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ALTRUISM OR TRADE MOTIVE: WHAT DETERMINES CHINA'S FINANCIAL AID TO AFRICAN OIL EXPORTING COUNTRIES?

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Abstract. Indeed, China's ascent is significantly changing the landscape in aid-donor and aid-recipient relationship for African countries, despite the changes, empirical studies on the determinant and motive is lacking. Therefore, this paper examines the determinants of China's financial aid to oil/minerals exporting African countries. By using China's loan data obtained from the China Africa Research Initiative, Johns Hopkins University and UN-COMTRADE product data classified into oil/minerals, agriculture and manufacturing, this study employs fixed effects, generalised least squares and Pesaran dynamic fixed effects to analyse the motives. The results indicate that oil/minerals are not the motives behind China's aid to Africa. However, China's aid is driven by its manufacturing exports, suggesting that aid may be tied to trade. Also, the institutional structure enhances more financial aid to Africa. The findings of this study serve as recommendations for policymakers to improve trade policies that will enhance the sustainability of Africa's engagement with China.

Keywords: China, Africa, oil and minerals, manufacturing, agriculture, aid, institutional structures.

JEL Classification: O53, O55, L72, L60, Q17, F35, E02.

Introduction

The dramatic change in China from a poor developing country to one of the world economic powers to reckon with has gained the attention and admiration of many developed and developing countries (Gold et al., 2015; Renard, 2011). However, China's economic dominance in the last two decades in developing countries, especially in Africa (Odoom, 2017; Selaya & Sunesen, 2012), has been attributed to the need to secure resources needed for its rapidly

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growing economy. In exchange, China exports manufacturing goods, provide infrastructure and grant loans to Africa. The economic factors that gravitate China's financial aid to Africa are debatable despite been its largest beneficiary. Considering that most of the existing studies are qualitative with little efforts to investigate the economic variables using econometric techniques and reliable Chinese bilateral aid data to Africa. Some claim it is based on China's need for political relevance. Others believe that China's aid to Africa is determined mainly by altruism (Biggeri & Sanfilippo, 2009; Bräutigam, 2010, 2011a, 2011b; Fijałkowski, 2011; Niu, 2016; Renard, 2011; Zafar, 2007). Furthermore, the issue of financial aid is more complicated as the few available studies focused more on the individual country recipient of China's aid-financed-infrastructure or oil-for-infrastructure development plan (Bräutigam, 2011a; Gold et al., 2017; Goldstein et al., 2009; Kobayashi, 2013; Niu, 2016). Leading to results and conclusions that are frequently generalised to many, if not all countries in Africa. Therefore, this paper contributes to aid literature and is among the pioneer attempt of providing empirical supports for the assertions and controversies surrounding China-Africa financial aid.

Most importantly, this paper objective is of two folds, first, it aims to investigate the determinants of China's aid to African oil/minerals exporting countries in a framework that reflects more socio-economical and institutional dimensions. Second, to examine China's aid motive; whether it's for trade-motive or for altruism-motive. Considering these two objectives, rigorous econometric analysis is required to examine the impacts for both motives, because, firstly, there is no reliable data on Chinese bilateral aid before the official launch of its "going global strategy" (Wang et al., 2020). Secondly, existing studies have neither focused on oil/minerals exporting African countries solely nor analyses the determinants using long-span standard and acceptable OECD data despite several qualitative studies pointing to the fact that about 40% of Chinese engagement is concentrated in these countries. Rather, the arguments are on China's acquisition of Africa's primary commodities; the win-win or win-lose status of their relationship; (Ado & Su, 2016; Gold et al., 2019; Murtala et al., 2017) and the political under-tone of their renewed engagement with Africa (Gold & Devadason, 2018; Muhammad et al., 2018). Thirdly, the formation of Forum for China-Africa Cooperation (FOCAC) in Beijing in the year 2000 with a follow-up forum held every three years to establish a fair and just international political order in the 21st century has led to more of China's aid to Africa (Lau, 2020). Besides, since the inception of FOCAC, Africa remains the largest recipient of China's financial aid (Gold et al., 2017; Kobayashi, 2013). Lastly, the proposed Belt and Road Initiative (BRI) in 2013 by China to improve transportation connectivity, trade, foreign investment and overall cooperation on the transcontinental scale does not exclude African countries (Nazarko et al., 2017; World Bank, 2019).

In view of the importance of China's financial aid to Africa and its implications, examining the determinants using a more acceptable bilateral Chinese loan data over a long span from 2003 to 2017 becomes worthy. This approach seems relevant in understanding the motives (altruism or economic) of the financial aid in the oil and minerals exporting African countries given the limitation in identifying the sectoral trade that determines their engagements. The rest of this paper is organised as follows; Section 1 lays out the literature review; Section 2 is the methodology which includes, data, empirical models and econometric techniques; Section 3 presents the results and discussion, and last section provides the conclusions from the paper.

