a large number of Chinese workers to Africa and are unwilling to hire local
19 workers. Hence, they hold a negative attitude toward the impact of China's foreign
20 economic engagement on local employment. The influx of Chinese workers associated
21 with Chinese development projects makes the acute unemployment problem in Africa
22 even worse. Therefore, in our third paper, we investigate whether and to what extent
23 China's aid projects affect local employment in Africa.

24 **1.3 Research Questions**

25 The focus of this PHD thesis is Chinese economic engagement in Africa. And there
26 are three relevant topics are discussed in this PHD thesis.

1 Regarding our first research, we aim to investigate the political considerations behind
2 China's economic engagement in the African continent using evidence from the FDI-
3 Trade Nexus. For this purpose, the following questions are considered in our first paper:

- 4 1. How does Chinese foreign trade respond to the increase in China's OFDI in the
5 African countries?
- 6 2. Is there a trade-promoting effect of China's OFDI in Africa, especially for the
7 imports of primary commodities from African countries, an indicator of natural
8 resource extraction motivation of China's economic engagement in this continent?
- 9 3. Considering the important role of Chinese state-owned companies, is, the trade-
10 promoting effect of China's OFDI associated with the ownership of Chinese MNEs
11 in African continents? Is the trade-promoting effect of China's OFDI more
12 significant for Chinese stated controlled MNEs?

13 In terms of our second research, the effectiveness of China's aid projects and local
14 corruption in Africa will be discussed on the basis of the development of Chinese
15 development projects and the pervasiveness of corruption in Africa. Hence, there are
16 several relevant questions which will be investigated in our second research:

- 17 1. Does the implementation of Chinese development projects give an increase in
18 economic activities in Africa?
- 19 2. Does local corruption negatively affect the effectiveness of China's aid projects in
20 Africa?
- 21 3. Given that corruption level varies across the different African regions or cluster, is
22 the effectiveness of China's aid projects consistent across the African clusters with
23 different corruption level?

24 Our third research relates to the literature on foreign aid and employment. So, certain
25 relevant research questions will be discussed in this research:

- 1 1. Does the implementation of Chinese development projects give an increase in local
2 employment in Africa?
- 3 2. Considering the concerns about the influx of Chinese workers associated with
4 Chinese development projects, is the employment-promoting effect of Chinese aid
5 projects consistent for different types of employment?
- 6 3. Are there some mechanism through which China's aid projects affect local
7 employment in Africa?

8 **1.4 Aim of Study**

9 The main aim of this PHD thesis is to understand Chinese economic engagement in
10 the African continent through using various types of sources. There are some concerns
11 and criticisms on Chinese economic engagement in Africa. We employ different types
12 of data to deal with these criticisms and investigate the evidence and considerations
13 behind Chinese economic engagement in Africa.

14 In terms of our first research, some researchers claim that China takes use of their
15 economic involvement in Africa to extract natural resources and secure the long-terms
16 needs of energy for its development. So, we aim to investigate the political
17 considerations behind China's economic engagement through the lens of the FDI-
18 Trade nexus in this resource-rich continent.

19 Regarding our second research, we employ the corruption experiences of African
20 citizens to test the effectiveness of China's aid projects and whether local corruption
21 could negatively affect the effectiveness of China's aid in Africa.

22 Moreover, we turn our focus on the impact of China's aid projects on local employment
23 in Africa in our third research. Considering the contradiction between the increase in
24 the inflows of foreign aid and the seriousness of unemployment in Africa, we aim to

1 test whether there is an employment-promoting impact of China's aid projects in Africa
2 through using the subnational dataset on corruption experiences of African citizens.

3 Certainly, this PHD thesis investigates Chinese economic engagement through
4 various perspectives, including the sources of data and evidences. There is no doubt
5 that this PHD thesis can yield more insights into the influence and evidence of China,
6 an emerging economy with an increasingly important presence in the global market.

7 **1.5 Main Contributions**

8 Nowadays, China appears as the biggest economic partner to Africa and claims its
9 partnership with Africa under the "win-win" policy framework. A topic on China's
10 contribution on Africa's economic activity happens to be a timely matter as neutral
11 voices suspiciously question the opportunity of such an economic cooperation,
12 knowing the needs of China's national economic development. Detractors even come
13 out with severe critics that China-Africa cooperation only benefits the Chinese side
14 leaving Africa without any gain. Therefore, this research contributes to existing
15 literature in many ways.

16 Firstly, in our first research, we attempt to steer China-Africa economic cooperation
17 into clarity by investigating the considerations behind China's economic engagement
18 in the African continent by using evidence from the FDI-Trade nexus and incorporating
19 China's geopolitics, such as China's "Go Global" policy and global resource request
20 policy. We seek to uncover how China's FDI in African countries affects its exports and
21 imports respectively by using various levels of data including country-level and
22 product-level data. Also, our research highlights the importance of going beyond
23 evaluating a general shift in China's economic involvement in the Africa continent, and
24 exploring the political considerations behind this shift, which is related to the types of
25 product being traded and the Chinese MNEs' political connections.

1 Moreover, in our second research, we aim to investigate the effectiveness of Chinese
2 aid projects by using a new georeferenced dataset on China's aid projects and
3 nighttime light intensity which is considered as a reliable proxy for economic activities
4 in subnational level. Also, local corruption is also considered in our second research
5 in order to test whether local corruption in African regions negatively affects China's
6 aid effectiveness. Certainly, our test results can yield more valuable insights into
7 Chinese aid projects and reduce the limitations resulted from the lack of detailed
8 financial information of Chinese aid, as some new subnational and georeferenced
9 datasets were employed in our research. Also, to the author's knowledge, there is few
10 empirical studies which link local corruption to the effectiveness of Chinese aid projects
11 and test the variation of the impact of local corruption on China's aid effectiveness
12 across African countries. Obviously, using subnational and spatial dataset can further
13 reveal the impact of Chinese aid effectiveness and more appropriately explain Chinese
14 aid projects in Africa where corruption is pervasive.

15 Also, our third research centers on the speculation of foreign aid job creation impact
16 through using the evidence of Chinese aid projects in Africa. By employing the
17 georeferenced dataset on China's aid projects and employment experiences of African
18 citizens collected by the Afrobarometer surveys, our research, certainly, can uncover
19 how Chinese aid projects affect local labor market in Africa. As such, we contribute to
20 an emerging literature using subnational geocoded aid data to examine the impacts of
21 China's foreign aid within African countries and across different regions.

22 **1.6 Layout of This PHD Thesis**

23 This PHD thesis is structured into five Chapters. Following this introductory chapter,
24 the next chapter presents our first research on the political considerations behind
25 Chinese economic engagement in Africa by using evidence from the FDI-Trade nexus.
26 Chapter 3 presents our second an empirical examination of the effectiveness of
27 China's aid projects and how local corruption affects China's aid effectiveness in Africa

1 by using geographically match the subnational data on Chinese aid in Africa with
2 geocoded data on respondents from four Afrobarometer survey waves across 29
3 African countries. Chapter 4 focuses on the relationship between China's development
4 projects and local employment in Africa. In Chapter 5, we make a comprehensive
5 summary of the various results obtained in the preceding chapters and we draw some
6 concluding remarks about this PHD thesis.

7

1

Chapter II:

2

Understanding China's Economic

3

Engagement in Africa: An

4

Exploration of the FDI-Trade

5

Nexus

6

1 **Abstract**

2 The rapid rise of China on the global stage has promoted a widely held concern about
3 the country's political intention behind its expanding overseas economic activities. This
4 paper attempts to shed new light on this old question: Is the abundance of natural
5 resources in Africa the primary motivation for Chinese engagement in the continent?
6 To this end, we investigate the nexus of China's direct investment in 54 African
7 countries and its international trade with the region between 2003 and 2014 to estimate
8 how and to which extent Chinese investment affects its trade with the continent. This
9 empirical task is facilitated using a transaction-level trade database from Chinese
10 customs, which allows us to trace the trade records by product, destination and
11 exporting firm. Our empirical results support the trade-promoting effect of China's
12 foreign direct investment in the region, and this effect is found to be more significant
13 for China's exports of consumption and processed goods to the continent than for
14 China's imports of primary goods from this same region. Furthermore, we do not find
15 systematic evidence that these investment activities lead to more primary goods being
16 imported by Chinese state-owned enterprises. While these findings do not rule out the
17 existence of resource-seeking motivation, they cast doubt on that being a primary
18 driving force behind Chinese investment in Africa.

19

20 **Key words:** Foreign direct investment; International trade; China; Africa; Consumption
21 goods

22

23

1 **1. Introduction**

2 The emergence of China as the second most influential global power has generated a
3 large variety of debates on the causes and implications of its global economic
4 engagement (Abdullah and Daud, 2020; Clement, 2019; Liang, 2012; Buckley et al.,
5 2016; Leslie, 2016). Among them, a range of the discussions has centered on the
6 economic involvement of China in Africa, as Africa has been one of China's major
7 sources of imports, its second largest overseas construction project contract market
8 and its fourth largest investment destination (Dong and Fan, 2017). Apart from purely
9 economic considerations, China's global policies, not surprisingly, can also affect
10 these activities (Buckley et al., 2016; Liang, 2012). Thus, a great deal of attention has
11 been paid to those policies that extend China's global reach, as well as unfolding the
12 institutional factors that are influencing China's economic involvement (Meyersson et
13 al., 2008). Some studies have criticized Chinese MNEs' investment as being a way to
14 extract the natural resources in African countries, given the abundance of natural
15 resources in this continent (Lin et al., 2018; Nuetah and Xin, 2019). However, most of
16 these existing discussions have been developed based on research on limited aspects
17 of economic activities without a systematic overhaul of Chinese economic engagement
18 with detailed quantitative evidence. To the author's knowledge, few studies have
19 investigated the political considerations behind China's economic engagement through
20 the lens of the FDI-Trade nexus in this resource-rich continent.

21 The Chinese economy has been undergoing impressive growth for the last five
22 decades because of the implementation of the Reform and Opening-up Policy and Go
23 Global policies. According to the National Bureau of Statistics of China (NBSC), the
24 Chinese economy experienced double-digit annual gross domestic product (GDP)
25 growth over the period from 2000 to 2014. Apart from being a major recipient country
26 of FDI in the world, China has also gradually increased its overseas investments in
27 other countries since 2004. Thus, arguably, these bi-directional investment flows

1 enable China to hold a prominent role in the global financial market. It would be
2 empirically inappropriate to examine the global economy system without considering
3 the dramatic shifts in China's economy. Therefore, this paper aims to unveil more facts
4 about Chinese economic activities and their impacts on the global market.

5 The Sino-Africa relationship has benefited from several visits by Chinese Presidents
6 to African countries since³ 1996. Noteworthy, there is an upward trend in China's
7 OFDI into Africa, with a sum of \$5.49 billion in 2009. Meanwhile, China has been the
8 largest trade partner of Africa, with trade reading almost \$220 billion in 2014, through
9 steady and solid growth. Although the Sino-Africa "Win-Win" approach could be
10 enhanced by these economic activities, it is also necessary to further conduct a
11 systematic overhaul of Chinese economy engagement with detailed quantitative
12 evidence.

13 This paper seeks to provide an empirical answer to the following questions: How does
14 Chinese foreign trade respond to the increase in China's OFDI in the African countries?
15 Is there a trade-promoting effect of China's OFDI in Africa, especially for the imports
16 of primary commodities from African countries, an indicator of natural resource
17 extraction motivation of China's economic engagement in this continent?

18 In doing so, we attempt to provide clarity by investigating the political considerations
19 behind China's economic engagement in the African continent using evidence from
20 the FDI-Trade Nexus. We seek to uncover how China's FDI in African countries affects
21 its exports and imports, separately, by using various levels of data including country-
22 level and product-level data. Then, we move onto the political and economic role of
23 Chinese state-owned firms in these African countries. We attempt to examine whether
24 the trade-promoting effect of China's OFDI is consistent across Chinese firms of
25 different ownership structures in the African continent. Evidently, our research can
26 extend the knowledge about China's role and political incentives in Africa through the
27 lens of its international economic activities.

1 Using panel data on China's FDI and trade (including exports and imports)
2 disaggregated by the receiving country and year, our first set of results confirms the
3 trade-promoting effect of China's OFDI in Africa. Moreover, after disaggregating our
4 export and import data based on the Board Economic Standard (BEC), our further
5 analysis reveals that the main objective of the Chinese FDI is to promote its exports to
6 these African countries, with the purpose of taking advantage of the promising market
7 potential in this continent. Whereas, the demand for natural resource or primary goods
8 was not the primary goal of the Chinese MNEs' economic engagement in Africa. After
9 further splitting our data based on the ownership of Chinese MNEs, our analysis of
10 China's state-owned firms is also consistent with our above argument that China's
11 OFDI into Africa has a more significant impact on China's exports of consumption and
12 processed goods to the continent than China's imports of primary goods from this
13 same region.

14 The above results have important policy implications for policymakers in the African
15 countries as well as in other countries. To the best of our knowledge, to date, no
16 empirical analysis has been conducted to unveil how China's economic engagement
17 with African countries (including trade and OFDI) explains China's proclaimed global
18 policies. Our research highlights the importance of going beyond evaluating a general
19 shift in China's economic involvement in the African continent, and exploring the
20 political considerations behind this shift, which is related to the types of products being
21 traded and the Chinese firms' political connections. By using product-level and
22 ownership-level data, our empirical results, consequently, revive the political debates
23 on whether Chinese economic involvement in the African continent aims to extract the
24 natural resources and to satisfy the needs of China's domestic market. It also rekindles
25 the debate on whether the Chinese state-owned firms bear more considerable
26 political responsibilities in the African continent. Certainly, our empirical results will
27 offer valuable insights into the knowledge about China's role in the African continent.

1 The paper is structured as follows. Section 2 provides an overview of Chinese
2 economic involvement in the African countries including China's OFDI and trade.
3 Based on this evidence, Section 3 provides a literature review to gain insights into how
4 the FDI-Trade Nexus uncovers China's political considerations in this continent. In this
5 section, we will discuss, in-depth, several crucial global policies of China, which
6 significantly influence its economic involvement in the African continent. On the basis
7 of this literature review, we will develop four hypotheses related to our research
8 questions. Section 4 presents the empirical approach, the data used and the empirical
9 results. Finally, Section 5 summarizes our findings and concludes.

10

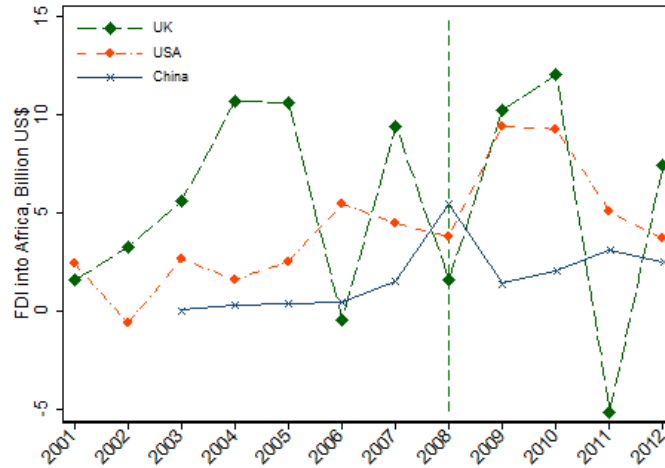
11

1 **2. Overview of China's economic engagement in the** 2 **African continent**

3 The economic ties between China and African countries can be dated back to the
4 beginning of the last century, and have been much closer since the implementation of
5 China's "Go Global" policy and the first Summit of the Forum on China-Africa
6 Cooperation (FOCAC) in 2000 (as shown in the Figure 1). China's OFDI and overseas
7 trade in Africa have undergone remarkable shifts.

8 A stable increase in China's OFDI in Africa has been discovered since 2009, reaching
9 \$3.2 billion in 2014. Most importantly, because of Industrial and Commercial Bank of
10 China's merger and acquisition with the Standard Bank of South Africa in 2009, China's
11 OFDI in the African continent reached a historical peak, with an amount of \$5.49 billion,
12 thus, resulting in China's appearance at the top of the rankings of the inward FDI
13 received by the African continent (Liu and Li, 2018). Moreover, by the end of 2014,
14 Chinese investment had entered 52 African countries¹. For instance, the share of
15 China's OFDI in Algeria increased dramatically from 3.3% in 2003 to 20.8% in 2014,
16 due to the end of its civil war and the subsequent need for infrastructure development
17 and other investments (John, 2017). A similar tendency could also be seen in Zambia.
18 However, it is worth mentioning that China's OFDI has remained marginal with a share
19 of 2.4% of the total FDI inflows into Africa in 2014.

¹ Algeria, Chad, the Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Kenya, Mauritius, Mozambique, Nigeria, South Africa, Sudan, Tanzania, Uganda, Zambia and Zimbabwe accounted for the lion's share of the FDI flows and stocks.



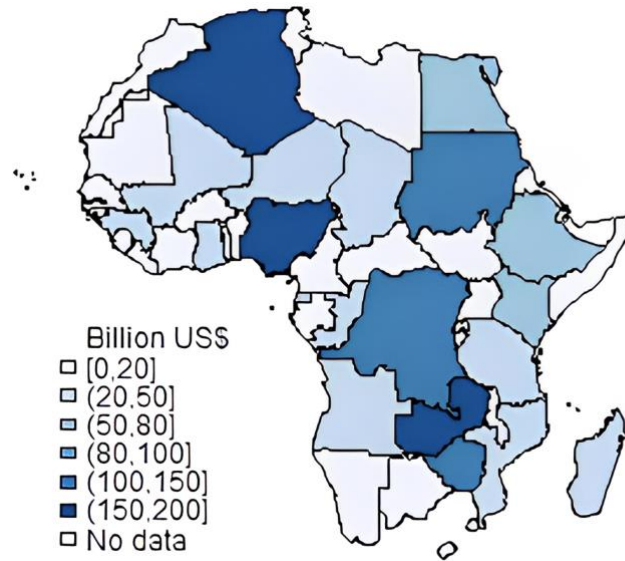
1

2 Figure 1: FDI into Africa (UK, USA and China)

3 Source: Yearly Bulletin of China's Foreign Direct Investment and International
 4 Monetary Fund (from 2000 to 2013).

5 Furthermore, China's FDI in the African continent is also increasingly diversified in
 6 terms of its location of distribution (as shown in Figure 2). By the end of 2014, Chinese
 7 MNEs had developed their overseas investments in almost 90% of African countries.
 8 However, there has been a significant shift in the distribution of China's investment in
 9 the African continent. In the early phase, whether African countries had abundant
 10 natural resources was a vital factor for Chinese MNEs to conduct their investment
 11 activities. Thus, the majority of their economic activities were concentrated in Sudan,
 12 Egypt, and South Africa. On the contrary, Chinese OFDI over the past decades has
 13 been distributed in the entire African continent (as shown in Figure 2). Especially,
 14 Algeria, Congo (Dem.), and Kenya received an increasing FDI from China over the
 15 period between 2003 and 2014. Furthermore, China's economic activities in Algeria
 16 have been no longer confined to the mining development and production sector.
 17 Instead, Chinese enterprises have also been seen in the petroleum industry and
 18 equipment manufacturing sectors (John, 2017).

19



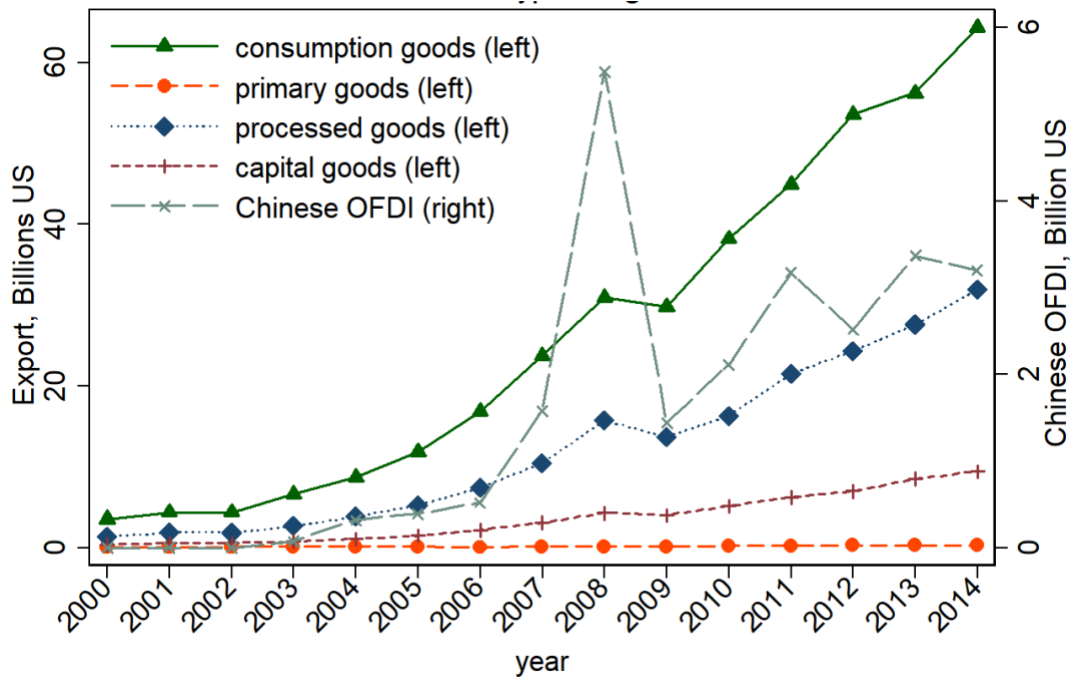
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2 Figure 2: The Geographic Distribution of China's OFDI in the African Continent (2003
3 - 2014)

4 Source: Yearly Bulletin of China's Foreign Direct Investment (2003-2014)

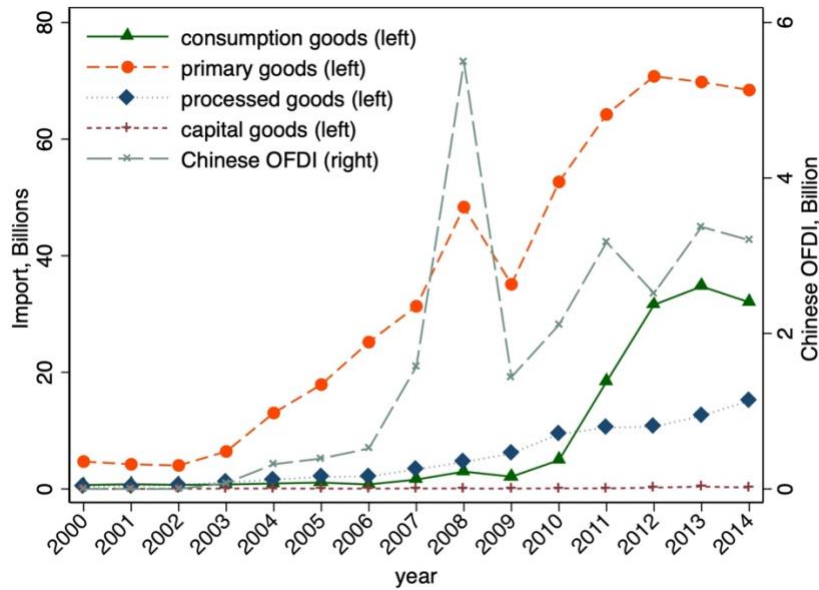
5 Similarly, China's overseas trade with African countries has also experienced an
6 unprecedented shift, since the first Summit of the Forum on China-Africa Cooperation
7 (FOCAC) in 2000. The inaugural FOCAC summit represented a landmark in Sino-
8 African cooperation, triggering soaring bilateral political and economic interactions
9 between China and African countries. With the increasingly tight trade relationship
10 between China and African countries, China has been the largest trade partner of
11 Africa, with trade reaching almost \$220 billion in 2014, through steady growth. In the
12 early 2000s, China's share of Algeria's foreign trade was negligible. Over the last ten
13 years, however, the Sino-Algerian trade ties have become increasingly close. China
14 has overtaken France as Algeria's largest source of imports. Indeed, Algeria-China
15 transactions are now settled in Chinese yuan instead of U.S. dollars (John, 2017).
16 Regarding the exports from China to Africa, there is also a robust growth, almost 13.2%
17 on a yearly basis, 8.3 percentage points higher than China's export growth over the
18 same period. Based on the classification standard of the Broader Economic Categories
19 (BEC), it can be found that most of China's exports to Africa have centered on the
20 consumption goods, followed by the processed goods for industrial supply (as shown

1 in Figure 3). Particularly, exports of technical equipment to Africa made a breakthrough.
 2 For instance, Chinese enterprises signed a supply contract for locomotives with South
 3 Africa, with the purpose of exporting electric locomotives with a total value of \$3 billion,
 4 hitting an order record of China's vehicle exports of high-end railway transportation
 5 equipment.



6
 7 Figure 3: Exports from China to Africa (US\$)
 8 Source: China Customs and Trade Statistics Database (2000-2014).

9 Conversely, imports from Africa to China have had a different tendency. The greatest
 10 increase lies in the imports of primary goods for industrial supply, followed by the
 11 consumption goods which also saw a dramatic increase after 2009 (as shown in Figure
 12 4). The smallest change could be found in the imports of capital goods. On the account
 13 of the fact that Africa is a continent with rich resources and that China could be
 14 considered as an energy-supported economy, it is essential for China to import
 15 resources from Africa, as well as worldwide, in order to secure sufficient energy, such
 16 as oil and fuels, and to sustain its long-term domestic economic growth. Also, the
 17 increase in China's imports of primary goods from Africa also implicitly reflects China's
 18 geopolitics, such as its global resource request policies.



1

2 Figure 4: Imports to China from Africa (US\$)

3 Source: China Customs and Trade Statistics Database (2000-2014).

4 3. Hypotheses

5 Within international business research, the determinants of FDI location have been
 6 investigated through a large variety of empirical and theoretical studies. The well-
 7 known theoretical analysis approach was the eclectic paradigm put forward by
 8 Dunning (2001). By amalgamating the major imperfect market-based theories (e.g.,
 9 internationalisation theories of FDI), he suggested that an MNE would engage in
 10 overseas investment if three advantages were fulfilled, that is the ownership, location,
 11 and internationalisation advantages (OLI advantages). Through comprehensively
 12 investigating these three advantages of MNEs, comprehensively, Dunning's OLI
 13 approach identifies a set of factors influencing the activities of MNEs and suggests four
 14 common motivations of FDI, namely resource-seeking, market-seeking, efficiency-
 15 seeking and strategy-seeking. Certainly, Dunning's approach to analysing FDI has
 16 gained wide acceptance. Thereafter, based on Dunning's OLI approach, an increasing
 17 number of studies have been developed to explore the corporate behaviours and
 18 decisions of MNEs (Zhang & Roelfsema, 2014). However, these theories have mainly
 19 explained the movement of investment from developed countries/regions to other

1 economies. They have failed to capture the phenomenon of investment from
2 developing countries to other countries, as several developing economies have
3 emerged on the map of international investors over the past two decades, such as
4 China and India. Undoubtedly, MNEs from these developing countries have
5 established themselves in every sphere of the global economy. Therefore, explaining
6 the essence of MNE's investment from these developing countries has become vital
7 to develop a theory that is consistent with their investment behaviours.

8 Similar to developed countries, the abundant natural resources in the African continent
9 are also the crucial attraction of China's OFDI. Deng (2004) segregates five factors
10 which motivate Chinese firms to explore investment including natural resources,
11 markets, technology, diversification, and strategic assets. His findings were supported
12 by a wide range of existing empirical studies on China's OFDI. For example, Kolstad
13 and Wiig (2011), using UNCTAD data, ran a cross-country regression with 29
14 observations and found an association of Chinese FDI with natural resource exports.
15 Meanwhile, they also found that China's MNEs were more likely to develop their
16 investment activities in countries with poor governance.

17 Apart from natural resources (discussed below), a large number of Chinese MNEs
18 have decided to conduct their economic activities in Africa with the aim of gaining
19 access to this promising market. The "Go Global" policy further urged Chinese firms to
20 take advantage of the booming world trade to invest in global markets. It has been
21 found that an increasing number of Chinese enterprises, including state-owned
22 enterprises (SOEs) and private enterprises, have ventured to investing and operating
23 abroad. There are several goals set by the "Go Global" policy: moving from an
24 investment to an innovation-driven economy, increasing Chinese outward foreign
25 direct investment, and promoting the competitiveness of Chinese companies in the
26 global markets (Bellabona, 2007). The "Go Global" strategy puts emphasis on China's
27 OFDI which is supposed to enable China better integrate into the global economy and
28 to improve access to domestically scarce raw materials (Buckley, 2017). Eventually,

1 China's OFDI surpassed its inbound FDI for the first time in 2014, reaching a historical
2 record of \$123.12bn. Under the impact of the "Go Global" policy, the same tendency
3 has also been found for China's overseas trade, particularly for China's exports which
4 undoubtedly improve the competitiveness of Chinese companies and products. Thus,
5 it is essential to investigate how China's OFDI exerts an impact on its trade with the
6 African continent.

7 Apart from Dunning's OLI approach, the proximity-concentration trade-off model,
8 which is proposed by Brainard (1997), also plays an essential role in studies on
9 international business. He also mentions the importance of "distance" or "transaction
10 cost" in the analysis of international business. Carr et al (2001) and Bergstrand and
11 Eggar (2007), subsequently confirm the substitution between FDI and exports, as they
12 found a negative effect of geographical distance on FDI. Also, the higher monitoring
13 costs, which increase with the physical distance, could reduce FDI, but encourage
14 exports between countries. However, unlike the conventional proximity-concentration
15 trade-off model, Lankhuizen and de Groot (2011) argue that FDI does not merely
16 substitute trade. Conversely, their research indicates that the larger economies
17 engage relatively more in outward FDI, and size and potential of the foreign market
18 can significantly affect exports. Therefore, it can be concluded that how FDI affects
19 international trade remains vague. In particular, the majority of research on
20 international business employs evidence from developed countries. It is essential to
21 further test the relationship between FDI and trade by using the evidence from
22 emerging economies.

23 Our first two hypotheses thus read as follows:

24 **Hypothesis 1: China's OFDI into Africa leads to a higher value of trade between**
25 **China and Africa.**

26 **Hypothesis 2: China's OFDI into Africa leads to a high4r value of exports of**
27 **consumption goods from China to Africa.**

1 In addition to the “Go Global” policy, which urges Chinese MNEs to integrate into the
2 global market and gain more development opportunities, Chinese MNEs’ economic
3 decisions are also influenced by China’s global resource request policies. Especially,
4 these resource-related policies should not be neglected when investigating China’s
5 economic engagement in Africa, as Africa is well-known for its abundant natural
6 resources.

7 China has experienced an unprecedented economic boom over the past few decades.
8 Whereas, this sharp economic increase has also fuelled China’s need for resources,
9 such as oil and raw materials. Due to the lack of sufficient energy or resources, the
10 Chinese government has put forward a set of foreign and energy-related policies in
11 order to secure the long-term energy supplies which are essential to sustain its
12 industrialisation. Therefore, it is considered that China has been experiencing energy-
13 supported economic growth (Caceres and Ear, 2012). For the sake of sustainable
14 economic growth, these global resource-related policies have made China an active
15 player and generous lender in Africa, Central Asia, Latin America, Russia, and
16 Southeast Asia.

17 Numerous aspects of China’s recent engagement with Africa have attracted as much
18 attention to what some observers refer to as China’s “oil diplomacy”. Although China’s
19 MNEs have been more active in Africa, an increasing amount of oil has been imported
20 to China, and China has surpassed the US as the world’s largest importer of oil in
21 recent years. The International Energy Agency’s World Energy Outlook 2014 (IEA,
22 2014) projected that China would become the world’s largest consumer of oil by the
23 early 2030s. Angola, for example, is playing the dominant role of being a crude oil
24 supplier to China. During 2018, \$24.9 billion in crude oil was imported from Angola to
25 China, accounting for about 10.4% of total oil exports from Angola. Moreover, Libya
26 has been one of the fastest growing suppliers of China’s imported crude oil since 2017,
27 with an increase of 248.1% (China-Lusophone Brief, 2020).

1 Apart from the implementation of so-called “oil diplomacy” in African countries, China
2 has also cooperated with the African authorities to build some special economic zones
3 (SEZ) in African countries or regions with the purpose of enhancing its influence and
4 securing the supply of necessary energy and resources. Established by the Angolan
5 government in 2009, the Luanda-Bengo Special Economic Zone is a state-owned
6 enterprise covering an area of about 840,000 hectares. In this SEZ, the latest
7 investment project belongs to CITIC Construction, a Chinese state-owned
8 conglomerate, which will invest \$40 million in an aluminium smelter to reduce imports
9 of these materials covering an area of 19.6 hectares. This factory is expected to
10 produce 8000 tons of profile products and 2000 tons of door and window products per
11 year, which could then be exported back to China and satisfy China’s domestic needs.

12 In this regard, it is also necessary to further test whether acquiring and importing
13 natural resources from Africa to China is an important consideration behind China’s
14 economic engagement in this continent. Conventional studies on the FDI of developed
15 countries highlight the importance of natural resources for international investors.
16 However, can their arguments be supported by firm-level and product-level evidence
17 from China, the largest emerging economy around the world? This question needs to
18 be further discussed and explored. Therefore, our third hypothesis can be developed
19 as follows:

20 **Hypothesis 3: China’s OFDI into Africa leads to a higher value of imports of**
21 **primary goods by China from Africa.**

22 The last strand of the literature that is related to this paper is on the soft budget
23 constraints of Chinese SOEs. In a 2007 study by Buckley et al. (2007), they examined
24 a Chinese OFDI over the period 1984-2001, a time when it could be “regarded as being
25 state-owned”. They found that the institutional constraints imposed by the Chinese
26 government, via its state’s OFDI approval mechanisms, effectively prohibited private
27 Chinese firms from internationalisation, but enhanced the economic activities of its

1 state-owned MNEs in the global market. They concluded that the institutional factors
2 at home were surmised to encourage Chinese state-owned FDI, including government
3 policy support (relating initially to support given to export promotion efforts), national
4 imperatives to secure the supplies of natural resources, and possibly strategic asset
5 acquisitions overseas (Buckley et al., 2017).

6 A well-known phenomenon in socialist and transition economies is that, when SOEs
7 incur losses, the state normally cannot restrain itself from bailing them out by providing
8 additional subsidies or credits, which are known as the soft budget constraints (Kornai,
9 1980; Lin and Li, 2008). There are several factors resulting in the soft budget
10 constraints, including the paternalism of socialist government, the highly centralised
11 system of socialist economies and the public ownership of socialist economies.
12 Recently, some scholars also found that policy burdens on enterprises could be a
13 crucial cause of the soft budget constraints in the socialist and transition economies.
14 Particularly, this phenomenon is more obvious in Chinese state-owned MNEs (Lin and
15 Li, 2008).

16 Economic considerations are entangled with the political considerations (Patrick and
17 Wagner, 2015). This is reflected in the regulations. Instead of giving directions directly
18 from the state to enterprises, there are regulatory mechanisms that try to influence the
19 investment decisions of China's state-owned MNEs without making them compulsory.
20 All investments are coordinated and regulated by the Ministry of Commerce; they have
21 a list of preferable countries and industries. If an enterprise decides to invest in a
22 particular sector that is listed in that catalogue, it is easier for them to apply for funding
23 and special treatment. The second instrument to influence the investment decision
24 made by China's state-owned MNEs is through a comprehensive package of financial
25 instruments. These consist of development funds, investment funds, concessional
26 loans, and export credit insurance. There are more instruments for financing foreign
27 investment in areas that are government approved. Although these financial packages
28 and support could enable Chinese state-owned MNEs to achieve their economic

1 outcomes to a large extent, their operation should be in accordance with the political
2 objectives. Therefore, China's state-owned MNEs are more likely to conduct their
3 overseas economic activities in the government's favor, with the aims of achieving
4 certain political objectives but at the expense of their performance, according to the
5 phenomenon of soft budget constraints. However, few studies employ quantitative
6 evidence to further illustrate this phenomenon in China, the largest socialist and
7 transition economy around the world. It is essential to explore whether Chinese state-
8 owned firms develop their economic activities with the political considerations in Africa.

9 Therefore, along these lines, we expect the trade-promoting effect of China's OFDI to
10 be more significant for Chinese state-owned MNEs if we disaggregate our data into
11 different categories based on the ownership of Chinese MNEs:

12 **Hypothesis 4: China's OFDI into Africa leads to a higher value of trade between**
13 **China and Africa, but more so for consumption goods exported by Chinese**
14 **state-owned firms.**

1 4. Empirical Analysis

2 4.1 Data and Method

3 In this paper, we investigate econometrically the political considerations of China's
4 engagement in the African continent by considering the FDI-trade nexus. Thus, we
5 employ the gravity model as our econometric model to explain bilateral trade flows,
6 because of its extraordinary stability and its power to explain bilateral trade flows
7 (Yotov et al., 2012).

8 The gravity model assumes that bilateral trade is proportional to the product of the
9 trading partner's economic masses, proxied by GDP, and inversely proportional to the
10 geographic distance between them. In order to control for the country heterogeneity,
11 we make use of partner fixed effects.

12 Considering our research aims and hypotheses, mentioned above, we run the
13 following econometric model:

$$14 \quad \ln Y_{i,t}^{China} = \alpha_1 \ln OFDI_{i,t}^{China} + \alpha_2 \ln OFDI_{i,t-1}^{China} + \alpha_3 \ln GDP_t^{China} + \alpha_4 \ln GDP_{i,t} \\ 15 \quad + \alpha_5 \ln Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t} \quad (1)$$

16 Where $Y_{i,t}^{China}$ represents the total volume of bilateral trade (measured by the sum of
17 exports and imports) between China and African countries; $\ln OFDI_{i,t}^{China}$ refers to the
18 log of China's outward FDI into the African country i ; $\ln GDP_{i,t}$ is the log of the gross
19 domestic product in current US dollars of the African country i ; $Control_{i,t}$ stands for
20 other variables that also influence the trade between China and African states; γ_t and
21 δ_i represent the time and country fixed effects respectively, $\varepsilon_{i,t}$ is the error term.
22 Considering China's investment projects in Africa is generally time-consuming, it is
23 essential to consider the lagged variable of China's OFDI in Africa which can capture
24 the dynamic impact of China's OFDI on its trade with African countries. Thus, we insert
25 a lagged variable, $\ln OFDI_{i,t-1}^{China}$ in our baseline equation (1). What is also needed to
26 mention that we should consider several control variables when we analyse the impact

1 of China's OFDI on its trade (including exports and imports). For instance, it is essential
 2 to take into account the influence of the population of these African states, their
 3 exchange rates, and their trade relationships with countries other than China. Likewise,
 4 considering the characteristics of the African continent, we should also take into
 5 account the natural resources rent as a factor influencing China's foreign trade with
 6 African countries, which is measured by the share of total natural resources in GDP in
 7 the African continent.

8 Our variable of interest is $\ln OFDI_{i,t}^{China}$, whose coefficient α_1 captures the impact of
 9 China's outward FDI on the bilateral trade between China and African countries. The
 10 Table 1 shows the in-detail explanation of our data and the data source:

11 **Table 1: List of Variables**

	Variables	Definition	Data Source
Dependent Variable	$X_{i,t}^{China}$	The volume of China's exports to the African country i in year t	China Customs and Trade Statistics Database
	$M_{i,t}^{China}$	The volume of China's imports to African country i in year t	
	$Y_{i,t}^{China}$	The total volume of trade between China and African country i in year t	
Independent Variables	$OFDI_{i,t}^{China}$	Chinese outward FDI flow into African country i in year t	2003-2014 Statistical Bulletin of China's Outward Foreign Direct Investment
Control Variables	GDP_t^{China}	China's GDP in year t	World Bank Development Indicators
	$GDP_{i,t}$	GDP of African country i in year t	World Bank Development Indicators

$Pop_{i,t}$	Population of African country i in year t	World Development Indicator	Bank
$Exchangerate_{i,t}$	Exchange rate of African country i in year t	World Development Indicator	Bank
$Tradeopeness_{i,t}$:	The share of trade without China's trade on the total GDP of African country i in year t	World Development Indicator	Bank
$Inflation_{i,t}$	Inflation rate of African country i in year t	World Development Indicator	Bank
$Resource_totl_{i,t}$	The percentage of total natural resources rent on GDP of African country i in year t	World Development Indicator	Bank

1

2 Our dataset covers the period 2003 to 2014. Furthermore, we also hypothesise that
3 the goods traded of different categories are affected by Chinese OFDI differently;
4 therefore, we also need to further divide our dataset into four categories of goods
5 based on the BEC standards, namely consumption goods, primary goods for industry,
6 processed goods for industry and capital goods. Regarding this, we can run the
7 following econometric model to test our Hypothesis 2:

$$\begin{aligned}
8 \quad \ln X_{i,t}^j &= \alpha_1 \ln OFDI_{i,t}^{China} + \alpha_2 \ln OFDI_{i,t-1}^{China} + \alpha_3 \ln GDP_t^{China} + \alpha_4 \ln GDP_{i,t} \\
9 \quad &+ \alpha_5 \ln Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t} \quad (2)
\end{aligned}$$

10 Where j refers to the category of goods traded according to the BEC standards and
11 $X_{i,t}^j$ refers to the volume of exported goods from China to African countries. Equation
12 (2) can be used to test our Hypothesis 2, which is looking at the effect of China's OFDI
13 on China's exports of consumption goods to African countries.

14 Likewise, as our Hypothesis 3 is used to investigate the impact of China's OFDI on
15 imports from Africa to China, we can run a similar econometric model, which uses

1 $M_{i,t}^{China}$ instead of $X_{i,t}^{China}$ to represent the volume of China's imports from Africa over
 2 the period from 2003 to 2014. Thus, we can develop an econometrical equation for the
 3 third hypothesis as follows:

$$4 \quad \ln M_{i,t}^j = \alpha_1 \ln OFDI_{i,t}^{China} + \alpha_2 \ln OFDI_{i,t-1}^{China} + \alpha_3 \ln GDP_t^{China} + \alpha_4 \ln GDP_{i,t} \\ 5 \quad + \alpha_5 \ln Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t} \quad (3)$$

6 Hypothesising that Chinese companies with different ownership also differentiate in
 7 terms of the impact of their OFDI on trade, we further split our dataset into three
 8 different types according to the ownership of Chinese firms, namely domestic private
 9 companies, state-controlled companies and foreign invested companies. Thus, in
 10 order to test our fourth hypothesis, our econometrical form could be run as the following:

$$11 \quad \ln X_{i,t}^{k,j} = \alpha_1 \ln OFDI_{i,t}^{China} + \alpha_2 \ln OFDI_{i,t-1}^{China} + \alpha_3 \ln GDP_t^{China} + \alpha_4 \ln GDP_{i,t} \\ 12 \quad + \alpha_5 \ln Control_{i,t} + \gamma_t + \delta_i + \varepsilon_{i,t} \quad (4)$$

13 Where k stands for the type of ownership of Chinese firms. In this equation, our
 14 variables of interest are also $\ln OFDI_{i,t}^{China}$, whose coefficient α_1 captures the impact
 15 of OFDI on China's trade in Africa.

16

17 **4.2 Main Results**

18 **a. The Trade-Promoting Effect of China's OFDI in Africa**

19 We now begin to examine the overall impact of China's OFDI on the bilateral trade
 20 between China and African countries. Table 2 presents the results of estimating
 21 Equation (1) by using the ordinary linear squares (OLS) estimation and fixed effect
 22 estimation. The total volume of bilateral trade between China and African countries is
 23 used as independent variables in this equation at first, and then we explore the impact
 24 of China's OFDI on exports and imports, respectively.

1 We find a positive coefficient of our investment variable, which is $\ln OFDI_{i,t}^{China}$, when
2 we used the sum of exports and imports to measure the total volume of Chinese foreign
3 trade volume in the African continent. Also, this coefficient is positive at a one per cent
4 significance level. This positive coefficient refers to the fact that China's OFDI in Africa
5 could promote its bilateral trade relationship with these African countries. In other
6 words, the more Chinese firms invest in African countries, the more active the
7 international trade interaction between China and these countries is. For instance, the
8 positive coefficient of $\ln OFDI_{i,t}^{China}$ in Column 2 indicates that 1% increase in China's
9 OFDI in Africa lead to an increase in bilateral trade between China and Africa by
10 0.011%. Noteworthy, the positive impact of $\ln OFDI_{i,t-1}^{China}$ on bilateral trade between
11 China and Africa is also unignorable based on our empirical results. For instance, the
12 positive coefficient of $\ln OFDI_{i,t-1}^{China}$ in Column 3 indicates that 1% increase in China's
13 OFDI in the previous year can also lead to an increase in international trade by 0.01%
14 in that year. Also, the positive effect of $\ln OFDI_{i,t-1}^{China}$ can be found in our Column 4 and
15 Column 5, which investigate the impact of China's OFDI on China's exports to and
16 imports from Africa respectively.

17 This result seems to support Neary (2009) and Hailu (2010) who both concluded a
18 pronounced and positive effect of FDI on international trade. Neary (2009) stated that
19 foreign firms established plants in one country as export platforms to serve the block
20 as a whole.

21 Columns (4) and (5) report the regression results by disaggregating foreign trade into
22 two categories, and that is China's exports to Africa and China's import from Africa. As
23 we mentioned in the earlier section, certain control variables should be considered
24 when analyzing the impacts of China's OFDI on trade. Time-invariant country
25 characteristics are captured by the country fixed effects and year fixed effects. After
26 having included five control variables in our baseline regression to further test our
27 regression, the effect of China's OFDI on its exports to African countries is more
28 pronounced compared with the effects on imports from African countries. The

1 coefficient of $\ln OFDI_{i,t}^{China}$ in Column 4 indicates that 1% increase in China's OFDI
2 leads to an increase in China's exports to African countries by 0.009%. Also, this
3 coefficient is significant economically at the ten-percentage significance level.
4 Regarding the coefficient of $\ln OFDI_{i,t-1}^{China}$, its positiveness and significance illustrates
5 that the impacts of China's OFDI in the previous year is greater than the impacts in the
6 current year. Surprisingly, although the coefficient of $\ln OFDI_{i,t}^{China}$ in Column 5, which
7 is related to China's imports from African countries, is positive, it is not significant
8 economically.

9 Thus, it can be said that most Chinese firms choose to develop their African
10 businesses because of the huge market potential in Africa. OFDI from China also, to
11 some extent, affects China's imports from Africa, but not as significant as exports.
12 Summing up to this point, the empirical results demonstrated a trade-promoting effect
13 of China's OFDI in Africa, and more so for China's exports to African countries.

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Table 2: The Effect of China's OFDI on bilateral trade with African countries

Variables	(1)	(2)	(3)	(4)	(5)
	Total Trade	Total Trade	Total Trade	Exports	Imports
$\ln OFDI_{i,t}^{China}$	0.042** *	0.011*	0.008	0.009*	0.000
	(0.011)	(0.006)	(0.006)	(0.005)	(0.018)
$\ln OFDI_{i,t-1}^{China}$	0.033** *	0.010*	0.009*	0.018***	0.016
	(0.010)	(0.005)	(0.005)	(0.005)	(0.016)
$\ln GDP_{i,t}$	0.836** *	2.876** *	1.827** *	0.604**	2.140**
	(0.051)	(0.285)	(0.320)	(0.285)	(0.978)
$\ln Pop_{i,t}$	-0.012	1.652** *	-0.720	2.741***	-0.503
	(0.044)	(0.593)	(0.714)	(0.636)	(2.207)
$Inflation_{i,t}$	-0.005 (0.005)	-0.001 (0.003)	-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.009)
$Exchangerate_{i,t}$	- 0.000** *	0.000**	0.000** *	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Resource_totl_{i,t}$	0.033** *	0.022** *	0.017** *	-0.011***	0.038***
	(0.003)	(0.005)	(0.004)	(0.004)	(0.014)
$Tradeopenness_i$	- 0.819** *	- 0.301**	- 0.420** *	-0.173	-0.83
	(0.142)	(0.130)	(0.126)	(0.112)	(0.384)
Country Fixed Effect		Yes	Yes	Yes	Yes
Year Fixed Effect			Yes	Yes	Yes
Observations	424	424	424	424	415
Number of countries		46	46	46	46
R-squared	0.865	0.767	0.798	0.858	0.362

2

Notes: Standard errors are clustered at the industry level and reported in

3

parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. $OFDI_{i,t}^{China}$

4

is China's outward foreign direct investment to country i in year t ; $OFDI_{i,t-1}^{China}$ is China's outward foreign

5

direct investment to country i in year $t - 1$; $GDP_{i,t}$ is the Gross Domestic Product of country i in year

1 t ; $Pop_{i,t}$ is the Population of country i in year t ; $Inflation_{i,t}$ is the inflation rate of country i in year t ;
2 $Exchangerate_{i,t}$ is the exchange rate of country i in year t ; $Resource_totl_{i,t}$ is the percentage of total
3 natural resources on the total GDP of country i in year t ; $Tradeopenness_{i,t}$ is the share of trade without
4 China's trade on the total GDP of country i in year t .

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6

1 **b. China's OFDI and Exports to African Countries**

2 In order to test our Hypothesis 2, which aims to investigate whether China's OFDI in
3 Africa leads to a higher value of exports of consumption goods from the country to the
4 African continent, we run a modified version of the basic regression for the relevant
5 time period (2003-2014) (see Table 3). We disaggregate the total volume of exports
6 into exports of consumption goods, exports of primary goods, exports of processed
7 goods for industry supply and exports of capital goods from China to African countries
8 in order to further analyse which type of exported goods is affected more significantly
9 by China's OFDI (column 2-5).

10 Our regression results confirm our Hypothesis 2 that the positive impact of China's
11 OFDI on its exports to African countries masks heterogeneities, associated with the
12 categories of exported products. We find that China's OFDI has more significant and
13 positive impact on the exports of Chinese consumption goods and processed goods
14 to African countries, compared with the exports of primary goods. 1% increase in
15 China's OFDI leads to an increase in China's exports of consumption goods and
16 processed goods to African countries by 0.008% and 0.007% respectively. Whereas,
17 their coefficient is not significant at any significance level. However, the positive and
18 pronounced coefficient of $\ln OFDI_{i,t-1}^{China}$ also confirms the trade-promoting effect of
19 China's OFDI in the African continent. 1% increase in China's OFDI in the previous
20 year leads to an increase of China's exports of consumption goods and processed
21 goods to African countries by 0.017% and 0.021% respectively in the current year.
22 These positive and significant coefficients suggest that the more Chinese firms invest
23 in African countries, the more consumption goods and capital goods African countries
24 import from China, such as machinery and technical equipment.

25 There are several explanations. Firstly, the "Go Global" strategy puts emphasis on
26 China's outward FDI as a means to better integrate China into the global economy. So,
27 an increasing number of Chinese enterprises, including state-owned enterprises and

1 private enterprises, have ventured to invest and operate abroad. In order to develop
2 their international businesses, Chinese firms need to import some necessary
3 equipment from China in order to initiate their projects. This interesting phenomenon
4 is more obvious for China's firms in the African continent where the industrial
5 development is relatively left behind. For instance, in recent years, China has emerged
6 as an automobile manufacturing powerhouse, and Algeria as a lucrative export market.
7 In fact, China exported more cars in 2012 and 2013 to Algeria than to any other country
8 (John, 2017). Second, considering that most of the Chinese investments centre on
9 infrastructure projects with Chinese government support, they give the most incentives
10 to import processed goods and capital goods in order to accomplish Chinese overseas
11 projects and improve the competitiveness of these Chinese companies. Third, on
12 account of the fact that China is one of the typical export-driven economies. In other
13 words, the potential of the African market and the requirements of domestic economic
14 growth could also promote China's outbound investment in these African countries.

15 Therefore, China's OFDI in African countries has more significant impacts on the
16 exports of consumption goods and processed goods, which is in line with China's
17 global policies. Compared with these two export products, China's OFDI does not exert
18 a significant impact on the export of primary goods to African countries, which also
19 complies with our expectation, as Africa itself has diverse resources.

20

Table 3: China's OFDI and exports to Africa

Variables	(1)	(2)	(3)	(4)	(5)
	Total export	Exports of consumption goods	Exports of primary goods	Exports of processed goods	Exports of capital goods
$\ln OFDI_{i,t}^{China}$	0.009* (0.005)	0.008 (0.006)	-0.021 (0.042)	0.007 (0.007)	0.009 (0.008)
$\ln OFDI_{i,t-1}^{China}$	0.018*** (0.005)	0.017*** (0.005)	0.030 (0.036)	0.021*** (0.006)	0.008 (0.007)
$\ln GDP_{i,t}$	0.604** (0.285)	0.409 (0.315)	-0.353 (2.169)	0.837** (0.367)	0.219 (0.454)
$Control_{i,t}$	YES	YES	YES	YES	YES
Country	YES	YES	YES	YES	YES
Fixed Effect					
Year Fixed	YES	YES	YES	YES	YES
Effect					
Observations	424	424	399	424	424
Number of countries	46	46	46	46	46
R-squared	0.858	0.827	0.307	0.811	0.789

2

3 Notes: Standard errors are clustered at the industry level and reported in
4 parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Control
5 variables include population, natural resource rent, inflation rate, exchange rate and trade
6 openness. $OFDI_{i,t}^{China}$ is China's outward foreign direct investment to country i in year t ; $OFDI_{i,t-1}^{China}$ is
7 China's outward foreign direct investment to country i in year $t-1$; $GDP_{i,t}$ is the Gross Domestic
8 Product of country i in year t ; $Pop_{i,t}$ is the population of country i in year t .

9

c. China's OFDI and Imports from African Countries

To test our Hypothesis 3, which focuses on the impact of China's OFDI on its imports from African countries, we also split our import data into four categories according to the BEC standards, namely China's imports of consumption goods, China's imports of primary goods, China's imports of processed goods and China's imports of capital goods (as shown in Table 4).

Compared with the results for China's exports, we find several different impacts on China's imports from African countries. On the basis of Table 4, it can be found that

China's OFDI does not exert an impact on China's imports of primary goods for industry supply, which is not in line with our expectation. Whilst there is a positive impact of China's OFDI on its imports of primary goods, this impact is not significant at any significance level. Also, we do not find a significant impact of $\ln OFDI_{i,t-1}^{China}$, which indicates the dynamic impact of China's OFDI on its imports of primary goods from African countries.

As mentioned in an earlier section, African countries are known for their rich natural resources. China could be considered as an energy-driven economy which needs to secure its energy supply to sustain long-term economic growth. Definitely, Table 4 demonstrates certain surprising results. However, some facts are also expected to explain these results. First, there is an impressive shift in the location selection of China's OFDI in Africa. Although natural resources were important for the early phase of China's economic engagement in Africa, this motive is not getting stronger over time. Especially, Cheung and Qian (2009) found a weakening effect of fuel in African countries on China's economic involvement in Africa. Moreover, Zhang et al (2013) argue that more Chinese MNEs engage in the manufacturing and services than in agricultural and mining sectors. This shift in their choices of overseas business sectors has also weakened the role of natural resources in China's economic activities in Africa. Shan et al (2018), furthermore, confirm that those countries with greater quantities of natural resources may not necessarily attract more of China's economic activities.

On the contrary, the effect on imports of consumption goods from African countries is negatively affected by FDI from China at the five per cent significance level. 1% increase in China's OFDI leads a decrease in China's imports of consumption goods from African countries by 0.378%. This negative coefficient of $\ln OFDI_{i,t}^{China}$ can be explained by the fact that China is a country with a well-developed manufacturing industry. Chinese companies' own-made products, to some extent, can satisfy the needs of China's domestic market. Also, FDI-driven economic growth in China makes it possible for Chinese consumers or businesses to import goods from other countries.

Compared with developed countries, African countries have extremely limited consumption products to export to China.

Brautigem et al (2017), through analyzing China's FDI inflows into Africa, also confirmed that growth in FDI inflows in some African non-resource-rich countries (e.g., Burkina Faso, Ethiopia) had been rapid in the most recent period. On the other hand, FDI flows to Nigeria fell sharply between 2012-2015 and 2004-2011, which implies that natural resource seeking FDI would be difficult to sustain over the long term.

Therefore, whilst natural resources were an important factor in attracting more Chinese economic involvement in the last century, our empirical results find a weakening role of natural resources in Africa. Moreover, our empirical results do not support the fact that China's OFDI in Africa leads to a higher value of imports of primary goods by country from the African continent.

Table 4: China's OFDI and Imports from African countries

Variables	(1)	(2)	(3)	(4)	(5)
	Total Imports	Imports of consumption goods	Imports of primary goods	Imports of processed goods	Imports of capital goods
$\ln OFDI_{i,t}^{China}$	0.000 (0.018)	-0.378*** (0.088)	0.019 (0.067)	0.071 (0.090)	-0.003 (0.136)
$\ln OFDI_{i,t-1}^{China}$	0.016 (0.016)	-0.088 (0.084)	0.115 (0.061)	0.029 (0.086)	-0.290** (0.127)
$\ln GDP_{i,t}$	2.140** (0.978)	4.644*** (1.676)	1.955 (1.225)	-1.736 (1.733)	-0.861 (2.568)
$\ln Pop_{i,t}$	0.573 (1.967)	21.479*** (3.907)	-12.695*** (2.974)	9.513** (4.038)	8.372 (6.316)
$Control_{i,t}$	YES	YES	YES	YES	YES
Country Fixed Effect	YES	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES	YES
Observations	415	315	306	309	306
R-squared	0.362	0.388	0.428	0.311	0.140
Number of Countries	46	41	40	40	41
R-squared	0.362	0.388	0.428	0.311	0.140

Notes: Standard errors are clustered at the industry level and reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Control variables include natural resource rent, inflation rate, exchange rate and trade openness. $OFDI_{i,t}^{China}$ is China's outward foreign direct investment to country i at year t ; $OFDI_{i,t-1}^{China}$ is China's outward foreign direct investment to country i at year $t-1$; $GDP_{i,t}$ is the Gross Domestic Product of country i at year t ; $Pop_{i,t}$ is the Population of country i at year t .

d. The Role of SOEs in China's Economic Involvement in the African Continent

Economic considerations are found to be frequently entangled with political considerations, as all of the economic activities of Chinese state-owned firms not only pursue economic performance but are also associated with some international political objectives. Meanwhile, while respecting multiple political objectives, the soft budget constraints are quite obvious in Chinese state-owned firms. In other words, these state-owned firms are more likely to operate in the government's favour and at the expense of performance. Thus, it can be found that the widespread portrait of China's economic engagement with Africa is related to state-directed behaviours. SOEs are the main agents of the Chinese government that are used to realise its policies. It is necessary to investigate the political connections of China's state-owned firms through investigating their economic engagement in Africa. In order to test our Hypothesis 4, which focuses on the role of Chinese state-owned firms in Chinese economic engagement in the African continent, we further split our data based on the ownership of Chinese firms, that is Chinese domestic private firms, Chinese state-owned firms and foreign invested firms in China.

Before we show our empirical analysis of Hypothesis 4, it is necessary to explain the basic role of Chinese state-owned firms compared with other firms with different ownerships. As shown in Figure 4, it can be seen that Chinese domestic private firms are more active in exports from China to African countries. Conversely, China's state-owned firms see a significant increase in their imports from African countries. Meanwhile, the imports from African countries to China, generated by Chinese domestic private firms, have also been experiencing an upward tendency. Although these two figures, to some extent, show the role of SOEs in China's economic involvement in the African continent, it is essential to analyse this role econometrically. By running the econometric equation (4) to test Hypothesis 4, the results are then shown in Table 5.

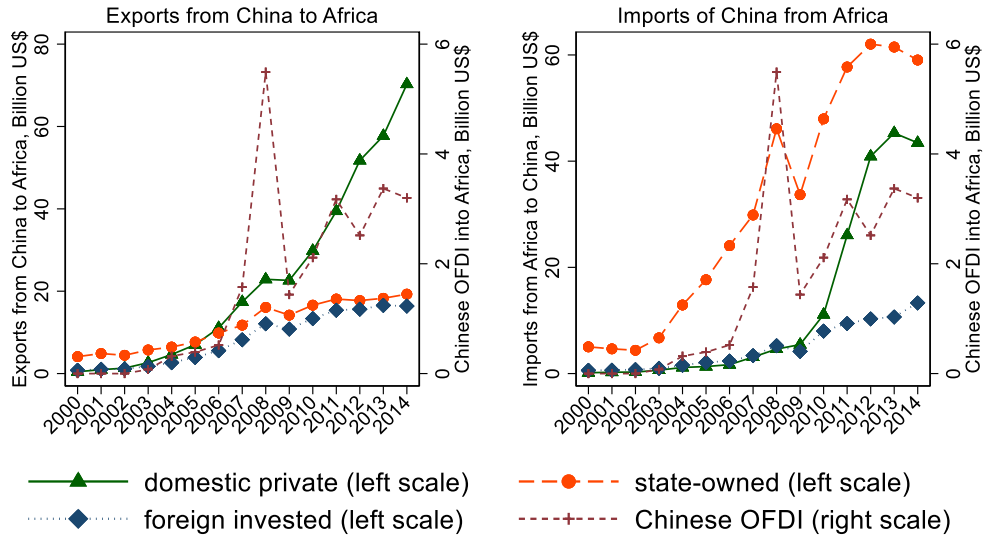


Figure 5: The Impact of ownership on China’s overseas trade
 Source: China Customs and Trade Statistics Database (2000-2014).

Based on our statement above on the phenomenon of the soft budget constraint of Chinese SOEs, the co-efficient showing the relationship between the imports generated by Chinese state-owned firms and China’s OFDI is of interest. According to Table 5, it is clearly found that Chinese state-owned firms generate a more significant impact in comparison with firms with other types of ownership. The coefficient of the variable of our interest, $\ln OFDI_{i,t}^{China}$, indicates that a 1% increase in China’s OFDI leads to an increase in consumption goods traded by China’s state-owned firms in Africa by 0.018%. The impacts on “consumption goods and processed goods” are expected to be closely associated with the ownership of the firms involved, as the main consideration of the increase in Chinese FDI is to gain access to African countries and enjoy its market potential, so as to secure the long-term economic growth in China. Similarly, we can find a similar positive and significant impact of China’s OFDI on processed goods traded between China and African countries. Some researchers believed that Chinese firms regard the African market as a platform through which they can gain access to the global market and enjoy cheap labour in that continent (Buckley et al., 2007; Cheung and Qian, 2009; Shan et al., 2018). Thus, it can be concluded that the trade-promoting effect of FDI exists predominantly for those consumption

goods and processed goods for industrial supply in the course of Chinese state-owned firms developing their business in African countries.

Conversely, we cannot find a significant and positive effect of China's OFDI on China's imports of primary goods, although the security of energy is relatively crucial for sustaining China's long-term economic growth. Currently, plenty of articles have criticized Chinese state-owned firms over their economic involvement in Africa, as they believe that acquiring resources is the main purpose of their economic activities. However, our finding is the refutation of their accusations.

There are two explanations of this insignificant coefficient. Firstly, considering the needs to obtain more of the resources needed, Chinese businesses have placed more of an emphasis on the market opportunities in African countries, especially in today's globalisation age with increasingly fierce competition. Chinese state-owned firms cannot only develop their business in the African continent, but also make use of these African countries to get access to a much wider global market, for example, the EU market or the American market, so as to enhance their competitiveness and international influence. Additionally, the development and utilisation of new energy could also reduce the imports of natural resources from African countries. This shift can also be found if we look at the shifts in location choice of Chinese FDI. Over the last decade, more Chinese firms locate their African plants where they can more easily get access to the local market. Therefore, the market-seeking motive has been increasingly important for China's economic engagement in Africa. According to our empirical results, it cannot be concluded that China's OFDI could stimulate its imports of natural resources from African countries.

It should be noted that our empirical work does not equate with the findings of most research on Chinese investment in Africa which put more emphasis on the importance of natural resources. Our research highlights that the market potential of African countries could be the main consideration behind Chinese economic engagement in the African continent in the current turbulent global environment. The subsequent empirical analysis on Chinese state-owned firms in African countries also confirms the

attractiveness of the African market to Chinese investors. Concerning the political importance of Chinese state-owned firms, our research using evidence of Chinese state-owned firms can, to some extent, reflect the political considerations behind Chinese economic engagement in Africa, namely, getting access to and enjoying the potential of the African market.

Table 5: The Role of SOEs in China's economic involvement in the African continent

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Domestic firms and consumption goods	Domestic firms and primary goods	Domestic firms and processed goods	Domestic firms and capital goods	State-owned firms and consumption goods	State-owned firms and primary goods	State-owned firms and processed goods	State-owned firms and capital goods	Foreign firms and consumption goods	Foreign firms and primary goods	Foreign firms and processed goods	Foreign firms and capital goods
$\ln OFDI_{i,t}^{China}$	0.002	-0.019	0.006	-0.003	0.018*	0.019	0.023**	0.019	0.024**	-0.009	0.016	0.034**
	-0.007	-0.029	-0.008	-0.012	-0.01	-0.03	-0.011	-0.013	-0.01	-0.029	-0.011	-0.015
$\ln OFDI_{i,t-1}^{China}$	0.017***	-0.023	0.019***	-0.001	0.020**	-0.046*	0.021**	0.013	0.031***	0.007	0.034***	0.017
	-0.006	-0.024	-0.007	-0.01	-0.008	-0.026	-0.009	-0.011	-0.008	-0.025	-0.01	-0.013
$\ln GDP_{i,t}$	1.590*	-4.339	2.086**	0.371	3.843***	-2.578	6.005***	2.351	4.149***	-2.209	4.755***	-0.479
	-0.903	-3.497	-0.945	-1.422	-1.154	-3.674	-1.309	-1.526	-1.152	-3.539	-1.367	-1.804
$Control_{i,t}$	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effect												
Year Fixed	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Effect												
Number of countries	46	46	46	46	46	45	46	46	46	45	46	46
Observations	424	381	423	421	424	379	421	419	424	349	419	421
R-squared	0.826	0.371	0.84	0.761	0.461	0.167	0.435	0.526	0.636	0.246	0.516	0.509

Notes: Standard errors are clustered at the industry level and reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Control variables include natural resource rent, inflation rate, exchange rate and trade openness. $OFDI_{i,t}^{China}$ is China's outward foreign direct investment to country i in year t ; $OFDI_{i,t-1}^{China}$ is China's outward foreign direct investment to country i in year $t - 1$; $GDP_{i,t}$ is the Gross Domestic Product of country i in year t .

5. Conclusions

Our article contributes to the literature on the political considerations of economic activities through an assessment of the relationship between its OFDI and foreign trade. The Chinese government has been frequently accused of the extraction and import of natural resources from African countries with the aims to satisfy the needs of its domestic economic growth. Using data on China's FDI and overseas trade in the African continent over the period from 2003 to 2014, we run a gravity model to shine insight into the political considerations of Chinese economic decisions in the African continent. All models are estimated using country and time fixed effects with clustered standard errors. Considering the political and economic influence of Chinese state-owned firms, we further split our dataset based on the ownership of the Chinese firms that are involved in the African continent.

Our empirical results confirm the trade-promoting effect of China's OFDI in the African continent, especially more so for the exports of Chinese consumption and processed goods to African countries. However, our results contradict the criticism of Chinese economic involvement, which puts an emphasis on the extraction of natural resources from the African continent. The trade-promoting effect of China's OFDI is merely significant on the exports of Chinese consumption and processed goods, instead of the imports of African primary goods to China. Furthermore, we find no additional evidence to support the impacts of Chinese state-owned firms on its imports, although Chinese state-owned firms should bear several political responsibilities. Therefore, it can be said that the main consideration behind Chinese economic activities in the African continent could be to further enhance the global influence of Chinese products and gain access to the African market and enjoy its huge potential.

Obviously, the noteworthy takeaway from our empirical research is to respond to the "Natural Resource Extraction" criticism of Chinese economic engagement in Africa. Also, according to our research work, we suggest that Chinese policymakers should shoulder more responsibilities in the African continent in order to further strengthen the "Win-Win" relationship between China and Africa.

The Sino-Africa relationship is vital for the development of China and Africa, both economically and politically. Therefore, when initiating an investment project in the African continent, Chinese government and investors should more carefully and comprehensively examine the impacts of their activities on the African market.

Although there are still various criticisms of Chinese economic involvement in this resource-rich continent, the Chinese government should continue to encourage local and foreign investors to develop their projects which are beneficial to economic development and poverty reduction in African countries. Therefore, this paper opens some new avenues for future research on the impacts of Chinese economic engagement on the economy development and poverty reduction in African countries. In particular, the United Nations considers the poverty reduction as one of the crucial goals of Sustainable Development (SDGs). How China's OFDI plays a role in the poverty reduction of African countries should be further investigated. Also, it should be noted that future research should be conducted to corroborate the findings in this research and the conclusions derived.

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Chapter III:

Does Local Corruption Reduce Chinese

Aid Effectiveness in Africa? Evidence

from Subnational Dataset

Abstract

In recent years, China has become Africa's biggest economic partner. The lack of transparency of official information of Chinese economic activities results in China's aid to Africa as the subject of much speculation. Hence, we intend to test the effectiveness of Chinese aid projects and whether local corruption is a factor reducing this effectiveness. To this end, we geographically match the subnational data on Chinese aid allocation in Africa with geocoded data on respondents from four Afrobarometer surveys waves across 29 African countries over the period from 2000 to 2014. Furthermore, in order to test the correlation between local corruption and the effectiveness of Chinese aid, we also use point coordinates to geo-match nighttime lights with Chinese aid projects in our sampling units. By comparing the corruption experiences of clusters with several ongoing Chinese development projects in their vicinity to those with future Chinese projects which were not initiated to be implemented at the time of survey, we are able to control certain unobservable features of African clusters which may affect our test of the effectiveness of Chinese aid projects. Our empirical results demonstrate the promoting impact of Chinese aid projects on local economic activities, and that this promoting effect is not negatively affected by local corruption which is measured by two questions from Afrobarometer surveys. In particular, the effectiveness of Chinese aid projects varies across African clusters with different corruption level. In other words, Chinese aid projects are more likely to fuel economic activities to a greater extent in more corrupted clusters, compared with less corrupted clusters in Africa.

KeyWords: China's Aid Projects; Afrobarometer Surveys; Nighttime Lights; Georeferenced Dataset

1.0 Introduction

The global economic landscape has changed dramatically on account of the fact that the emerging economies have been driving global economic growth. Undoubtedly, new sources of development finance have emerged and the development cooperation arena has seen continued diversification of actors, instruments and impacts. In this process, the dominance of aid from Western traditional donors has been declining, with a sharp increase in development finance from non-Western donors (Brautigam, 2009; Doucouligos and Paldam, 2009). Definitely, these changing circumstances call for a renewed focus on the implications and challenges of development cooperation, and for an understanding of the implications of the rise of new actors and financial flows in particular. Therefore, there is a need for a broader view when analyzing the impacts of aid, incorporating questions traditionally not studied within the aid framework (Isaksson and Kotsadam, 2018a; Kaplinsky et al., 2007).

For over a decade there has been increasing recognition that aid flowing to governments implementing ineffective policies is wasteful, consistent with empirical findings already available in the early 1990s (Doucouliagos and Paldam, 2008; Doucouliagos and Paldam, 2009; Brautigam and Knack, 2004). As a result, over the past decades aid has become somewhat more sensitive to supporting domestic policy reform efforts of recipient countries, even though narrow political objectives of donors still play a dominant role in many aid decisions today. Hence, a large variety of studies indicate the corrosive effect of corruption that undermines the effectiveness of foreign aid (Dionne et al., 2013; Dreher and Lohmann, 2015; Dreher et al, 2021). Also, they argue that the political dimension of governance and corruption could be considered as the key to improve aid effectiveness, especially for African countries which has been the recipients of international assistance and where corruption has permeated. A report by the African union pointed out that corruption has stolen futures in Africa (Quibria, 2017). Therefore, it could be said that Africa presents a typical case whose development and the desired change have been undermined and retarded by the menace of corrupt practice.

In recent years, China has become Africa's biggest economic partner. Unlike the ODA donors, the Chinese government does not release detailed project-level financial information about its foreign aid activities (Morgan and Zheng, 2019; Kaplinsky et al., 2007). This lack of transparency also has made evaluation of Chinese aid difficult. As a result, China's aid to Africa is the subject of much speculation. Some praises could be also seen for Chinese aid on the account of the fact that Chinese development projects have been centered on the infrastructure development of developing countries, as well as that the "non-interference policy" by Chinese government, which is quite different from Western donors, has reduce the administrative burden associated with development projects in developing countries (Isaksson and Kotsadam, 2018a; Isaksson and Kotsadam, 2018b).

However, Chinese aid effectiveness could be also described as something of a paradox. Some scholars hold a pessimistic attitude toward this emerging donor in Africa continent. For instance, *The Economist* doubted Chinese aid effectiveness in Africa because of the repeated mistakes which was also conducted by Western donors at the beginning period of their investment in Africa (Morgan and Zheng, 2019). Moreover, critics claim that Beijing uses their development finances to create alliances with the leaders of developing countries, to secure commercial advantages for their domestic firms, and to prop up corrupt and undemocratic regimes in order to gain access to their nature resources endowments (Dreher et al., 2021; Dreher et al., 2015).

Therefore, in the midst of the controversy of Chinese aid effectiveness and the debate on corruption, we aim to analyze Chinese aid effectiveness with the consideration of local corruption in the African continent. This paper asks whether local corruption could minimize the effectiveness of Chinese development projects in Africa, whether Chinese aid effectiveness is uniform across African clusters with different level of corruption.

In order to yield more valuable insights into Chinese aid projects and reduce the limitations resulted from the lack of detailed financial information of Chinese aid, a host of empirical studies use a new subnational data material of Chinese aid projects which can be obtained from AidData's Chinese Official Finance to Africa Dataset introduced by Strange et al. (2015). There is no doubt that this

geocoded and product-level data of Chinese aid projects has significantly advanced our understanding of the complicated effects of Chinese aid projects in Africa.

To answer our research questions related to Chinese aid effectiveness and local corruption in Africa, we also geographically match the subnational data on Chinese aid allocation in Africa with geocoded data on respondents from four Afrobarometer surveys waves across 29 African countries. These Afrobarometer surveys can capture the corruption experiences of respondents, which have potentials to extend our understanding of corruption related facts across these African countries.

Similar to georeferenced dataset on Chinese aid projects and local corruption activities in Africa, we also employ another subnational data material, that is, nighttime lights, allowing us to yield comprehensive insights into economic activities and outcome in Africa where disaggregated data from some statistical offices are unavailable and of poor quality. Nighttime lights can be calculated from weather satellite recordings and made available by the US National Oceanic and Atmospheric Administration (NOAA) as an annual time series. One practical advantage of this subnational dataset is that it is measured with consistent quality across administrative regions, cities or municipalities, so as to reveal the more comprehensive and systematic variation in a subnational unit (Shi et al., 2014; Min et al., 2013; Isaksson and Kotsadam, 2018a).

By geo-matching the dataset on Chinese aid projects, local corruption activities with nighttime lights across African countries, our empirical research confirms that Chinese aid projects can enhance the economic activities in African, as well as that local corruption activities across African regions have not diminished the effectiveness of Chinese aid projects. Furthermore, considering the level of corruption across African regions, we further create an interaction terms to justify whether there is a uniform effect across African regions. The further investigation indicates that Chinese aid projects are more likely to fuel economic activities to a greater extent in more corrupted clusters, compared with less corrupted clusters in Africa. Given some existing studies on location selection of Chinese aid projects argues that Chinese aid projects tend to be sited in locations where governance performs relatively unsatisfied compared

with Western donors, our empirical results can also, to some extent, reflect these criticisms concerning Chinese aid practices.

Our paper relates to the literature on aid effectiveness and the impact of corruption, which provides something of a paradox. Similarly, our study can directly make significant contributions to relevant research. In particular, how to improve the estimation accuracy of aid effectiveness has become a central notion in the lexicon of the aid industry. So, using nighttime lights can extend the growing literature on the effectiveness of foreign aid in developing countries where subnational data is of poor quality and where data accuracy is not available. Meanwhile, considering the pervasiveness of corruption – commonly defined as the misuse of public office for private gain - in African countries, the present study can definitely add to the strand of the literature focusing on the impact of corruption. Corruption or mis-governance is closely related to the location selection of foreign financial assistance and its local externalities. Using geocoded and subnational data, obviously, can reveal the differences between China’s aid practices and those of traditional Western donors.

The remainder of this paper is structured as follows. Section 2 describes the related literature. Section 3 illustrates our data and empirical strategy to estimate Chinese aid effectiveness and the impact of local corruption on this effectiveness. In Section 4, we present our empirical findings and discuss various robustness tests. Section 4 summarizes the results and draws conclusions for the long-standing debate on the effectiveness of Chinese aid.

2.0 Related Literature

2.1 Aid Effectiveness

One of the most enduring and important questions in economics is whether foreign aid can help countries grow. It is expected that the resource transfer from rich countries could set the poor countries on a path to growth. Hence, since 2000, rich countries have made a great effort to grant more generous development assistance and reduce poverty in poor countries, especially those with good policies and institutions (Quibria, 2017; Salahuddin et al., 2020; Senu, 2019).

Yet, whether this mobilization of billions of dollars could help poor countries grow in a sustainable way is still mired in controversy. Many researchers claim that the impact of aid is unconditional good for growth, bad for growth, or has no clear effect (Doucouliagos and Paldam, 2008; Doucouliagos and Paldam, 2009).

On the one side, researchers argue that there should have a positive impact of aid on economic development through the economic indicators at the macro-level. For instance, foreign investment is frequently flown into the recipient countries of international aid, in order to secure the normal operation of international aid projects (Felicitas and Elena, 2021). Hence, the large amount of inward foreign investment could boost the economy vitality of recipient countries, so as to enhance their economic development. Rosenstein-Rodan (1961) emphasizes that underdeveloped countries require a big push, i.e., large amounts of investments, to embark on the path of economic development from their present state of backwardness. Chenery and Strout (1966) view foreign aid as a means to reach a certain output target by filling two gaps (the investment-savings gap and the trade gap). They used this two-gap model to compute the amount of foreign aid that is necessary to promote development.

However, the simplistic view that foreign aid adds to the availability of external resources without substituting domestic savings has been challenged in empirical studies that show that foreign aid reduces the incentive to save in aid-receiving countries (Doucouliagos and Paldam, 2009). Therefore, some

empirical studies find a negative and significant impact of aid on domestic saving, and hence a negative effect on growth. They illustrate that aid can increase total savings but not by as much as the aid flow, suggesting that a considerable part of the aid is consumed rather than invested. In line with this, Boone (1996) finds that aid does not significantly increase investment, but it does increase consumption and expands the public sector. Mosley (1987) adds that aid can also change the structure of government spending depending on the government's preferences for consumption and investment. So, it can be said that there is an overemphasis for the impact of aid on the physical capital accumulation in the recipient countries. Moreover, more recent evidence shows aid has a negative impact on domestic savings because of substitution, and hence reversely affects economic performance (Nowak-Lehmann et al., 2012).

With the development of econometric techniques and theories, a new generation of aid effectiveness research has been gained more attention. Apart from the investigation on the aggregate impact of aid, more and more researchers have shifted their focus on the features of recipient countries, which could influence the effectiveness of international aid explicitly or implicitly. For instance, Burnside and Dollar (2000) investigate the influence of the quality of economic policy on aid, and then they also emphasize that the institutional quality of recipient countries is also an unignorable factor for the investigation on aid effectiveness (Burnside and Dollar, 2004). Although an increasingly number of empirical studies put forward the diminishing return to aid and the conditionality of aid effectiveness, they have produced mixed results. For instance, Burnside and Dollar (2000) found an insignificant impact of aid when taking into consideration the economic policy of recipient countries. Whereas, the poor institutional quality could negatively and significantly affect the impact of international aid on growth (Brautigam and Knack, 2004). Hence, it can be summarized that investigating the features of recipient countries is undoubtedly insightful to analyze the effectiveness of international aid.

In addition to analyzing the aggregate impact of aid, research on aid effectiveness is also moving to investigating the effectiveness of different types of aid projects (Donaubauer et al., 2014), especially when discussing Chinese

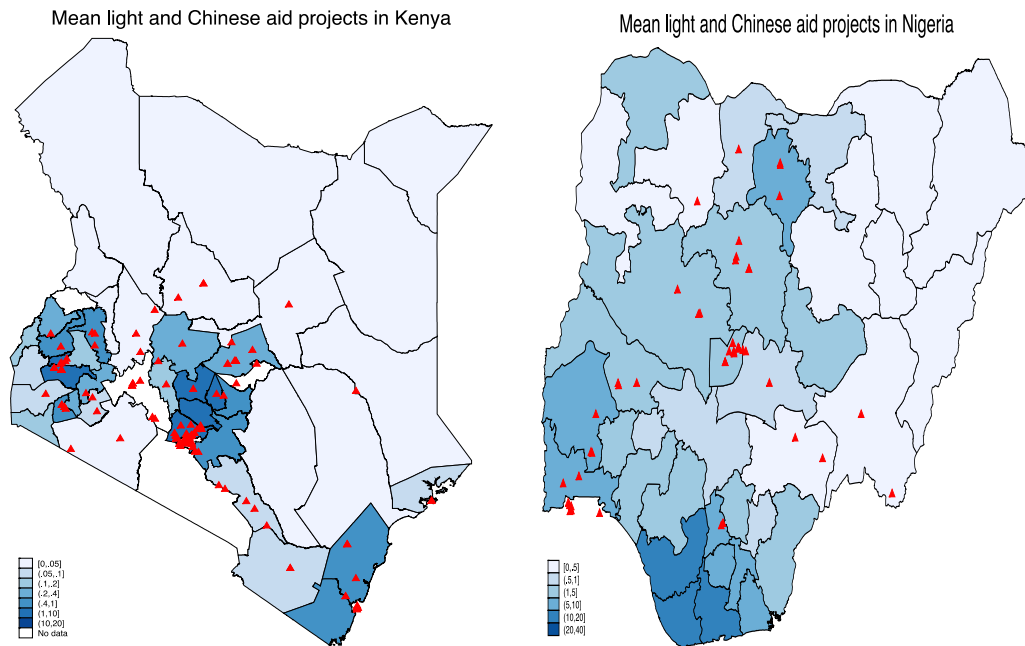
international aid which is holding an increasingly crucial role in global financial market. Dreher and Fuchs (2016) state five phases of China's aid program since the 1950s. They highlight that political and ideological considerations could not be unignorable, and that a new era for China's aid program started in 2006, with China declaring a "new strategic partnership" at the Beijing Summit of the Forum on China–Africa Cooperation (FOCAC). China announced plans to double its 2006 aid effort to Africa by 2009 "to reach the target of mutual benefit and win-win situation between China and African countries" (Ministry of Commerce, 2007).

Compared with Western donors in developing countries, China's aid can be said to be not linked explicitly with conditions which are traditionally mentioned by international aid organizations, for instance, the implementation of good policies and the respect for human rights (Strange et al., 2013; Tan-Mullins et al., 2010). Hence, China has been a welcome alternative to Western donors in developing countries because of its quick implementation and less scrutiny of conditions compared with Western donors. However, development aid from China is criticized as being driven by its economic and political interests to a greater extent than development aid from traditional Western donors. Hence, it is necessary to consider the political and ideological considerations when discussing the effectiveness of China's aid in developing countries.

With respect to poverty and development, China's Ministry of Commerce (1985) emphasizes that its aid projects play "a positive role in expanding the national economies of the recipient countries and improving the material and cultural life of the people in these countries." Highlighting the idea of mutual benefit, the ministry claims "to help the recipient countries develop their national economies and bring about economic progress for both China and these countries" (Ministry of Commerce, 1985).

By using nighttime light emission as the reliable proxy of economic activities, we geographically test how China's aid project sites are related to the economic development of the African countries. Kenya and Nigeria are taken as the examples in the following figure:

Figure 1: The Allocation of Chinese aid projects and nighttime light emission in Kenya and Nigeria



Source (AidData.com, 2022; NOAA, 2022)

Through the figure above, it can be noted that Chinese aid project sites are centered on the regions with high nighttime light intensity. In other words, it can be said that Chinese aid projects are related to the increase in local economic activities in the African regions, as high nighttime light emissions mean there are frequent and vibrant economic activities in the African regions.

On basis of relevant literature on aid effectiveness and evidence on China's aid projects, our first hypothesis could be formulated as follows:

H1: There is a positive and significant impact of China's aid on economic activities in Africa.

2.2 Local Corruption in Africa

One research objective of our research is to investigate how China's aid effectiveness in Africa is affected by local corruption, a phenomenon that likely has wider negative consequences for investment and economic growth (Mo, 2001). Meanwhile, African countries can be considered as natural resource dependent economies and China's aid is widely seen as been associated with

economic and political interests. Therefore, investigating the local corruption in Africa could be insightful to estimate our hypothesis 2.

Corruption remains the most daunting challenge for majority of African countries. As evidenced by several studies and surveys, it is a major obstacle to economic progress, social welfare, service delivery and good governance in the continent. According to the United Nations Economic Commission for Africa (UNECA, 2009), it is estimated that in 2004, the continent lost more than \$148 billion to corruption; approximately 25 percent of its gross domestic product (GDP). In addition, the African Development Bank (ADB, 2006) suggests that 50 percent of tax revenue and \$30 billion in aid for Africa ends up in corrupt hands. According to the UNECA (2005), corruption ranked as one of the three most serious national problems confronting African countries, the other two being poverty and unemployment. In the 2009 African Governance Report, corruption seems to have worsened in many Africa countries (UNECA, 2009). Many African countries have adopted policy measures, enacted laws and established institutions in a bid to address the issue. Yet corruption continues to be a lingering concern in governance and economic life (Asongu, 2013). Particularly, some studies consider local corruption as the thief who has stolen the African economic prosperity and argue that African development and desired change have been undermined and retarded by the menace of corrupt practice (Bhattacharyya and Roland, 2010).

Andreas (2015) investigates the relationship between natural resources and corruption, and then put forward that natural resources may affect corruption directly or indirectly without being mediated through regime types. Natural resource extraction could be considered as “high-rent” activity to the economy, increasing the bribes that involves economic actors can possibly pay while still reaping profits. This, in turn, increase incentives for individual bureaucrats to accept bribes. Also, it is widely recognized that the economic costs for government of accepting corruption is lower when the economy is dominated by sectors, such as natural resource extraction. Indeed, leading government actors may themselves benefit from bribes relating to control over natural resource production and exports, as has been the case in numerous African countries (Meredith, 2006).

As per the studies of Andreas (2015), it can be evident that mining areas turn more corrupt after mines open and actively produce, independent of whether increased local economic activity mainly increases the number of bribes asked for by already present officials, or by generating a flow of corrupt officials into mining areas. This “political resource curse” can be explained by the increase in costs of doing business in the mining sectors caused by corruption (Brunnschweiler, 2008; Frankel, 2010; Schlenker, 2017). With respect to the types of China’s aid projects in Africa, it can be found that natural resources related aid projects play a relatively vital role, with the percentage of 10.54% over the period from 2000 to 2014 based on the detailed project-level data from Chinese Official Finance to Africa Dataset (Morgan and Zheng, 2019; Menard and Weill, 2016). Hence, it is impossible to analyze the effectiveness of China’s aid in African countries without the consideration of local corruption.

As described in Charron (2011), the mid 1990s saw the beginning of an “anti-corruption” movement among major Western donors, and today, many donors and international organizations indeed use “no tolerance for corruption” to signal a tough stance towards corrupt practices in recipient countries (Asongu, 2013; Quibria, 2017). Also, the institutional quality and corruption situation of recipient countries has been an important principle to check whether the developing countries or areas are suitable for international aid. Hence, it can be said that global efforts are being made to fight corruption and ameliorate the negative impacts of corruption.

As what we have mentioned above, China’s aid is not explicitly linked to some conditions which are required by traditional Western donors. Critics claim that China uses its development projects to satisfy its political and ideological considerations, such as securing the commercial advantages of Chinese domestic firms and propping up corrupt and undemocratic regimes in order to gain access to their natural resource endowments (Tan-Mullins et al., 2010; Tull, 2006). Strange et al., (2013) show that China’s cross-border allocation of highly concessional flows is primarily driven by political consideration, while economic interests shape the allocation of less concessional types of official financing. Most notably, through using georeferenced dataset on the political leaders’ birth regions of African countries and the subnational allocation of China’s

development projects, Dreher et al. (2015) confirm that the political leaders' birthplaces are more likely to receive larger flows of Chinese official financial, implying that China's aid allocation is also affected by the features of recipient countries.

Furthermore, there is no doubt that corruption varies across the African continent. For instance, according to the report from World Bank (2010), the inefficiency of government institutions due to corruption is pervasive and widespread across Africa. Indeed, the latest Transparency International report (2015) clearly describes the serious problem of corruption in Africa and shows that six African countries are ranked among the ten most corrupt countries in the world, stating that: "*Forty out of the region's 46 countries show a serious corruption problem and there's no improvement*". According to the 2016-Transparency International ranking, the most popular measure of corruption, more than 30 African countries scored at the 100 bottom countries out of 176 studied countries. For example, sub-Saharan Africa scored 31 where the score 43 indicates endemic corruption. The Middle East and North Africa scored 38 and the European Union and Western Europe scored 66. Therefore, it is also necessary to investigate whether the effectiveness of China's aid is disproportionally allocated to the African clusters with different corruption level. In other words, given that corruption level varies across the different African regions or clusters, we should study whether there is a consistent effectiveness of China's aid across the African clusters with different corruption level.

Therefore, our Hypothesis 2 could be shown as follows:

H2: China's aid projects are less effective in the African corrupted clusters.

3. Data and Empirical Strategy

3.1 Data Sources

To analyze whether local corruption could reduce China's aid effectiveness in Africa, we geographically match a novel, spatial dataset on China's official financial flows to Africa over the period 2000-2014 with the geocoded dataset on respondents from 4 Afrobarometer survey waves in 29 African countries

over the period from 2002 to 2013. Moreover, given that the nighttime light can be considered as a reliable proxy to estimate the economic activities of an area, we also employ the nighttime lights which are calculated from weather satellite recordings and made available by the US National Oceanic and Atmospheric Administration (NOAA) as an annual time series in order to test the effectiveness of China's aid in Africa.

The data on China's aid projects is obtained from georeferenced project-level data of AidData's Chinese Official Finance to Africa dataset, introduced by Strange et al. (2015) and geocoded by Dreher et al. (2016). Compared with the traditional Western donors, it is not easy to gain access to the official financial data or information related to China's international economic activities which is released by Chinese government. Therefore, this limitation generated by data non-transparency can directly affect the results of research on China's foreign economic engagement, as well as cannot appropriately disclose the characteristics and global impact of this giant economy. There is no doubt that the information and data from AidData dataset can enhance the understanding of China's economic involvement in global financial market. As AidData dataset is collected and extracted from public media outlets, which is not a perfect substitute for official information from Chinese government, we, therefore, only employ whether, where and when a project was implements in order to avoid the usage of potentially sensitive and less reliable information. Even though dataset from AidData was relatively new compared with dataset from World Bank or IMF where also show macro-level data on economic activities, a large variety of publications have used it to support the in-depth investigation on China's international influence. For instance, Isaksson and Kotsadam (2018a) indicate that more widespread local corruption experience around active Chinese project sites. Dreher et al. (2015) illustrate the relationship between the political leaders' birthplaces and China's aid flows in the African regions.

In addition to the improvement of transparency of China's economic data, dataset from AidData also allows researchers to use the latitude and longitude coordinates and information about the precision of the location identified (Dreher et al., 2016). For instance, some locations of Chinese development projects can be identified as a village or a city, others can be considered as a

state or greater administrative region. Although AidData mentions eight degree of precision of a specified location of Chinese development project, we only focus on projects with recorded locations coded as corresponding to an exact location or as “near”, in the “area” of, or up to 25km away from an exact location (precision code 1 and 2 in Strandow et al., 2011).

Measuring corruption in a valid and reliable manner is not easy and there is always certain bias even though we employ the existing measures. Therefore, Knutsen et al. (2016) put forward a quite different measures of corruptions from local surveys where the respondents of surveys are geocoded. Compared with traditional measures of corruption at country level, Afrobarometer surveys includes several questions on the perception of local corruption, and on whether respondents have actually paid bribes over the last years. Obviously, perceptions could be considered as a better proxy for actual corruption when pertaining to local-level corruption is closer to respondents’ daily lives than national level corruption, as the first-hand knowledge could be collected from respondents.

We mainly take account of two Afrobarometer questions on the perceptions of local corruption: Respondents are asked if they have paid a bribe for “a document or permit” or “for avoiding problems with the police” and they can answer “Never”, “Once or Twice”, “A Few Times”, “Often” or “No experience with this in past years”. Hence, two variables are generated in our research, that is, *bribe to police* and *bribe for permit*, by coding those that have paid a bribe, but not in past years, and those who never paid a bribe as 0. Other categories ranging from 1 to 3 stands for “Once or Twice” to “Often”. Also, dummy variables are also considered where categories 1-3 are collapsed.

As shown in our Table 1, it can be found that 75% of observations, after sample restrictions, have experienced a bribe for a permit, and that 77% of observations have experienced a bribe to police.

Table 1: Descriptive statistics

	N	Mean	SD
Main outcome variables			
Log of nighttime light intensity	120,875	-0.152	2.69

Aid variables			
Ongoing25	145,745	0.17	0.38
Future25	145,745	0.02	0.17
Corruption variables			
Permit corruption dummy	145,745	0.75	0.43
Police corruption dummy	145,745	0.77	0.42
Control Variables			
Electricity (cluster-level percentage)	145,745	60.13	45.98
Employment (cluster-level percentage)	145,745	35.86	25.01
Wealth index (cluster-level percentage)	145,745	18.04	19.30

Notes: Variable descriptions are provided in Table A1.

Apart from the perceptions of local corruption from the respondents of surveys, Afrobarometer also geolocates the respondents. Therefore, we can use the point coordinates in aid data to link aid projects to local survey respondents in the Afrobarometer. The coordinates of the surveyed Afrobarometer clusters (consisting of several geographically close villages or a neighbourhood in an urban area) are used to match individuals to aid project site for which we have precise point coordinates. We measure the distance from the cluster center points to the aid project sites and identify the clusters located within a cut-off distance of at least one project site.

As one of our research objectives is to examine the effectiveness of China's aid in African continent, it is necessary to consider a spatial and reliable dataset which can reflect the economic activities in African clusters. Therefore, we employ nighttime lights, emitted from residential, industrial, commercial and entertainment areas and captured by satellites, to measure the economic activities in the African clusters.

Since the end of the 1990s, nighttime light data have been used to monitor population concentrations and to assess the economic performance of countries and regions (Doll et al., 2006; Dreher and Lohmann, 2015). The

reason is that nighttime light data are indeed a very promising tool to catch the patterns of human activities remotely. Specifically, these data are nowadays available for each day and each point on the Earth, thus being more advantageous than traditional estimates, which might be scarce and irregular (due to time-consuming analysis, as in the case of defining the commuting rates), non-unified (due to different national reporting standards), or confidential (due to security reasons or illegality, as in the case of shadow economies) (Li et al., 2015; Henderson et al., 2012). Applied researchers typically use nighttime lights as a reliable proxy for economic activities when official statistics or data at the small geographical scales are not available (Keola et al., 2015).

The nighttime light obtained from the National Oceanic and Atmospheric Administration (NOAA, 2018) and the nighttime light images obtained with the OLS of the Defense Meteorological Satellite Program (DMSP) from 2000 to 2012 were used in this study. The satellite altitude of DMSP is approximately 830 km, its swath is 3000 km, and its revisit cycle is approximately 101 min, and the satellite can orbit the earth 14 times per day and obtain four global coverage maps. DMSP OLS can be used to detect city lighting, auroras, lightning, fishing, fire, etc. The NOAA provides three types of nighttime light data. Therefore, studies of this kind have been increasing in an avalanche-like manner, and with nighttime lights being used as a proxy for even more sophisticated things. For instance, Chang et al. (2022) analyzes the relationship between Chinese tourism economy and nighttime light by employing the evidence from 31 Chinese provinces. They indicate that the concentration degree of nighttime light could appropriately reflect the distribution area of Chinese tourism. In other words, the higher the nighttime light density, the more developed the tourism economy is in a Chinese province. Also, Weidmann and Theunissen (2021) use the nighttime light time recorded by satellite to investigate the local inequality. Therefore, given that most of official statistics of the African continent is of poor quality, the employment of nighttime light, clearly, allows us to be more insightful for the comprehensive and systematic variation in a subnational unit.

3.2 Connecting China's Aid Projects with Survey Respondents and Nighttime Light Data

As AidData dataset provides the geocoded information of China's aid projects in Africa and Afrobarometer surveys enable us to geo-locate the African clusters, we can link them based on spatial proximity, employing point coordinates of Afrobarometer clusters – that is, one or several geographically villages or urban neighborhood – to match cluster-level variables to China's aid projects. Totally, AidData dataset identifies 503 China's aid projects in 30 African countries, and the baseline analysis draws on four Afrobarometer survey waves (wave 2-5) conducted in 33 African countries. Through using point coordinates, we geo-match China's aid projects to the African clusters where respondents are living at the time of survey. From a cluster center point, we measure its distance to China's aid project sites and identify the clusters located within a cut-off distance of at least one project site. Then we register if ≥ 1 China's aid project exists within 25 kilometers (km). The indicator variable *Ongoing25* captures whether ≥ 1 ongoing aid project lies within the cut-off distance. If not, we code individuals as *Future25* if ≥ 1 future aid project will be implemented in the area. Thus, we get the location information of 11433 Afrobarometer clusters in our subsequent empirical analysis. Table 1 also shows that 17% of sample within 25km of an African cluster are ongoing Chinese aid projects at the time of survey and 2% of samples are within 25km of an ongoing project, without having any active projects in the same area.

Similarly, nighttime light dataset also shows the georeferenced information of our African sampling units. Point coordinates associated with nighttime light emissions can be also used to geo-match with China's aid projects in order to estimate the effectiveness of China's aid in Africa, so as to further estimate the impact of local corruption on China's aid effectiveness. Eventually, we obtain the average cluster-level of nighttime light emission intensity, which can be seen as a reliable proxy for economic activities in our sampling units. As a result, these three spatial datasets from different sources are geo-matched and employed to test our hypotheses.

3.3 Estimation Strategy

There are challenges with investigating the causal effect of local corruption on China's aid effectiveness, as the characteristics of African subnational units are also likely to affect the distribution of economic engagement in Africa. As per our research on the impact of local corruption, pre-existing local corruption levels, and other factors correlated to corruption (such as population density, infrastructure access) are likely to influence projects' location selection. For instance, more corrupted areas are more likely to be selected by donors who may get used to engage in corrupt activities. Therefore, certain existing research on corruption in Africa assumes ex-ante that there is no relationship between project localization and the pre-existing institutional characteristics of project sites (Isaksson and Kotsadam, 2018a; Isaksson and Kotsadam, 2018b).

On the basis of the empirical strategies mentioned by Knutsen et al. (2016), we also employ a spatial-temporal estimation strategy in order to address the identification issues mentioned above. Specifically, we compare the corruption experiences of survey respondents living near sites where a development project is currently under implementation and those of respondents instead living near sites where a project will be opened but where implementation had not yet initiated at the time the Afrobarometer surveys covered that particular areas.

On the account of the fact that Afrobarometer surveys show different localities at different points in time and that we can know at what points in time and in localities aid project has been initiated through the information released by AidData, we are allowed to identify respondents living in areas where a project was ongoing at the time of survey and compare them with respondents living in areas where we know that a project will start, but where implementation had yet to begin at the time of survey.

Similarly, we also know at what points in time and in localities nighttime light density has been captured by NOAA, this, further allows us to identify economic activities in areas where are within a cut-off distance from the center point of an African cluster, so as to estimate how China's aid projects affect the economic activities in this cluster.

Assuming that corruption is both affected by a cut-off distance, our main estimation strategy includes three groups of individuals, namely those, 1) within 25km of at least one active project site (*ongoing*), 2) within 25km of a site where a project will start, but where implementation was yet to begin at the survey date and not close to any active projects (*future*), and 3) >25km from any project sites. Regarding our first research hypothesis which is to estimate how China's aid projects affect economic activities, we employ the similar estimation strategy to calculate the average nighttime light density within a cut-off distance from the center point of an African cluster which is identified based on the georeferenced information from Afrobarometer surveys. Then, nighttime light density can be geo-matched with China's aid projects within the same cut-off, so as to test our research hypotheses.

As per our first research Hypothesis which is to estimate the effectiveness of China's aid on economic activities in Africa, our baseline regression could be:

$$\begin{aligned}
 \ln mean_light_{c,t} &= a_1 * ongoing_{c,t} + a_2 * future_{c,t} + \beta_1 * Control_{c,t} + \gamma_t + \delta_c \\
 &+ \varepsilon_{c,t} \quad (1)
 \end{aligned}$$

Where $\ln mean_light_{c,t}$ stands for economic activities, which is measured by using nighttime light density, in cluster c in year t , $ongoing_{c,t}$ refers to a dummy variable capturing whether there is at least one ongoing project site within 25km of the African cluster c in year t , and $future_{c,t}$ is a dummy variable for where a project within our cut-off distance will start, but where implementation was yet to begin at the survey date. Using these two different variables can enhance our assumption that China's aid project localization is uncorrelated with institutional characteristics before projects start. This regression also includes cluster-fixed effect (δ_c) and year-fixed effect (γ_t) in order to control for variation across time and space. To control for cluster variation in economic activities, we include several cluster-level control variables from Afrobarometer surveys. For instance, we control for whether the African cluster is in a rural or urban area ($urban_{c,t}$), the average percentage of electricity access in our sampling clusters ($pc_electricity_{c,t}$), the average wealth index in our sampling units ($pc_wealthindex_{c,t}$) and the average employment rate in the African cluster, which is calculated based on questions mentioned in Afrobarometer surveys

$(pc_employment_{c,t})$. To account for correlated errors, the standard errors are clustered at the geographical clusters (i.e., at the enumeration areas which correspond to either a village, a town, or a neighborhood).

Therefore, this regression can provide test results for the difference between *ongoing* and *future* ($\alpha_1 - \alpha_2$), obtaining a difference-in-difference measure that controls for unobservable characteristics influencing economic activities in our sampling units.

Our 25km cut-off distance is admittedly, but it seems appropriate considering practical commuting distances in the African context. Smaller cut-off distances quickly decrease the sample of inactive aid projects, making it harder to identify effects. A too large cut-off distance means that we should include too many samples in our treatment clusters, which is more likely to pull down the coefficient of our interest ($\alpha_1 - \alpha_2$). And this coefficient is expected to be positive and significant.

Being interested in whether local corruption could reduce China's aid effectiveness in Africa, it is expected to insert a corruption variable into our baseline regression (that is regression (1)) in order to investigate the changes of China's aid effectiveness. Therefore, our equation 2 for Hypothesis 2 could be shown:

$$\ln mean_light_{c,t} = a'_1 * ongoing_{c,t} + a'_2 * future_{c,t} + c * corrupt_{c,t} + \beta_1 * Control_{c,t} + \gamma_t + \delta_c + \varepsilon_{c,t} \quad (2)$$

Where we include $corrupt_{c,t}$ into our baseline regression, which stands for corruption measure outcome for cluster c in year t . This equation aims to test the changes in Chinese aid effectiveness after considering the variable of local corruption. So, we need to compare $(\alpha_1 - \alpha_2)$ and $(\alpha'_1 - \alpha'_2)$. What we expect is that $(\alpha'_1 - \alpha'_2)$ is less than $(\alpha_1 - \alpha_2)$, implying that local corruption will reduce Chinese aid effectiveness in Africa.

As per the perceptions of corruption collected from Afrobarometer surveys, it is necessary to organize the individual data into the cluster-level data which can reflect the average corruption situation in our sampling units. As we have

mentioned above about the data sources, there are two relevant questions that we can use to measure corruption perceptions from Afrobarometer surveys, and dummy variables are generated based on respondents' corruption experiences. Hence, the individual-level perceptions could be clustered at the geographical clusters. Then, we geo-match the cluster-level corruption outcomes with China's aid projects by using point coordinates, so as to test whether local corruption could decrease the effectiveness of China's aid in Africa.

In order to more properly estimate the impacts of local corruption on China's effectiveness, it is also essential to test whether the impacts are consistent across the African clusters. Thus, we create and insert an interaction term between local corruption outcome and China's aid projects in our baseline equation. In other words, this interaction term can indicate whether China's aid effectiveness varies across the African clusters with different corruption level.

Therefore, our new equation with the interaction term could be formulated as follows:

$$\ln\text{mean_light}_{c,t} = a''_1 * \text{ongoing}_{c,t} + a''_2 * \text{future}_{c,t} + c' * \text{corrupt}_{c,t} + d_1 * (\text{corrupt}_{c,t} * \text{ongoing}_{c,t}) + d_2 * (\text{corrupt}_{c,t} * \text{future}_{c,t}) + \beta_1 * \text{Control}_{c,t} + \gamma_t + \delta_c + \varepsilon_{c,t} \quad (3)$$

Regarding this equation, what we expect is that the clusters with high corruption will experience a more obvious changes in aid effectiveness compared with clusters with low corruption.

Our coefficient of interest is $(d_1 - d_2)$ which implies the difference of aid effectiveness between clusters with high corruption level and ones with low corruption level. We expect that the $(d_1 - d_2)$ is positive and significant, which can imply that compared with the less corrupted clusters, Chinese aid projects are more effective in clusters with high level of local corruption.

4 Results

4.1 Main Results: benchmark estimations

The results indicate that Chinese aid projects can fuel economic activities in African continent, and that local corruption is more likely to positively correlate China's aid projects. Table 2 presents the results of our baseline regressions, focusing on corruption experiences when dealing with the police (variable *dummy_policecorrupt*) and when applying for documents and permits (variable *dummy_permitcorrupt*), including the baseline cluster controls, year fixed effect and subnational region dummies. Column 1 and Column 2 show the results related to our hypothesis 1 which is to estimate the effectiveness of Chinese aid projects in Africa by using nighttime light emission as the main outcome variable. Considering two common corruption experiences in our sampling units, Column 3 and Column 4 show the empirical estimation which uses permit-related behaviours to measure local corruption in African clusters. Corruption experiences dealing with the police are considered as an estimation of local corruption in Column 5 and Column 6. Thus, both of them can show how local corruption affects the effectiveness of China's aid projects in Africa. Noteworthy, Column 4 and Column 6 also show the variation of impacts of local corruption in our sampling units because of the involvement of interaction term between China's aid projects and corruption variables.

Compared with Column 1, we consider the cluster controls in Column 2, namely, the cluster-level percentage of employment, the cluster-level percentage of electricity access, urban and the cluster-level wealth index. It is clear to find an obvious effectiveness of China's aid projects in our sampling units, when using nighttime light emission as the proxy of local economic activities. Looking at the coefficients on *Ongoing25*, we can note that clusters with more active China's aid projects which are currently being implemented, indeed associated with a greater probability of having more dynamic economic activities. More specifically, the implementation of China's aid projects is predicted to increase the local economic activities with 0.172, based on our empirical results in Column 2.

As noted, however, interpreting the coefficient on ongoing China's aid projects in isolating as capturing an effect of Chinese development projects requires that the location of Chinese development projects is not correlated with pre-existing features, an assumption which we do not deem plausible. In order to account for the likely endogenous placement of projects, we instead compare the experience with economic activities and local corruption in areas where Chinese aid projects in their vicinity were under implementation at the time of survey (*ongoing*) with those where Chinese aid projects will take place but were yet initiated to be implemented at the time of survey (*future*).

Looking at the coefficients on *future* Chinese projects (that is *Future25*), we can note that similar to areas with *ongoing* Chinese aid projects in their vicinity, we here can also see a positive impact of *future* Chinese development projects on local economic activities. However, this positive influence is much smaller as what our Column 2 indicates. As it turns out, the difference -in-difference estimates ($\overline{a_1 - a_2}$) and associated test results presented in the bottom section of Table 2 clearly indicate more significant effectiveness of ongoing Chinese development projects compared with inactive Chinese project sites.

Therefore, based on the baseline results indicated by Column 1 and Column 2, there is evidence that Chinese aid projects can booster local economic activities in our sampling unites, regardless of whether Chinese development projects are under implementation or not yet. But active or ongoing Chinese development projects exert more significant effectiveness on local economic activities compared with inactive or future ones which were not initiated to be implemented at the time of Afrobarometer surveys.

Our Hypothesis 2 is to estimate how local corruption affects Chinese aid effectiveness by using the cluster-level corruption perception collected by four Afrobarometer survey waves. As there are two questions related to corruption experiences of survey respondents, we mainly employ these two questions on experiences with bribes as the variable to measure local corruption, that is, bribe to get a permit or document (*dummy_permitcorrupt*) and bribe to police (*dummy_policecorrupt*). Similarly, in order to reduce the impact of pre-existing features of our sampling units on our test results, we keep comparing the experiences with corruption in areas where a Chinese development project

(ongoing) is under implementation with those in areas where a Chinese development project *(future)* is not yet initiated to be implemented at the time of Afrobarometer surveys. Column 3 and Column 4 present the estimation results which employ permit corruption as the proxy for local corruption in African clusters. Column 5 and Column 6 indicates the estimation results using corruption experiences dealing with police.

Surprisingly, the results of these Columns all present a significant effectiveness of Chinese aid projects in our sampling units. In other words, our regressions indicate that China's aid effectiveness is relatively obvious and significant in African clusters, although corruption is quietly pervasive in these clusters. Thus, it can be said that local corruption is more likely to do not exert a negative influence on Chinese aid effectiveness in the African continent. Meanwhile, looking at the coefficient on ongoing development projects in Column 3, it can be noted that the implementation of Chinese ongoing aid projects is expected to increase local economic development with 0.175 in our sampling units when considering corruption experiences dealing with getting a permit. Regarding the clusters with future Chinese development projects in their vicinity, the coefficient is much smaller, with a 0.152 percentage points when we consider corruption experiences with bribes for permit to measure local corruption in our sampling units.

Furthermore, we do not also find a negative impact of local corruption on the effectiveness of China's aid projects when considering corruption experiences dealing with police in Column 5 and Column 6. Based on the coefficient in these two Columns, the implementation of China's aid projects is predicted to increase local economic development with 0.149. In particular, the coefficient of corruption variable also indicates that local corruption in African clusters does not negatively affect the local economic development. Surprisingly, our general estimation results in Table 2 reject our expectation.

Our positive coefficients on local corruption demonstrates that corruption does not always exert a negative impact on local economies, although it is clear that corruption is likely to increase certain business costs for international businesses. However, regarding developing countries with the pervasive corruption and poor governance, certain corruptions could shorten the time

required for the international projects, as corruption gives an opportunity for project staff to pay a bribe, give a gift, or do a favour to local government officials in order to get a permit or document for their projects. Especially, based on reports related to global corruption from World Bank, China is also an economy with high corruption level. In other words, active Chinese development project sites are more likely to become more accepting of corruption happened in African countries. Isaksson and Kotsadam (2018a) also use China's no-interference policy to explain the correlation between China's development projects and local corruption. They indicate that this no-interference policy means that Chinese government and project leaders are unlikely to affect prescriptive norms in a direction delegitimizing corruption, and their alleged use of corrupt practices in recipient countries risk affecting descriptive norms in a way which legitimizes corruption. Therefore, local corruption may, to some extent, not affect the effectiveness of Chinese aid projects in African clusters. Also, in a sense, local corruption can promote local economic activities.

Looking at our difference-in-difference estimates ($\overline{a'_1 - a'_2}$) after considering local corruption, it is also clearly indicated that clusters with ongoing Chinese development projects enjoys a more significantly improvement in their economic activities compared with those with future Chinese development projects. Although local corruption is pervasive in some African clusters, these bribe behaviors, to some extent, could be conducive to their local economy.

As per our hypothesis 2, we should also analyze the variation among African clusters with different corruption level. We hypothesize that more corrupted clusters enjoy a more significant effectiveness of Chinese development projects. In other words, we intend to test whether Chinese aid projects are more likely to fuel economic activities to a greater extent in more corrupted clusters, compared with less corrupted clusters in Africa. In order to test this hypothesis, we create an interaction term between Chinese aid projects and local corruption which is also measured by two corruption experiences collected by Afrobarometer surveys.

Similarly, the effectiveness of Chinese aid projects is still discovered in our Column 4 and Column 6 which include the interaction term between China's aid projects and corruption-related variable. The coefficient on ongoing Chinese

development projects keeps indicating that Chinese development projects are conducive to economic activities in the African clusters. Looking at the coefficients on the interaction term of ongoing Chinese development projects, we can note that in African clusters with high corruption level, China's aid projects are more effective compared with the less corrupted clusters. When considering corruption activities dealing with a permit as a proxy of local corruption, it can be found that the more corrupted clusters are expected to enjoy a more effective aid projects of China with 0.486. As per bribes to police, its positive and significant coefficient on the interaction terms also confirms this variation among African clusters with different corruption level.

Also, it is required that the location of Chinese development projects should be no-correlated to pre-existing features of African clusters. In order to satisfy this requirement and possible endogenous issues, we also generate an interaction term between future Chinese development projects and corruption experiences, and then compare it with the interaction of ongoing projects in African clusters we examine.

As it turns out, the difference-in-difference estimated $\overline{(d_1 - d_2)}$ and associated test results presented in the bottom of our Table 2 clearly indicate more effective Chinese aid projects in clusters with high corruption level compared with those in less corrupted clusters, when using bribes to permit to measure local corruption in our sampling units. For bribes to police, the equivalent difference is 10.5 percentage points. In both cases, the parameter differences are clearly statistically as well as economically significant.

Table 2: Chinese aid, economic activities and local corruption

VARIABLES	(1) Equation 1:	(2) Equation 1:	(3) Equation 2: Permit corruption	(4) Equation 3: Interaction term	(5) Equation 2: Police corruption	(6) Equation 3: Interaction term
Ongoing25	0.373*** (0.005)	0.322 *** (0.005)	0.327*** (0.005)	0.297*** (0.019)	0.330*** (0.021)	0.341*** (0.021)
Future25	0.178*** (0.004)	0.151*** (0.004)	0.152*** (0.004)	0.170*** (0.007)	0.181** (0.015)	0.185*** (0.021)
Permit corruption			0.006*** (0.000)	0.133*** (0.016)		
Police corruption					0.007** (0.000)	0.010*** (0.015)
Permit corruption*ongoing25				0.050*** (0.025)		
Permit corruption*future25				-0.044*** (0.022)		
Police corruption*ongoing25						0.052*** (0.032)
Police corruption*future25						-0.057** (0.018)
Difference	0.195	0.172	0.175	0.094	0.149	0.109
F test: ongoing25-future25=0	730.6	372.6	423.7		339.8	
F test: interaction term = 0				0		14.66
p value	0	0	0	0	0	0
Baseline controls	NO	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES
Region FE	NO	YES	YES	YES	YES	YES
Observations	120,875	70,573	70,573	56,153	70,573	63,757
R-squared	0.097	0.764	0.777	0.778	0.766	0.767

Notes: the baseline controls are employment, electricity access, urban and wealth index for African clusters. The “difference in difference” results give the difference between active and inactive areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.2 Robustness Check

We consider possible effects of project timing. While the year dummies included in all regressions will control for general time trends in corruption, a potential concern would be if local corruption perception changes over time and there are timing effects relating specifically to the evaluation of the impact of local corruption on the effectiveness of Chinese aid. In particular, the changes in local corruption level will further affect our estimates of how China's aid effectiveness varies across African clusters with different corruption level.

To test whether our results are affected by project timing, Column 1-6 of our Table 3 present the results of our baseline regressions focusing on subsamples containing the corruption information from the first survey in our sampling units. It can be noted that our results are remarkably stable and robust. In other words, the effect of local corruption on China's aid effectiveness is not affected by the changes in local corruption. Also, our estimation results shown in Table 2 confirm the effectiveness of China's aid projects, as well as that local corruption does not exert a negative impact on the effectiveness of China's aid projects in African clusters. Moreover, the employment of interaction terms between China's aid projects and local corruption also confirms the variation of impacts of local corruption across African clusters with different corruption level. Although some researchers find that Chinese economic engagement is centered on areas with poor governance, this robust test indicates that the effectiveness of China's aid projects is not driven by the changes of characteristics of sites selected by China's aid projects. Once a Chinese development project begin to be initiated, it will keep enhancing local economic activities in African continent.

Furthermore, we also test whether altering cut-off distances from center point of African clusters changes our results. In our baseline regressions, 25km cut-off distance is considered as this distance can be considered as practical commuting distances in the African context. However, it is still necessary to test whether our results are affected if we use a different cut-off distance. Hence, we further use 50 cut-off distance to test this potential concern (See Table 4). It is noted that using 50km cut-off distances still indicate the significant

effectiveness of Chinese aid projects and that local corruption do not negatively affect the effectiveness of Chinese aid projects in African continents. Also, 50km cut-off distances also illustrate the differentiation among African clusters with different cluster level, that is, Chinese aid projects exert a more effective influence on local economic activities in more corrupted African clusters compared with less corrupted African clusters. In terms of the difference of effectiveness between ongoing and future Chinese development projects, our Table 4 also shows they are in line with the results of our baseline regression, with statistical and economic significance.

Then, we restrict our sampling units which can be considered as urban instead of rural areas, as it is often suggested that Chinese aid projects are likely to be tied to natural resources extraction where is more serious in rural areas than urban areas. While recent studies actually find no support for this claim at the national levels, we intend to investigate whether the nature of African clusters is an important factor influencing the effectiveness of China's aid projects. Using a dummy variable to identify whether our subnational clusters are urban and rural, our results in Appendix Table A2 also show that both African rural and urban areas can enjoy the improvement in local economic activities resulting from China's aid projects. Although only bribe to permit is considered to measure local corruption in our sampling units, our results of Column 3 and Column 4 in Table A2 is also in line with the results of our baseline regressions. In other words, the impact of local corruption on China's aid effectiveness is not affected whether our sampling unit are urban or rural in Africa.

Moreover, considering that NOAA has started to employ a new satellite to record nighttime lights since 2012, it is necessary to ensure that the time range of our three datasets are consistent. Regarding the fourth Afrobarometer survey wave, it was collected from 2013 to 2014. It means that we have to exclude this survey wave to further test our baseline regressions. Our results of Table A3 shows that elimination of Afrobarometer survey wave 4 does not affect the results of our baseline regression, the effectiveness of Chinese aid projects and the impact of local corruption on Chinese aid projects' effectiveness.

Table 3: Chinese aid and local corruption timing effects

VARIABLES	(1) Equation 1:	(2) Equation 1:	(3) Equation 2: Permit corruption	(4) Equation 3: Permit corruption	(5) Equation 2: Police corruption	(6) Equation 3: Police corruption
Ongoing25	0.373*** (0.005)	0.322*** (0.005)	0.321*** (0.005)	0.285*** (0.009)	0.324*** (0.005)	0.294*** (0.008)
Future25	0.178*** (0.004)	0.151*** (0.004)	0.149*** (0.004)	0.172*** (0.007)	0.149*** (0.004)	0.178*** (0.007)
Permit corruption in year1			0.005*** (0.000)	0.005*** (0.001)		
Police corruption in year 1					0.006*** (0.000)	
Permit corruption*ongoing25				0.050*** (0.009)		
Permit corruption*future25				-0.035*** (0.008)		
policecorrupt_year1						0.006*** (0.000)
Police corruption*ongoing25						0.042*** (0.008)
Police corruption*future25						-0.043*** (0.007)
Observations	120,875	70,573	70,573	70,573	70,573	70,573
R-squared	0.097	0.745	0.746	0.746	0.746	0.746
Baseline controls	NO	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES
Region FE	NO	YES	YES	YES	YES	YES
Difference	0.195	0.172	0.172		0.175	
F test: ongoing25-future25=0	608.5	472.6	476.2		489.5	
p value	0	0	0		0	

Notes: the baseline controls are employment, electricity access, urban and wealth index for African clusters. The “difference in difference” results give the difference between active and inactive areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.

Table 4: Chinese aid projects and local corruption within 50 cut-off distances

VARIABLES	(1) Equation 1:	(2) Equation 1:	(3) Equation 2: Permit corruption	(4) Equation 3: Permit corruption	(5) Equation 2: Police corruption	(6) Equation 3: Police corruption
Ongoing50	0.210*** (0.003)	0.213*** (0.003)	0.213*** (0.003)	0.214*** (0.003)	0.206*** (0.004)	0.195*** (0.004)
Future50	0.127*** (0.003)	0.155*** (0.003)	0.154*** (0.003)	0.154*** (0.003)	0.164*** (0.004)	0.177*** (0.005)
Permit corruption			0.004*** (0.000)	0.001 (0.001)		
Permit corruption*ongoing25				0.016*** (0.005)		
Permit corruption*future25				-0.024*** (0.005)		
Police corruption					0.005*** (0.000)	0.001 (0.000)
Police corruption*ongoing25						0.043*** (0.005)
Police corruption*future25						-0.045*** (0.005)
Observations	166,366	96,165	96,165	96,165	96,165	96,165
R-squared	0.061	0.753	0.753	0.753	0.754	0.754
Baseline controls	NO	YES	YES	YES	YES	YES
Year Fixed effects	NO	YES	YES	YES	YES	YES
Region Fixed effects	NO	YES	YES	YES	YES	YES
Difference	0.0832	0.0586	0.0588	0.0601		
F test: ongoing50-future50=0	277.2	115.7	116.6	121.9		
p value	0	0	0	0		

Notes: the baseline controls are employment, electricity access, urban and wealth index for African clusters. The “difference in difference” results give the difference between active and inactive areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, **

5.0 Conclusion

Considering China's increasing influence in Africa and the mounting critics concerning Chinese aid practices, this paper aims to analyze whether Chinese aid projects can stimulate local economic activities by using subnational data in the African countries. Also taking into consideration the pervasiveness of local corruption in African countries, it is necessary to use subnational data to further test whether local corruption can negatively affect the effectiveness of China's aid projects. Our research differs from most studies in the literature on foreign aid by investigating the impact of local corruption on the effectiveness of development projects in a large multi-state samples, focusing on the corruption experiences which are closely related to daily life of residents of African countries rather than the estimates of national level corruption and foreign aid from government departments.

To investigate the empirical validity of this claim, we geographically match a new georeferenced dataset on the subnational location of Chinese aid projects to Africa over the period 2000 - 2014 with respondents from four Afrobarometer survey waves across 29 African countries. In order to test the effectiveness of Chinese aid projects, we further use point coordinates to geo-match subnational-level dataset on nighttime lights (a reliable proxy for economic activities) with Chinese aid projects. By comparing the corruption experiences of clusters with several ongoing Chinese development projects in their vicinity to those with future Chinese projects which were not initiated to be implemented at the time of survey, we are able to control certain unobservable features of African clusters which may affect our test of the effectiveness of Chinese aid projects.

Our results consistently indicate that Chinese aid projects have a significant and effective influence on local economic activities in the African clusters as Chinese aid projects promote the development of local infrastructure, communication or manufacturing. Considering the difference between ongoing and future Chinese development projects, our results clearly indicate that more significant effectiveness of ongoing Chinese development projects compared with inactive Chinese project sites.

Then, we test the impact of local corruption on the effectiveness of Chinese aid projects by using two questions on corruption experience collected by four Afrobarometer survey waves. It is surprising that local corruption does not negatively affect the effectiveness of Chinese aid projects in our African sampling units. Also, local corruption, to some extent, is conducive to the development of local economies in Africa. China's no-interference policies and the domestic corruption issues in China may explain these unexpected results, implying that it would be much easier and more accepting for Chinese project leaders to use bribes to carry on their projects in Africa with pervasive corruption. And these accepting bribes can shorten times with governments and local authorities which are required to get a permit or documents, so as to booster the increase in economic activities in African clusters.

In order to further investigate where the effectiveness of Chinese aid projects varies across African clusters with different corruption level, we classified the African clusters into two samples, based on the cluster level percentages of whether respondents had experience bribes past years. Using the interaction terms to further test our Hypothesis 2, our results indicated that Chinese aid projects exert a more effective influence on local economic activities in African clusters with high corruption level in comparison to less corrupted African clusters.

There is no doubt that our test results can yield more valuable insights into Chinese aid projects and reduce the limitations resulted from the lack of detailed financial information of Chinese aid, as some new subnational and georeferenced datasets were employed in our research. Also, to the author's knowledge, there is few empirical studies which link local corruption to the effectiveness of Chinese aid projects and test the variation of the impact of local corruption on China's aid effectiveness across African countries. Obviously, using subnational and spatial dataset can further reveal the impact of Chinese aid effectiveness and more appropriately explain Chinese aid projects in Africa where corruption is pervasive and natural resources extraction is the main objective for most international projects. Regarding relevant criticisms concerning Chinese aid projects, our research verifies the promoting effect of Chinese aid projects in Africa and no negative correlation between local

corruption and the effectiveness of Chinese development project. Clearly, a more in-depth sights into Chinese aid projects and local corruption in Africa can be acquired from this research.

In terms of further research, as we use georeferenced data over the period 2000 to 2014, it is interesting to test whether our results will be consistent by using the new Afrobarometer survey wave. Also, further research is needed on how other local features, such as the institutional quality or the changes in political leaders, affects the effectiveness of Chinese aid projects in Africa. Similarly, spatial and subnational dataset is needed to consider to further research on Africa and Chinese aid practices.

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Table A1: Variable descriptions

Dependent Variable: Nighttime Light as the Dependent Variable

$\ln\overline{mean_light}_{v,t}$: Considering some of African clusters contain nighttime light with Digital Number (DN) of 0, we take the log of the average DN of nighttime light plus 0.01 within a spatial unit for the year in which the respective Afrobarometer survey was carried out as our main analysis. The spatial unit is the cluster formed based on the geocoded data from the Afrobarometer survey.

Explanatory Variables for Chinese Aid Projects in Africa

$\overline{ongoing25}_{v,t}$: a dummy variable, 1 if Chinese aid projects are being implemented at the time of the interview, as well as which are less than 25km from a cluster.

$\overline{future25}_{v,t}$: a dummy variable, 1 if Chinese aid projects the implementation of the project has not yet started at the time of the Afrobarometer survey interview, as well as which are less than 25km from a cluster.

$\overline{ongoing50}_{v,t}$: a dummy variable, 1 if Chinese aid projects are being implemented at the time of the interview, as well as which are less than 50km from a cluster.

$\overline{future50}_{v,t}$: a dummy variable, 1 if Chinese aid projects the implementation of the project has not yet started at the time of the Afrobarometer survey interview, as well as which are less than 50km from a cluster.

Explanatory Variables for Local Corruption in Africa

$\overline{pc_permitcorrupt}_{v,t}$: the cluster-level percentage of respondents who have experienced the situation, (that is, who have been asked if they have had to pay for a bribe, give a gift, or do a favour to government officials in order to get a document or a permit), at least once over the past year

$\overline{pc_policecorrupt}_{v,t}$: the cluster-level percentage of respondents who have experienced the situation, (that is, who have been asked if they have had to pay for a bribe, give a gift, or do a favour to government officials in order to avoid a problem with the police), at least once over the past year

$\overline{dummy_permitcorrupt}_{v,t}$: dummy variable equal to one if $\overline{pc_permitcorrupt}_{v,t}$ is more than the average percentage of permit-driven corruption, zero otherwise.

$\overline{dummy_policecorrupt}_{v,t}$: dummy variable equal to one if $\overline{pc_policecorrupt}_{v,t}$ is more than the average percentage of police-driven corruption, zero otherwise.

Control Variables

$\overline{pc_employment}_{v,t}$: the cluster-level percentage of respondents who have had a job (either a part-time job or full-time job) at the time of the Afrobarometer survey interview.

$\overline{pc_wealthindex}_{v,t}$: the cluster-level percentage of respondents who have had a motor, a car or a motor vehicle at the time of the Afrobarometer survey interview.

\overline{urban} : dummy variable equal to one if a spatial unit corresponds to an urban area, zero otherwise.

Table A2: Chinese aid effectiveness and local corruption in Africa: Only urban areas

VARIABLES	(1) Equation 1: Chinese aid effectiveness	(2) Equation 1: Chinese aid effectiveness	(3) Equation 2: changes in Chinese aid effectiveness	(4) Equation 3: interaction terms
Ongoing25	0.216*** (0.006)	0.218*** (0.006)	0.219*** (0.006)	0.211*** (0.007)
Future25	0.082*** (0.005)	0.159*** (0.005)	0.159*** (0.005)	0.169*** (0.006)
Permit corruption			0.005*** (0.001)	0.002*** (0.001)
Permit corruption*Ongoing25				0.016** (0.007)
Permit corruption*Future25				- 0.019*** (0.006)
Observations	29,992	29,992	29,992	29,992
R-squared	0.067	0.782	0.783	0.783
Baseline controls	NO	YES	YES	YES
Year FE	NO	YES	YES	YES
Region FE	NO	YES	YES	YES
Difference	0.135	0.0588	0.0601	
F test: ongoing25-future25=0	186.2	44.10	46.15	
p value	0	0	0	

Notes: the baseline controls are employment, electricity access, urban and wealth index for African clusters. The “difference in difference” results give the difference between active and inactive areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Chinese aid effectiveness and local corruption in Africa: 25km and excluding wave 6 survey

VARIABLES	(1) Equation 1: Chinese aid effectiveness	(2) Equation 1: Chinese aid effectiveness	(4) Equation 2: changes in Chinese aid effectiveness	(5) Equation 3: interaction terms
Ongoing25	0.385*** (0.006)	0.322*** (0.005)	0.322*** (0.005)	0.295*** (0.006)
Future25	0.162*** (0.005)	0.151*** (0.004)	0.149*** (0.004)	0.167*** (0.005)
Permit corruption			0.007*** (0.000)	0.003*** (0.001)
Permit corruption*Ongoing25				0.059*** (0.007)
Permit corruption*Future25				- 0.045*** (0.007)
Observations	70,573	70,573	70,573	70,573
R-squared	0.105	0.745	0.746	0.747
Baseline controls	NO	YES	YES	YES
Year FE	NO	YES	YES	YES
Region FE	NO	YES	YES	YES
Difference	0.222	0.172	0.173	
F test: ongoing25-future25=0	511	472.6	482	
p value	0	0	0	

Notes: the baseline controls are employment, electricity access, urban and wealth index for African clusters. The “difference in difference” results give the difference between active and inactive areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Chapter IV:

**The Impact of China's Aid Projects on
Employment in Africa: Evidence from
Georeferenced Data**

Abstract:

Africa has enjoyed nearly two decades of sustained economic growth. However, Africa has been still experiencing the serious unemployment issues. So, some researchers doubt the impact of foreign aid on local employment in Africa. Among them, Chinese aid is the one which has been heatedly debated. In this paper, we intend to investigate the impact of Chinese aid projects on local employment in Africa through employing a new georeferenced dataset on China's aid projects in Africa and a spatial dataset on respondents' working experiences collected by the Afrobarometer surveys. To this end, we use point coordinates to geo-match these two subnational datasets, and thus test whether Chinese aid projects can fuel local employment in our sampling units. Using temporal-spatial estimate, we find that Chinese aid project sites are always associated with more job opportunities for local citizens, and this result is robust to using alternative tests. By comparing ongoing Chinese development projects, future Chinese aid projects are more likely to create more part-time jobs to local workers. But ongoing Chinese development projects play a more significant and positive impact on full-time employment. Furthermore, we use nighttime light intensity as a proxy for local economic activity to test the possible mechanism through which Chinese aid projects affect local employment. It is found that the employment-promoting effect of Chinese projects is driven by the increase in economic activity.

Keywords: Afrobarometer Survey; China's Aid Projects; Point Coordinates; Local Employment

1. Introduction

Africa has been enjoying a remarkable development of its economy. For instance, the income for the African citizens as a whole has been seeing a steady increase. Yet, when looking at the shifts in other economic indicators, there is a surprising fact that the issues of poverty and inequality remains serious in the whole African continent (Asiedu, 2014). In particular, there is a growing concern that Africa's economies are failing to enhance the employment rate (ACET, 2013). Page and Simeles (2015) claim that there is no significant difference between today's African economic situation and that of two last decades. This surprising phenomenon in Africa is in the completely contradiction to the economic development of Asian countries where the living standard of local citizens has enjoyed a significant improvement. However, both African countries and Asian countries has received a great deal of international aid from developed countries which aim to help them enhance their economy and improve the life of their residents. Hence, some researchers doubt the impact of foreign aid and argue that foreign aid is partly responsible for the slow pace of employment growth and poverty reduction on the account of the fact that donor attention over the past decades has not focused on the impact of their international strategies and investment on job growth (Babaloda and Shittu, 2020; Brautigam, 2009; Page and Shimeles, 2015).

The global economic landscape has changed dramatically on account of the fact that the emerging economies have been driving global economic growth. Undoubtedly, new sources of development finance have emerged and the development cooperation arena has seen continued diversification of actors, instruments and impacts. In this process, the dominance of aid from traditional Western donors has been declining, with a sharp increase in development finance from non-Western donors. Definitely, it is crucial to consider this changing environment in order to have a more comprehensive and renewed research on the global financial market. How the new actors influence the global economy and the traditional order of global financial market remains unclear. Therefore, there is a need for current studies on the global financial market. In other words, the role and economic activities of new actors should not be ignorable for the studies within the aid framework.

China is well-known for its principle of non-interference in the domestic affairs of recipient countries – a principle that is officially reiterated in the Chinese government’s 2014 white paper on foreign aid, which explains that “when providing foreign assistance, China adheres to the principles of not imposing any political conditions, not interfering in the internal affairs of the recipient countries and fully respecting their right to independently choose their own paths and models of development” (State Council, 2014). There is no doubt that this principle, to some extent, can protect the sovereignty of the recipient countries (Harry, 2014). For instance, the manufacturing project by China Great wall Computer Shenzhen Co. in Algeria is expected to provide more than 2000 working opportunities to local workers. We can also find similar facts when looking at the cooperation project between Group Mazouz in Alegria and the Chinese Higer. Apart from the creation of jobs, this cooperation project also enables the Algerian company to acquire the advanced technologies related to the production of mini-buses (Africa Development Bank, 2012). But some qualitative researches also suggest Chinese aid may be easily to exploit for politicians or leaders who are engaged in patronage politics, which is more likely to affect the impacts of Chinese aid in African countries (Daniel, 2008). Among them, how Chinese aid affects local employment in Africa is the one that should have been further investigated, as the employment in African countries has not been improved as what the international organizations expect. While China’s “no-interference” principles have received some praises from recipient countries, the employment practices of Chinese companies in Africa have been also obtained a great deal of focuses and debates. Some media and observers doubt the impact of Chinese economic engagement on employment in Africa, on account of the facts that there are a large number of Chinese workers flowing into the African labour markets (Brautigam, 2009; Mahembe, 2021; Morgan, 2019). Through using some surveys, they found thousands of Chinese workers and engineers were imported to build infrastructure projects in Ethiopia, Sudan and other African countries (Tan-Mullins et al, 2010). This makes the acute unemployment problem in Africa even worse. Therefore, they argue that the influx of Chinese workers associated with Chinese projects could be considered as a reason for poor employment level in the African continent.

The improvement in employment level in Africa could not be the consideration behind Chinese economic engagement in Africa. Whereas, the huge influx of Chinese workers would keep worsening the African labor market.

Apart from the concerns about the influx of Chinese workers, some researchers also blame Chinese companies that they usually pay less than other foreign investors. This low wage cannot sustainably improve the living standard of African citizens, as well as cannot secure the working welfare and stability of African workers who have jobs in Chinese project sites (Yang, 2022).

Finally, doubts are raised about Chinese companies' contribution to the development of the continent's human capital. A World Bank research paper states: "Chinese firms tend to rely on their own low-cost labor and do not invest heavily in the training and education of African workers." Southern Africa Resource Watch also stated that "technology transfer to local people is not a feature of most Chinese investment."

However, most of these comments are based on individual experiences or scattered case studies. Systematic research in this area has been scarce. To what extent are these perceptions about Chinese companies' employment practice true? Can we map out a picture of Chinese aid and its impact on local employment in Africa? Further, do Chinese employment patterns contribute to Africa's own development and benefit African workers? Below, this paper begins with investigating the nature of Chinese companies' employment practices in Africa and explores the impacts behind these practices.

In this paper, we investigate whether and to what extent China's aid projects affect local employment in Africa. More specifically, we ask 1) whether the implementation of Chinese development projects gives an increase in local employment in Africa; 2) whether the impact of Chinese development projects of local employment is different between part-time and full-time employment; 3) if so, what drives this difference.

In order to yield more valuable insights into Chinese aid projects and reduce the limitations resulted from the lack of detailed financial information of Chinese aid, a host of empirical studies use a new subnational data material of Chinese aid projects which can be obtained from AidData's Chinese Official Finance to

Africa Dataset introduced by Strange et al (2015). There is no doubt that this geocoded and product-level data of Chinese aid projects has significantly advanced our understanding of the complicated effects of Chinese aid projects in Africa.

To answer our research questions related to Chinese aid effectiveness and local employment in Africa, we also geographically match the subnational data on Chinese aid allocation in Africa with geocoded data on respondents from four Afrobarometer surveys waves across 29 African countries. These Afrobarometer surveys can capture the employment experiences of respondents, which have potentials to extend our understanding of individual working related facts across these African countries. By comparing the employment experiences of individuals who live near a site where a Chinese project is under implementation at the time of survey to those of individuals living near a site where a Chinese project will appear in the future, but where implementation had yet to be initiated, we get a difference-in-difference type of estimates that control for unobservable time-invariant characteristics that may influence the selection of project sites.

Our paper relates to the literature on the impact of foreign aid and employment. Looking at the relationship between foreign aid and employment, some researchers argue that if policy makers in a country and the aid organizations that assist them decide to give priority to expanding the number of jobs for the poor in paid employment, the employment rate is expected to see an increase and the poverty in the recipient countries is expected to be reduced (Kabir, 2020; Gomanee et al, 2005). Hence, it can be noted that foreign aid plays a vital role in the development process of a country (Wamboye et al, 2014; Xu et al, 2020)

Foreign aid job creation is not merely speculation. Theoretically, aid can improve the business environment of recipient countries and enhance the competitiveness of recipient companies, thereby creating more and better jobs. Empirically, Simpasa et al (2015) uses the data of the projects implemented by the African Development Bank during 1990-2010 to test for the difference in the role of aid in job creation in different sectors. They found that projects in the production sector were mainly concentrated for small-scale enterprises industry provides financing and credit, which generates more jobs than programs in

health and education. However, Page and Shimeles (2015) studied It has been found that the share of aid flowing to social services, such as education and health, has increased in recent years, while the share of aid flowing to productive sectors has decreased. But they also found that this shift in the share of aid flowing could not enhance the employment rate effectively. Also, more educated local workers are much easier to be employed by foreign projects on communications, transportation and energy supply which require workers to be familiar with certain skills. Meanwhile, female workers are more likely to employ as some part-time household jobs which are also required for the implementation of projects (Poulsen (2019). Hence, it can be said that the effect of foreign aid on employment is also related to the sectors which are the receivers of foreign aid.

Pages and Shimeles (2015) summarizes the “employment problems” in Africa, and states that Africa is not doing particularly well in creating more jobs for their citizens. The average unemployment in Africa is higher than the global average, even though global organizations and countries has implemented a great deal of aid projects in Africa in order to reduce poverty and other development issues. Hence, the effect of foreign aid in Africa is of great speculation.

We also add to the discussion of how the Chinese economic involvement in Africa influences local labor markets. There have been anecdotal claims that Chinese firms and projects rely largely on Chinese expatriate workers and make little effort to develop local labor skills, which has a detrimental impact on employment in Africa (Adisu et al, 2010; Wegenast et al. 2019). Although it is not easy to obtain the exact number of African employees in Chinese companies due to the lack of official statistics, Tang (2016) uses some reports and surveys to indicate a general trend of the shift in employees in Chinese companies in Africa. His results discredit the belief that Chinese do not hire local workers and Chinese projects rely largely on Chinese workers. But empirical study should be also carried out to test his findings. Obviously, our research can, to some extent, help us to understand the shift in the African labor markets for Chinese companies, as we will split our dataset on employment based on the nature of employment, that is, part-time and full-time employment.

The present paper differs from the existing research in that it studies the local employment effects of a multitude of aid projects in a large multi-country sample, focusing on the effects on citizen experiences with employment around aid project sites rather than estimates of national aid inflows and country-level employment. As such, we contribute to an emerging literature using subnational geocoded aid data to examine the impacts of the allocation of foreign aid within countries and across different regions.

To our knowledge, there is few studies using geocoded and subnational data to estimate the impact of foreign aid on local employment in a wide selection of African recipient countries. Hence, the paper also contributes to an emerging quantitative literature on the effects of China's aid allocation. Considering China's increased presence in Africa and the mounting criticism concerning Chinese aid practices, empirical evidence on the possible employment effects of Chinese development projects is central.

The remainder of this paper is structured as follows. Section 2 describes the related literature on Chinese aid and local employment in Africa. Section 3 illustrates our data and empirical strategy to estimate Chinese aid effectiveness and the impact of local corruption on this effectiveness. In Section 4, we present our empirical findings and discuss various robustness tests. Section 4 summarizes the results and draws conclusions for the long-standing debate on the effectiveness of Chinese aid.

2. Data and Estimation Strategy

2.1 Data Sources

To analyze the impact of China's aid projects on local employment in Africa, we geographically match new spatial data on China's official financial flows to Africa to respondents from 4 Afrobarometer survey waves in 29 African countries over the period 2005-2015.

The data on China's aid projects is obtained from georeferenced project-level data of AidData's Chinese Official Finance to Africa dataset, introduced by Strange et al (2015) and geocoded by Dreher et al (2016). Compared with the traditional Western donors, it is not easy to gain access to the official financial data or information related to China's international economic activities which is released by Chinese government. Therefore, this limitation generated by data non-transparency can directly affect the results of research on China's foreign economic engagement, as well as cannot appropriately disclose the characteristics and global impact of this giant economy. There is no doubt that the information and data from AidData dataset can enhance the understanding of China's economic involvement in global financial market. As AidData dataset is collected and extracted from public media outlets, which is not a perfect substitute for official information from Chinese government, we, therefore, only employ whether, where and when a project was implements in order to avoid the usage of potentially sensitive and less reliable information. Even though dataset from AidData was relatively new compared with dataset from World Bank or IMF where also show macro-level data on economic activities, a large variety of publications have used it to support the in-depth investigation on China's international influence. For instance, Isaksson and Kotsadam (2018a) indicate that more widespread local corruption experience around active Chinese project sites. Dreher et al (2015) illustrate the relationship between the political leaders' birthplaces and China's aid flows in the African regions.

In addition to the improvement of transparency of China's economic data, dataset from AidData also allows researchers to use the latitude and longitude coordinates and information about the precision of the location identified (Dreher et al., 2016). For instance, some locations of Chinese development

projects can be identified as a village or a city, others can be considered as a state or greater administrative region. Although AidData mentions eight degree of precision of a specified location of Chinese development project, we only focus on projects with recorded locations coded as corresponding to an exact location or as “near”, in the “area” of, or up to 25km away from an exact location (precision code 1 and 2 in Strandow et al., 2011).

National-level employment rate or relevant data is widely used to measure employment experiences and analyze the influencing factors of employment. To our knowledge, there are few studies which use household-level data to measure the working experiences of individuals and then investigate how the employment is affected by the economic activities. Hence, in order to shed more lights on the employment in Africa, we employ 4 Afrobarometer survey waves, where respondents had to answer some questions related to their working experiences, to estimate the employment status and occupation of African citizens. Compared with traditional national-level data on employment, methods used by Afrobarometer survey, which was put forward by Knutsen et al. (2016), provide d a quite different measures of local employment from local surveys where the respondents of surveys are geocoded. Afrobarometer surveys includes several questions on the employment status and occupation of African citizens. Undoubtedly, respondents’ answers could be considered as a better proxy for actual employment status which is closer to respondents’ daily lives than national level employment, as the first-hand knowledge could be collected from respondents.

We mainly take account of the questions on the working experiences and occupation of respondents. Respondents are asked if they have a job that pays a cash income and if this job is part-time or full time if they say yes. Regarding this question, they can answer “No (not looking)” “No (looking)” “Yes (part time)” “Yes (full time)” “Don’t know” “Refused to answer” and “Missing”. Hence, we can create a dummy variable to measure whether a respondent has a job at the time of survey, regardless of his job is part-time or full-time. Also, in order to further distinguish the nature of their jobs, two separate variables need to be also considered and created for part-time and full-time jobs respectively. Other

answers, such as “don’t know” “missing” and “refused to answer”, will be collapsed.

Apart from the employment status and occupation of the respondents of surveys, Afrobarometer also geolocates the respondents. Therefore, we can use the point coordinates in aid data to link aid projects to local survey respondents in the Afrobarometer. The coordinates of the surveyed Afrobarometer clusters (consisting of several geographically close villages or a neighbourhood in an urban area) are used to match individuals to aid project site for which we have precise point coordinates. We measure the distance from the cluster center points to the aid project sites and identify the clusters located within a cut-off distance of at least one project site.

As our research aims to investigate the impact of Chinese aid projects on local employment in Africa, it is vital to merge these two spatial datasets together. As AidData dataset provides the geocoded information of China’s aid projects in Africa and Afrobarometer surveys enable us to geo-locate the African clusters, we can link them based on spatial proximity, employing point coordinates of Afrobarometer clusters – that is, one or several geographically villages or urban neighborhood – to match individuals to China’s aid projects. Totally, AidData dataset identifies 503 China’s aid projects in 29 African countries, and the baseline analysis draws on four Afrobarometer survey waves (wave 2-5) conducted in 33 African countries. Through using point coordinates, it is allowed to geo-match China’s aid projects to survey respondents. From a cluster center point, we measure distance to China’s aid projects and register if ≥ 1 China’s aid project exists within 25 kilometers (km). The indicator variable *Active* captures whether ≥ 1 active aid project lies within this distance. If not, we code individuals as *Inactive* if ≥ 1 *future* aid project will be implemented in the area.

2.2 Estimation Strategy

There are challenges with investigating the causal effect of China’s aid projects on local employment, as the characteristics of African subnational units are also likely to affect the distribution of economic engagement in Africa. As per our research on the impact of China’s development projects on local employment,

pre-existing local employment levels, and other factors correlated to employment (such as population density, infrastructure access) are likely to influence projects' location selection. For instance, areas with more citizens are more likely to be able to provide the labour forces needed for projects. Therefore, certain existing research on China's aid projects in Africa assumes ex-ante that there is no relationship between project localization and the pre-existing institutional characteristics of project sites (Isaksson and Kotsadam, 2018b).

On the basis of the empirical strategies mentioned by Knutsen et al (2016), we also employ a spatial-temporal estimation strategy in order to address the identification issues mentioned above. Specifically, we compare the working experiences of survey respondents living near sites where a development project is currently under implementation and those of respondents instead living near sites where a project will be opened but where implementation had not yet initiated at the time the Afrobarometer surveys covered that particular areas.

On the account of the fact that Afrobarometer surveys show different localities at different points in time and that we can know at what points in time and in localities aid project has been initiated through the information released by AidData, we are allowed to identify respondents living in areas where a project was ongoing at the time of survey and compare them with respondents living in areas where we know that a project will start, but where implementation had yet to begin at the time of survey.

Assuming that the employment effect of Chinese development projects is both affected by a cut-off distance, our main estimation strategy includes three groups of individuals, namely those, 1) within 25km of at least one active project site (*active*), 2) within 25km of a site where a project will start, but where implementation was yet to begin at the survey date and not close to any active projects (*inactive*), and 3) >25km from any project sites.

Regarding our main research aim is to investigate the employment effect of Chinese development projects, our baseline regression equation is as follows:

$$\begin{aligned}
pc_employment_{c,t} &= a_1 * ongoing_{c,t} + a_2 * future_{c,t} + \beta_1 * Control_{c,t} + \gamma_t + \delta_c \\
&+ \varepsilon_{v,t} \quad (1)
\end{aligned}$$

Where $pc_employment_{c,t}$ measures the cluster-level percentage of employment in the African cluster c at the year t . $ongoing_{v,t}$ refers to a dummy variable capturing whether there is at least one active project site within 25km of the African cluster c at year t . $future_{v,t}$ is a dummy variable for where a project within our cut-off distance will start, but where implementation was yet to begin at the survey date. Using these two different variables can enhance our assumption that China's aid project localization is uncorrelated with institutional characteristics before projects start. Hence, the comparison group includes the Afrobarometer clusters with no aid projects within 25 km in the sample period. In this way, the difference-in-differences estimator ($a_1 - a_2$) measures how employment changes between places where projects have not yet been activated and places with active aid projects, compared to places with no aid projects. It identifies the causal impact of Chinese aid projects on local employment. It is also important to note that the coefficient a_1 provides a test for the potential site selection of Chinese aid projects in terms of local employment. Meanwhile, this regression also includes cluster-fixed effect (γ_c) and year-fixed effect (γ_t) in order to control for variation across time and space. Covariates at cluster levels are included in $Control_{c,t}$. They include cluster-level physical asset index, education level and urban, which are likely to influence the individual's employment decisions and then affect the general employment status of an African clusters. Standard errors are clustered at the geographical clusters (EA, town, or neighborhood) to account for alternative control sets an alternative clustering option.

3. Results

In this section we present the main results. In section 4.1, we show the baseline evidence of the impact of Chinese development projects on employment across distance and over time. In this section, we further examine the impact on local individuals' employment status more formally and illustrate the dynamic pattern of this impact. Two typical types of employment are considered in this section, that is, part-time and full-time employment. We show how Chinese development projects affect them respectively. In section 2, we do some sensitivity analysis. As subnational dataset and cut-off distances are employed to geo-match Chinese aid projects and African clusters it is necessary to do some extra sensitivity analysis to check our robustness of our baseline regression results. Apart from the investigation of the employment impact of Chinese development projects, it is also crucial to understand the possible mechanism through which Chinese aid projects affect local employment in Africa. So, possible mechanism is expected to be explored in our section 4.3. In this section, we propose that Chinese development projects enhance local employment through local growth.

3.1 Baseline Regression

The results indicate that Chinese aid projects can provide more employment opportunities. Table 1 presents the results of our baseline regressions, focusing on the employment experiences of respondents of Afrobarometer surveys across 29 African countries over the period 2005-2015. We do not take account of control variables in Column 1, but control variables, which are likely to affect employment status, are taken into consideration in our Column 2. Meanwhile, year-fixed effects and cluster-fixed effects are also considered in our baseline regression which aims to investigate the impact of China's aid projects on local employment across African clusters.

Looking at the coefficient on ongoing Chinese development projects, we can note that living within 25km of sites where Chinese projects are currently implemented is, indeed, associated with a higher possibility of having a job (with a value of 1.383). In particular, compared with the African clusters where there

is not any Chinese project site in their vicinity, there are more employment opportunities for respondents whose clusters are close to ongoing Chinese development projects. In other words, the employment rate of clusters with ongoing Chinese projects in their vicinity is higher than those without any Chinese development projects.

As noted, however, interpreting the coefficient on *ongoing* in isolating as capturing an effect of Chinese development projects requires that the location of Chinese development projects is not correlated with pre-existing features, an assumption which we do not deem plausible. In order to account for the likely endogenous placement of projects, we instead compare the local employment status in areas where Chinese aid projects in their vicinity were under implementation at the time of survey (*ongoing*) with those where Chinese aid projects will take place but were yet initiated to be implemented at the time of survey (*future*).

Looking at the coefficients on *future*, we can note that similar to areas with *ongoing* Chinese aid projects in their vicinity, we here can also see a positive impact of *future* Chinese development projects on local employment. It is also noted that this positive influence is much greater, with a higher possibility of 1.832. So, it can be said that even though some Chinese development projects had had not been initiated to be implemented at the time of survey, its influence on local employment or labor market was not unignorable. There are a great deal of preparation works required for the beginning of a project, especially an international project, such as the project reviewing, project site checking, negotiation with local authorities, etc. Meanwhile, these preparation works for the future Chinese projects could generate some working opportunities for local labor forces, so as to improve the local employment level of African clusters.

Looking at the estimates of the difference-in-difference estimates ($a_1 - a_2$) which measures how employment changes between places where projects have not yet been activated and places with active aid projects, compared to places with no aid projects, the associated test results presented in the bottom section of Table 1 clearly indicate that there is no evidence that active Chinese aid projects exert more significant employment-promoting impact compared to inactive Chinese aid projects, as the difference-difference estimate is not

significant econometrically at any significance level. Also, the negative parameter difference shows that individuals in the regions/clusters living close to future Chinese development projects are more likely to obtain some working opportunities, in comparison to those living close to ongoing Chinese development projects. But it should be noted that our coefficient of difference-in-difference is neither statistically nor economically significant. Hence, it is necessary to further investigate why future and ongoing Chinese development projects have a different impact on local employment in African clusters.

Table 1: China's Aid Projects and Local employment in Africa: 25km

VARIABLES	(1) Local Employment	(2) Local Employment	(3) Part-time Employment	(4) Full-time Employment
ongoing25	8.374*** (0.165)	1.383*** (0.193)	-0.106 (0.108)	1.173*** (0.151)
future25	4.529*** (0.401)	1.832*** (0.390)	0.746*** (0.220)	-0.948*** (0.305)
Observations	145,745	145,745	145,745	145,745
R-squared	0.018	0.422	0.261	0.440
Baseline controls	NO	YES	YES	YES
Year FE	NO	YES	YES	YES
Region FE	NO	YES	YES	YES
Difference	3.845	-0.449	-0.853	2.121
F test:	83.52	1.187	13.53	43.37
ongoing25- future25=0 p value	0	0.276	0.000235	0

Notes: the baseline controls are education level, urban and wealth index for African clusters. The "difference in difference" results give the difference between ongoing and future areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Column 3 and Column 4 show the impact of Chinese development projects on part-time employment and full-time employment respectively. As Afrobarometer surveys also ask respondents to tell the type of their employment at the time of survey, it is easy for us to further divide our employment data into two aspects, that is, full-time employment and part-time employment, in order to estimate whether the type of employment is a reason to explain why ongoing and future Chinese development projects exert a different impact on local employment in African regions/clusters.

There is also a wide concern that Chinese companies tend to bring Chinese workers instead of hiring local people. Although this claim is currently not supported by any available data, our estimate on Column 3 and Column 4 may show certain reflections on this concern. If Chinese projects do not hire local workers, it is expected that Chinese aid projects have a greater impact on part-time employment in comparison to the full-time employment, which implies that Chinese companies may bring more full-time Chinese workers to their African project sites who are familiar with Chinese companies and their operations. Regarding local workers in Africa, Chinese companies may hire them as part-time workers in order to ensure the implementation of their projects, as they are familiar with local policies and regulations, which can help Chinese companies to reduce additional costs and times on accommodations and permit applications.

Looking at our estimates of Column 3 which shows how Chinese projects affect local part-time employment in Africa, we can note that living within 25km of sites where Chinese development projects will take place but where implementation was yet not be initiated at the time of survey, is associated with a greater probability of finding a part-time job. Especially, compared with individuals who are living close to ongoing Chinese development projects, future Chinese projects may need more part-time local workers in the preparation phase of their projects. However, once Chinese development projects are under implementation, part-time workers would not be preferred by Chinese companies due to their instabilities. Moreover, the estimates of our difference-in-difference ($a_1 - a_2$) in the bottom rows of Table 1 also clearly indicate more significant promoting impact of future Chinese development projects on part-time employment compared with ongoing projects. Also, our parameter difference is clearly statistically and economically significant.

However, we can find a different argument for the impact on local full-time employment when looking at the results of our Column 4. Only respondents who are having a full-time job at the time of the survey are counted in this Column. It can be noted that once Chinese projects are initiated to be implemented, its promoting impact on full-time jobs are greater, as Chinese companies may provide a stable and long-time job opportunities for local labors.

Conversely, the impact of future Chinese projects on full-time employment is expected to be negative, which is also in line with our expectation. Also, our difference-in-difference estimates in the bottom rows of Table 1 also illustrates more widespread promoting impact on local full-time employment close to ongoing compared to future Chinese development projects site.

Based on our results from Column 3 and Column 4, it can be found that in the preparation phase of Chinese projects or when Chinese development projects are not initiated to be implemented, local labour forces in Africa are more likely to find more part-time jobs. But once Chinese projects are under implementation, the promoting impact of these projects on full-time employment are more significant in African clusters. These interesting arguments, to some extent, confirm that Chinese companies are more likely to have to bring some Chinese workers to Africa, at least at the beginning of their operations. First, Chinese workers are familiar with the companies' organization and process. They can put the enterprises into operation quickly, especially for urgent projects. Second, Chinese technicians are required to install and test the machineries, as most equipment is imported from China. Third, experienced Chinese workers can also tutor their local colleagues on the job. Through working together for a period of time, Chinese employees can demonstrate and transfer their work skills to Africans.

But, once Chinese projects are under implementation, there is an increasing number of local African workers and a decreasing number of Chinese workers. In Zambia's ECCZ, around four hundred Chinese and five hundred Zambians were employed during the early phase of construction, machinery installation and training, but the percentage of Chinese workers was down to less than 20 percent after the production process became stabilized. We can also find a similar evidence from the case of China-Africa Overseas Tannery in Ethiopia where we can find a decrease in Chinese workers and an increase in local workers.

Therefore, on the basis of our estimate results of Table 1, it can be said that Chinese aid projects exert a promoting but insignificant impact on local employment. However, this impact is different for different types of employment. It can be noted that future Chinese development projects play a more significant

impact on local part-time employment as their preparation works require a great deal of local workers who are familiar with local policies and regulations. However, in the implementation phase, Chinese development projects exert a more significant and positive impact on full-time employment, as the production process has become stabilized and using local workers as full-time could reduce certain business costs.

Furthermore, given that Chinese aid projects are of different purposes in Africa, we divide our dataset on Chinese aid projects into five main aspects, which are taking account of the majority of Chinese development projects in the African continent, that is, communications (18.09%), education and health (28.6%), energy and water supply (7.96%), transport and storage (18.69%), and government and other infrastructures (16.70%). We keep using coordinate points to geo-match the dataset on the African employment level to these five categories respectively, as well as employ the difference-in-difference estimates to reduce the impact of pre-existing features of the African clusters on our results. In other words, we keep using *ongoing25* to measure if there is an active Chinese development projects within 25km of an Afrobarometer cluster, and *future25* to measure if there is a Chinese aid projects which will take place but were yet initiated to be implemented at the time of survey.

Looking at our table 2 showing the impact of five main Chinese aid projects in Africa, we can note that living within 25km of sites where Chinese development projects is under implementation at the time of survey, is associated with a greater probability of finding a job. Regarding Chinese aid projects with the purpose of improving communications in Africa, our coefficient in Column 2 confirms the employment-promoting effect of Chinese ongoing development projects in Africa. However, our coefficient of *future25*, surprisingly, demonstrates a negative impact of Chinese future development projects on local employment in Africa. This surprising negative coefficient, to some extents, implies that the increase in the presence of Chinese workers, which aims to the smooth preparation of Chinese future communication projects in Africa, is more likely to worsen the African labor markets. Meanwhile, the negative coefficients of Chinese future development projects of education and transport in Column 3 and 4 also confirm this claim.

Indeed, although studies on labor-market effect of Chinese aid in Africa is still in its infancy, there are some reporting statistics showing the increase in presence of Chinese workers in Africa and the low rate of workforce localization (as proportion of employment given to African workers in Chinese firms in Africa). For instance, a SAIS-CARI report (2019) demonstrates a marked increase in Chinese expat labors between 2001 (nearly 47,000 workers) and 2016 (227,000 workers) with a peak of over 263,000 workers in 2015. Even though not all Chinese migrants are for the implementation of Chinese development projects, it is clear that the heavy reliance on Chinese workers in Chinese projects, especially in the preparation phase of projects, could negatively affect the contribution of Chinese aid projects to job creation in Africa. But, with the increase in Chinese projects in Africa, there is a decline in the number of registered Chinese workers and an increase in workforce localization in Africa. For instance, the proportion of Chinese workers of the Sub-Sahara part of Africa has been steadily declining from a peak of 78% in 2011 to only 58% in 2016 (Oya and Schaefer, 2019). Also, McKinsey (2017) reports an increase in reliance on local labor for Chinese firms in Africa. Looking at our Table 2, our positive coefficient of Chinese ongoing development projects and the difference-in-difference estimates, to some extents, can also reflect these changes in impacts of Chinese projects in African local labor markets. In the early or preparation period of projects, Chinese firms find it advantageous to use Chinese workers for management, engineering, and skilled positions. Chinese workers were more familiar with companies' organization and processes, could install new equipment imported from China more quickly, and help make sure the first projects, which often had political significance, were completed in very short timeframes (Sinkala and Zhou, 2014). Hence, a worsening impact of Chinese development projects on African labor market can be found. However, with the stabilization of Chinese projects and the increase in Chinese projects in Africa, the presence of Chinese expat workers has been much more limited. On the contrary, there are more job opportunities for African local workers. In other words, Chinese development projects is more likely to exert a positive impact on local employment in Africa. Furthermore, the results of Column 5 and 6 also show that the improvement in infrastructure cannot only

provide more job opportunities during the implementation period of projects, but also be beneficial for local labor market in the longer term (Guo and Jiang, 2021).

Table 2: Types of Chinese Aid Projects in Africa

VARIABLES	(1) Local Employment	(2) Local Employment	(3) Local Employment	(4) Local Employment	(5) Local Employment	(6) Local Employment
Projects' type	Benchmark Regression	Communications (18.09%)	Education and Health (28.63%)	Transport and Storage (18.69%)	Government and Other Infrastructures (16.70%)	Energy and Water Supply (7.96%)
ongoing25	1.383*** (0.193)	3.934*** (0.472)	1.054*** (0.188)	2.953*** (0.453)	2.261*** (0.248)	0.232 (0.440)
future25	1.832*** (0.390)	-2.388*** (0.615)	-1.184*** (0.403)	-2.219*** (0.637)	0.319 (0.549)	0.724 (2.007)
Observations	145,745	145,745	145,745	145,745	145,745	145,745
R-squared	0.422	0.421	0.421	0.421	0.421	0.421
Baseline controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Difference	-0.449	6.322	2.238	5.172	1.942	-0.502
F test:	1.187	86.11	7.43	54.55	11.30	0.06
ongoing25-future25=0						
p value	0.276	0.000	0.0064	0.0000	0.008	0.8073

Notes: the baseline controls are education level, urban and wealth index for African clusters. The "difference in difference" results give the difference between ongoing and future areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

3.2 Sensitivity Analysis

The findings that Chinese aid projects promote local employment is stable across a wide range of specifications and sub-samples. The results of first set of robustness check are presented in Table 2, which aims to testing whether altering cut-off distance from project sites changes our results (Column 2). Using 50km cut-off distance still reveals more significant employment-promoting impact of Chinese development projects in African clusters. In comparison to ongoing Chinese development projects which are under implementation at the time of the Afrobarometer survey, future Chinese development projects may still create more job opportunities for local citizens.

In column 3, we restrict the sample to clusters that have a Chinese project – either ongoing or future – nearby, thus comparing the employment rate of these African clusters directly rather than in relation to the African clusters with no Chinese projects nearby. As our sample is restricted, the coefficient on *ongoing25* can directly show the difference between active and inactive Chinese development projects. We see that the result for the employment-promoting impact of Chinese development projects is similar, despite the reduction in sample size. Also, our result is statistically and economically significant at the 1% level. In other words, respondents living close to Chinese project sites are more likely to obtain a job – either full-time or part-time job. Hence, African clusters with Chinese project sites in their vicinity also enjoy a higher employment rate compared with those without Chinese project sites nearby.

Table 3: Robustness Check

VARIABLES	(1) Local Employment: 25km	(2) Local Employment: 50km	(3) Local Employment: Chinese projects nearby
ongoing25	1.383*** (0.193)	0.986*** (0.123)	1.598*** (0.131)
future25	1.832*** (0.390)	1.287*** (0.220)	
Observations	145,745	95,683	56,473
R-squared	0.422	0.460	0.540
Baseline controls	YES	YES	YES
Year FE	YES	YES	YES
Region FE	YES	YES	YES
Difference	-0.449	-0.567	
F test: ongoing25- future25=0	1.187	1.353	
p value	0.276	0.235	

Notes: the baseline controls are education level, urban and wealth index for African clusters. The “difference in difference” results give the difference between ongoing and future areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Next, we consider possible effects of project timing. While the year dummies included in all regressions can control for general time trends in local employment rate, a potential concern would be if there is a lagged impact of Chinese aid projects on local employment, as the nature of Chinese aid projects has changed over time. Hence, in order to test the dynamic impact of Chinese aid projects, we consider the lagged terms for Chinese development projects in the African clusters. In comparison to our baseline regression (1), we employ $ongoing_{v,t-1}$, a lagged term, which equals to 1 if Chinese aid projects were implemented within 25km of clusters in the year $t-1$. Respondents in these African clusters had been exposed to Chinese aid projects for one year. Similarly, $ongoing_{v,t-2}$ stands for a dummy variable which equals to 1 if aid

projects within 50km started two years preceding the year of the Afrobarometer survey. Hence, our new regression can be formulated as follows:

$$\begin{aligned}
 pc_employment_{c,t} & \\
 &= a_0 * future_{c,t} + a_1 * ongoing25_{c,t-1} + a_2 * ongoing25_{c,t-2} \\
 &+ \beta_1 * Control_{c,t} + \gamma_t + \delta_c + \varepsilon_{c,t} \quad (2)
 \end{aligned}$$

Where the cluster-level percentage of employment $pc_employment_{c,t}$ is considered as the dependent variables to measure the employment status in African clusters. The coefficient $(a_1 - a_0)$ and $(a_2 - a_0)$ can measure how the local employment changes over time after Chinese projects became “inactive” or “completed”. Overall, these difference-in-differences estimators illustrate the dynamic effects of Chinese infrastructure aid on local employment. They also allow us to examine whether the observed dynamic pattern is reasonable and consistent with other evidence.

Even though only two preceding years are considered, our estimate results can still show the employment-promoting impact of Chinese development projects. Also, it is noted that in the first year after the implementation of Chinese development projects, the employment rate of the African clusters increases significantly by about 1.24 percentage points. Similarly, the employment rate keeps increasing by about 1.2 percentage points in the second year after the implementation of Chinese development projects. Also, in the second year, the employment rate for the African clusters with Chinese project sites nearby is 0.54 percentage points higher than the comparison areas without Chinese projects nearby. Therefore, the results shown in Table 3 also confirm the employment-promoting impact of Chinese development projects which is tested by our baseline regression.

Table 4: The dynamic impact of Chinese aid projects on local employment

VARIABLES	(1) Local Employment:	(2) Local Employment:	(3) Local Employment:
ongoing25	1.383*** (0.193)		
<i>ongoing25_{c,t-1}</i>		1.245*** (0.134)	
<i>ongoing25_{c,t-2}</i>			1.205*** (0.103)
future25	1.832*** (0.390)	0.887* (0.220)	0.663* (0.356)
Observations	145,745	134,786	123,675
R-squared	0.422	0.465	0.476
Baseline controls	YES	YES	YES
Year FE	YES	YES	YES
Region FE	YES	YES	YES
Difference	-0.449	0.385	0.542
F test: ongoing25-future25=0	1.187	1.321	1.465
p value	0.276	0.065	0.021

Notes: the baseline controls are education level, urban and wealth index for African clusters. The “difference in difference” results give the difference between ongoing and future areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

To summarize our finding so far, they consistently indicate that Chinese aid projects can promote local employment rate around project sites. Ongoing Chinese aid projects are more likely to create more full-time jobs for citizens living in the African clusters with Chinese aid projects in their vicinity. Future Chinese aid projects are more likely to increase the part-time job opportunities for African citizens because of the increasing needs of labour forces in the preparation phase of projects nearby. In the next section, we will explore the possible mechanism through which Chinese aid projects affect local employment.

3.3 Exploring Mechanism

Regarding the possible mechanism through which Chinese aid projects improve local employment, we argue that economic-incentive arguments speak

in favour of Chinese aid projects promoting local employment. If the increase in local employment around aid project sites is primarily due to a surge in economic activity and thus in the flow of resources that are up for more job opportunities for local citizens, we would expect to observe an effect of Chinese aid projects on economic activities, and of economic activity on local employment.

As subnational and spatial datasets are employed in our baseline regressions, it is also required for our research to use a subnational dataset on economic activity. Hence, we employ nighttime lights, emitted from residential, industrial, commercial and entertainment areas and captured by satellites, to measure the economic activities in the African clusters.

The nighttime light obtained from the National Oceanic and Atmospheric Administration (NOAA, 2018) and the nighttime light images obtained with the OLS of the Defense Meteorological Satellite Program (DMSP) from 2000 to 2012 were used in this study. Since the end of the 1990s, nighttime light data have been used to monitor population concentrations and to assess the economic performance of countries and regions. The reason is that nighttime light data are indeed a very promising tool to catch the patterns of human activities remotely (Henderson et al, 2012). Specifically, these data are nowadays available for each day and each point on the Earth, thus being more advantageous than traditional estimates, which might be scarce and irregular (due to time-consuming analysis, as in the case of defining the commuting rates), non-unified (due to different national reporting standards), or confidential (due to security reasons or illegality, as in the case of shadow economies). Applied researchers typically use nighttime lights as a reliable proxy for economic activities when official statistics or data at the small geographical scales are not available (Keola et al, 2015; Schueler et al, 2013; Strange et al, 2013; William and Chen, 2015). Hence, to proxy for local economic activity, we use satellite data on nighttime lights, and thus geo-match it to our dataset on

China's aid projects and local employment by using point coordinates. And our estimation regression would be formulated as follows:

$$\begin{aligned}
 pc_employment_{c,t} &= a_0 * future_{c,t} + a_1 * ongoing25_{c,t} + a_2 * lnmean_light_{c,t} \\
 &+ a_3 * ongoing25_{c,t} * lnmean_light_{c,t} + \beta_1 * Control_{c,t} + \gamma_t + \delta_c \\
 &+ \varepsilon_{v,t} \qquad \qquad \qquad (3)
 \end{aligned}$$

Where we use $lnmean_light_{c,t}$ to measure the cluster-level economic activity in the African regions. Also, this regression also includes cluster-fixed effect (γ_c) and year-fixed effect (γ_t) in order to control for variation across time and space. The standard errors are clustered at the geographical clusters.

The results of using nighttime lights to explore mechanism are presented in our Table 4. Column 1 of Table 4 shows that the baseline results are robust to this. For Column 2, we use nighttime lights as the dependent variables to investigate whether Chinese aid projects fuel economic activity in the African clusters. Obviously, it can be noted that Chinese aid projects are followed by the increased economic activity. The point estimate for $(a_1 - a_0)$ suggests that Chinese aid projects are more likely to increase mean light intensity in the African clusters. Furthermore, the column 3 of Table 4, which tests the coefficient of nighttime lights on local employment, also presents that there is a positive relationship between local employment and the mean intensity of nighttime lights in the African clusters. Further, controlling for economic activities does not change the effect of Chinese aid projects on local employment (see Column 4 of Table 4). Hence, it can be said that Chinese aid projects increase local employment as a by-product of a more general increase in economic activity.

In Column 5 of Table 4, we interact being an ongoing Chinese project site with light emission, in order to further test whether economic-activity mechanism is uniform across all the African clusters. We can see that the interaction term is

highly significant, suggesting that economic activity is systematically more conducive to local employment in Chinese project sites than elsewhere. Higher economic activity corresponds with more working opportunities for local African citizens in clusters with Chinese project sites nearby.

Therefore, our results are expected to suggest that the relationship between Chinese development projects and local employment is driven by the increase in economic activity in the African clusters. Moreover, it can be noted that clusters with higher economic activity can enjoy a more significant employment-promoting effect of Chinese aid projects. However, theoretically, economic growth could expectedly increase local employment through other channels or have no impact on local employment due to some factors. We leave investigations of this for the future research, but we note that economic growth can be seen as an important channel through which Chinese aid projects affect local employment.

Table 5: Nighttime Lights, China's Aid Projects and Local employment in Africa

VARIABLES	(1) Local Employment	(2) Mean Lights	(3) Local Employment	(4) Local Employment	(5) Local Employment
ongoing25	1.383*** (0.193)	2.336*** (0.020)		0.575* (0.298)	1.094* (0.355)
future25	1.832*** (0.390)	1.629*** (0.035)		-1.120 (0.483)	
Inmean_light25			0.920*** (0.047)	0.891*** (0.052)	0.791*** (0.053)
Ongoing25*mean lights					1.227*** (0.132)
Observations	145,745	70,573	70,573	70,573	70,573
R-squared	0.422	0.754	0.445	0.445	0.445
Baseline controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Difference	-0.449	0.707		1.695	
F test: ongoing25- future25=0	1.187	371.9		11.25	
p value	0.276	0		0.000797	

Notes: the baseline controls are education level, urban and wealth index for African clusters. The "difference in difference" results give the difference between ongoing and future areas and we present the associated F-test and the p-value of the F-test. Robust standard errors (clustered by the survey clusters) in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4. Conclusion

Although there is a huge improvement in the African economy, the unemployment has been still a serious issue which has been received a great deal of discussion. More and more researchers are doubting the impact of foreign aid in Africa. Among them, the impact of Chinese aid projects in African countries is of the most heated debate, as China has been increasing its presence in Africa. Hence, it is necessary to investigate how Chinese aid projects affect local economy in Africa through using some subnational evidence, in order to more clearly reveal the facts of Chinese economic engagement in Africa.

We use spatial and temporal variations in Chinese aid projects and multiple waves of Afrobarometer surveys across 29 African countries over the period from 2005 to 2015, and identify how Chinese aid projects affect local employment in the African regions/clusters. Our research differs from most studies in the literature on foreign aid by investigating the impact of foreign aid projects in a large multi-state samples, focusing on the working experiences which are closely related to daily life of residents of African countries rather than the estimates of national level corruption and foreign aid from government departments.

Our results consistently indicate that Chinese aid projects can promote local employment in the African clusters. Splitting our dataset based on the type of employment, it can be found that ongoing and future Chinese aid projects exert different impacts. Regarding ongoing Chinese aid projects, it is more likely to create more full-time jobs for local citizens living in the African clusters with Chinese project sites nearby. However, in terms of future Chinese aid projects, its promoting impact on part-time employment suggests that local people are more likely to find some part-time jobs as future projects needs a great deal of preparation works before their implementation. Furthermore, considering the

types of Chinese aid projects in Africa, we further split our dataset into five main categories of Chinese aid projects. Although our results still confirm a positive and local effect of Chinese development projects on employment in Africa, it is also surprising to find a negative impact of the influx of Chinese workers in the early stage of Chinese projects on African local labor markets. However, with the stabilization of Chinese projects, workers in Chinese firms and projects have been localized. It means that African local workers stand a more important part in Chinese firms and projects in Africa. An increasing number of job for African local workers is created and provided by Chinese firms and projects.

Investigating possible underlying theoretical mechanisms, the employment-promoting impact of Chinese aid projects is likely to be driven by the increase in economic activity. Through using nighttime light intensity as the proxy of local economic activity, it can be found that higher economic activity corresponds with more working opportunities for local African citizens in clusters with Chinese project sites nearby.

Our research thus can make two contributions. First, it provides new evidence of the much-debated discussion on Chinese aid projects in Africa through using subnational and spatial datasets. There is no doubt that our test results can yield more valuable insights into Chinese aid projects and reduce the limitations resulted from the lack of detailed financial information of Chinese aid. Second, our research can add to literatures on foreign aid and local employment. Even though there are some existing researches on this phenomenon, to our knowledge, we are the first to systematically employ respondents' working experiences, rather than national aggregated data, to study whether Chinese aid projects create more working opportunities for the African citizens. Also, to our knowledge, we are also the first to investigate whether part-time and full-time employment is affected differently by Chinese aid projects.

Our design and results open up different avenues of future research. Local employment may be affected by some local institutional characteristics and

these local characteristics may also affect the allocation of Chinese aid projects. Hence, arguments on how local characteristics affects the employment-promoting impact of Chinese aid projects could be investigated in the future research with similar designs. Furthermore, currently, our research shows the short-run impact of Chinese aid projects. While we find the dynamic impact of Chinese aid projects on local employment through using the lagged terms, the long-run impact of Chinese aid projects remains unclear. Especially, how the quality of institution affects the impact of Chinese aid projects in Africa is an important question for future research. Also, how African local firms response to China's aid projects could be also explored in the future research.

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Appendix A1: Variable Descriptions

Dependent Variable: Employment status as the dependent variable

$pc_employment_{c,t}$: the cluster-level percentage of employment in an African cluster v at the year t , which is calculated by using a question from Afrobarometer survey on the employment status of respondents.

$pc_partemployment_{c,t}$: the cluster-level percentage of part-time workers in an African cluster v at the year t , which is calculated by using a question from Afrobarometer survey on the employment status of respondents.

$pc_fullemployment_{c,t}$: the cluster-level percentage of full-time workers in an African cluster v at the year t , which is calculated by using a question from Afrobarometer survey on the employment status of respondents.

Independent Variables: China's aid projects in Africa

$ongoing25_{c,t}$: a dummy variable, 1 if Chinese aid projects are being implemented at the time of the interview, as well as which are less than 25km from a cluster.

$future25_{c,t}$: a dummy variable, 1 if Chinese aid projects the implementation of the project has not yet started at the time of the Afrobarometer survey interview, as well as which are less than 25km from a cluster.

Control Variables:

$pc_assetindex_{c,t}$: the cluster-level percentage of respondents who have had a motor, a car or a motor vehicle at the time of the Afrobarometer survey interview.

$pc_education_{c,t}$: the cluster-level percentage of respondents who have had completed at least primary school at the time of the Afrobarometer survey.

$urban$: dummy variable equal to one if a spatial unit corresponds to an urban area, zero otherwise.

Other Explanation Variables:

$lnmean_light_{c,t}$: Considering some of African clusters contain nighttime light with Digital Number (DN) of 0, we take the log of the average DN of nighttime light plus 0.01 within a spatial unit for the year in which the respective Afrobarometer survey was carried out as our main analysis. The spatial unit is the cluster formed based on the geocoded data from the Afrobarometer survey.

Table A2: Descriptive Statistics

	N	Mean	SD
<i>pc_employment</i>	145,745	35.86	25.01
<i>pc_partemployment</i>	145,745	19.31	19.87
<i>pc_fullemployment</i>	145,745	9.62	12.45
<i>pc_assetindex</i>	145,745	18.04	19.30
<i>pc_education</i>	145,745	60.54	14.35
<i>urban</i>	145,745	.393	.488
<i>ongoing25</i>	145,745	0.19	0.39
<i>future25</i>	145,745	0.03	0.16

Chapter V

Conclusion

5.1 Concluding Summary

China has been the biggest economic partner with Africa and Sino-Africa cooperation has been seeing an increasingly tightness over the last decades. It can be noted that praises and criticisms co-exist for Chinese economic engagement in Africa. On the one hand, Chinese economic activities in African are praised for China's contributions to the improvement in African economies. On the other hand, some observers claims that the Chinese government has been frequently accused of the extraction and imports of natural resources from African countries with the aims to satisfy the needs of its economic growth. Also, they doubt the effectiveness of Chinese economic engagement in Africa, as there is still a high unemployment rate in African countries, but a large number of Chinese workers flow into the African labor markets for the purpose of the implementation of Chinese projects in Africa. However, most of claims are formulated by using national level information. Will we obtain similar claims by using more detailed datasets? Can our more detailed dataset reveal a more comprehensive image of Chinese economic engagement in Africa?

Therefore, this PHD thesis aims to investigate Chinese economic engagement in Africa, which has been of a great deal of debates, by using various sources, such as product-level dataset on the bilateral trade between China and African countries, and a spatial dataset of novelty on China's aid projects which enables researchers to know the latitude and longitude of China's aid project sites.

In our first paper, we investigate the nexus of China's direct investment in and international trade with 54 African countries between 2003 and 2014 to estimate the extent to which Chinese investments affect its trade with the continent, with the

intention to shed light on the political motivation behind these economic activities. To best detect the evidence, we distinguish between exports and imports, and classify trade products by their economic usages. In light of the role of political connections in Chinese economy, we further split our data by the ownership of Chinese firms who trade with Africa. Our empirical results support the trade-promoting effect of China's foreign direct investment in the region, which is more significant for China's exports of consumption and processed goods than for China's imports of primary goods from African countries. In particular, we do not find systematic evidence that the investment activities lead to more primary goods being imported by Chinese state-owned enterprises. Our overall findings suggest that Chinese investments are correlated with more subsequent exports of consumption and processed goods from China, an indicator of market-seeking motivation of the country's investment activities in the continent.

In terms of our second research, we, afterwards, focus on the evidence of China's development projects in Africa and local corruption experiences of the African citizens. we aim to analyze Chinese aid effectiveness with the consideration of local corruption in the African continent. This paper asks whether local corruption could minimize the effectiveness of Chinese development projects in Africa, whether Chinese aid effectiveness is consistent across African clusters with different level of corruption. To answer our research questions related to Chinese aid effectiveness and local corruption in Africa, we geographically match the subnational data on Chinese aid allocation in Africa with geocoded data on respondents from four Afrobarometer surveys waves across 29 African countries. These Afrobarometer surveys can capture the corruption experiences of respondents, which have potentials to extend our understanding of corruption related facts across these African countries. Our empirical results demonstrate the promoting impact of Chinese aid projects on local economic activities, and that this promoting effect is not negatively affected by local corruption which is measured by two questions from Afrobarometer surveys. In particular, the effectiveness of Chinese aid projects varies across African clusters with different

corruption level. In other words, Chinese aid projects are more likely to fuel economic activities to a greater extent in more corrupted clusters, compared with less corrupted clusters in Africa.

Moreover, we turn our focus on whether there is the employment-promoting impact of Chinese aid projects in Africa. Similar to our second research, we geographically match the subnational data on Chinese aid allocation in Africa with geocoded data on working experiences of African citizens collected by four Afrobarometer surveys. There is no doubt that this research can extend the studies which employ the subnational dataset. Through using multiple regressions, our empirical results confirm the employment-promoting effect of China's aid projects in Africa. Through the difference-in-difference estimates by comparing clusters with ongoing Chinese development projects in their vicinity with those with future Chinese projects nearby, our results also suggest that ongoing Chinese development projects exert a more significant promoting impact on full-time employment, and that future Chinese aid projects influence part-time projects more significantly. This difference is more likely to be in line with the facts that Chinese workers are needed in the initial phase of Chinese projects as they are familiar with the process of organization and relevant equipment. Whereas, with the implementation of Chinese projects, local workers are preferred because of low labor costs and their stabilization.

Certainly, our design and results open up different avenues of research on Chinese economic engagement in Africa. There is co-existence of praises and criticisms for Chinese economic engagement in Africa. Our research employs a variety of sources and dataset to uncover this discussion of paradox. There is no doubt that this PHD thesis on understanding Chinese economic engagement in Africa can yield more insights into studies on China's foreign economic activities and Africa.

5.2 Limitations and Future Research

Even though this PHD thesis can uncover more evidences about Chinese economic engagement in Africa, there are some limitations for my PHD thesis.

Regarding my first research on China's OFDI and trade with African countries, due to paucity of sufficiently disaggregated data, we conducted research using product-level data on African countries selected based on data availability. Also, this research is conducting over the period from 2004 to 2014 based on data availability. Certainly, this limitation on data would influence the accuracy and comprehensiveness of our research on Chinese economic engagement in Africa.

Similarly, although we employed a new dataset on China's aid projects in Africa in our second research and third research, this dataset is not released by Chinese government, which would affect the reliability of our research results. Fortunately, there are an increasing number of studies using the georeferenced dataset on China's aid projects collected by AidData.

Moreover, we attempted to use nighttime light intensity as the proxy for economic activities in the African regions. Although some researches confirm the reliability of this proxy, there is still an issue that we should pay attention to, that is, that there are two different satellites to record nighttime light emissions. The Defense Meteorological Satellite Program (DMSP), which used in my research, covers the period from 2000 to 2012. Hence, the lack of nighttime light emissions after 2012 is also likely to affect the results of our research, although our results are still robust to doing alternative tests.

Based on research results we obtained and limitations we mentioned above, some ideas about future research are emerged. For instance, certain Chinese economic activities are affected by local institutional characteristics of the African regions. Arguments on how Chinese economic engagement in Africa is correlated to local bureaucratic capacity or political participations could be investigated in the future. Also, due to the limitation on data availability, our research results can only employ 10-years

dataset to test our research questions. So, the long-run effect of Chinese economic engagement on the African economy could be discussed further. While we found the employment-promoting effect of Chinese aid projects in Africa by employing the estimates of difference-in-difference which can reduce the impact of variation of unobservable features, how local characteristics of the African regions affect this employment-promoting impact remains unclear. Hence, future research is needed on how local features of the African regions affect the effects of Chinese economic activities on economic development of the African continent.