1. Literature review

The theoretical framework for aid effectiveness is concerned with the questions of whether aid works, and not why it should be given. The necessity of providing aid has contended on the grounds of its alleged ineffectiveness in which the four strands of arguments are established in the aid effectiveness literature. The first argument leans on empirical and theoretical conclusions bothering on the claim that most conditionalities practised by donors have failed. The second stressed that aid fungibility undermined the donors' intentions as given capital is used for other ostensible projects not meant to be funded through aid. The third argument bothers on how growth regression is used to examine the determinants of aid effectiveness and measure the recipient country's policy quality. The fourth argument emerges as an extension of the third one, and it posits that aid effectiveness varies in conformity with the quality of recipient country policy environment (Calì & te Velde, 2011; Selaya & Sunesen, 2012). Furthermore, the broad aid objectives of development and welfare improvements have been effective, mainly in targeted programs with defined goals (Levine, 2005). However, aid is distorting fiscal sustainability, policy ownership, institutional development and autonomous long-term economic growth that donors expect to encourage aid. Analysing the effectiveness of aid has led to the consideration of the effect of aid inflows and the question of how the foreign aid transfer through external trade balance is affected. This becomes a genuine resource transfer issue that is somehow similar but different from the actual finance accessibility. The economic analysis consensus regarding transfer issue is based on attaining trade deficit through higher imports and lesser exports related to the appreciation of exchange rate (Calì & te Velde, 2011).

In the case of China, several studies argue that trade and investment are linked with infrastructure development, foreign aid and granting of loans has increased to about 50 African countries (Biggeri & Sanfilippo, 2009; Gold & Devadason, 2018; Renard, 2011; Zafar, 2007). This practice of aid to trade linkage is inconsonant with the economics of aid objective of securing trade benefits through goodwill (Younas, 2008). According to Wagner (2003), foreign aid and trade have both direct and indirect linkages that invariably enlarge the donor country's export levels to the recipient country. The direct linkage explicitly tie-aid is when an aid recipient country is obligated to procure goods and services from the donor country. Although, exports of the donor countries are not proportional to the amount of assistance given. However, Wagner (2003), believes that this is done to minimise loss due to corruption or unintentionally motive. The indirect linkage is when aid is not triggered by trade but rather to maintain goodwill in expectation of future project or aid. Alesina and Dollar (2000), analyses the extent to which different self-interest or altruistic factors can explain giving patterns. In their study, they include the recipient country's per capita income, measures for colonial ties and friendship, the democracy level of recipient's country as the explanatory variables. The findings indicate self-interest as the predominant factor behind the giving patterns, and this varies amongst donors (Wagner, 2003). Specific studies that focus on China's aid to Africa are summarised in Table 1.

Table 1. Studies on China's foreign aid in Africa

Author	Coverage	Method	Main findings
Kobayashi (2013)		Qualitative	The present Chinese development cooperation principle in Africa is a prototype of the Japanese development cooperation to China itself. In which both public and market-oriented activities are combined.
Bräutigam (2011a)	Case studies: Ghana "Bui Dam" and the DRC "mining and reconstruction"	Qualitative: Narrative case studies	Chinese statistics on foreign aid in Africa are being over-bloated by the media and some researchers. Foreign economic cooperation data should be distinguished from "foreign aid" to avoid ambiguity. Also, China's development assistance to the continent is based on its national interest and the role of institutions quality are inevitable.
Bräutigam (2010)	Selected African countries: Angola, DRC and Nigeria	Qualitative: Interviews	China's aid and development finance in Africa is a clear divergence from the laid down standards, norms of definitions and transparency of the OECD. Likewise, as against the general belief, Chinese aid and development finance practices are relatively like that of other donors.
Biggeri and Sanfilippo (2009)	Panel data for 43 African countries (1998–2005)	OLS, FE and Instrumental Variable two-stage least squares methods (2SLS)	China's trade, FDI and aid in Africa are determined by resource endowment, market potentials and other pull factors.

Others argue that China gives support and build vital infrastructures, such as railroads, hospitals, government buildings, roads, dams, power plants, and telecom services in African countries who have diplomatic relations with Beijing instead of Taipei (Bräutigam, 2011b; Edwards & Jenkins, 2014; Gold & Devadason, 2018; Gold et al., 2017; Odoom, 2017; Zafar, 2007). Also, China's aid is rapidly overshadowing several traditional donors, yet, is said to encourage debt defaults and hinder good governance and reforms (Alden, 2005; Broich & Szirmai, 2014; DeBoom, 2020; Kragelund, 2008; Tull, 2006; Zafar, 2007). On this premise, China's aid to Africa is termed "ambiguous" (Hanusch, 2012; Kobayashi, 2013, p. 5; Mawdsley, 2008). However, several studies are divided on the volume of China's aid in Africa (Alabi et al., 2011; Zafar, 2007). For instance, Bräutigam (2011a), argues that the volume is exaggerated, the rationale and the effectiveness of the aid are questionable. Despite the divided arguments on the effectiveness of Chinese aid, its volume, flows and rationale in Africa, Kobayashi (2013) and Renard (2011) argue that assessing the impact of China's aid in Africa is premature, when compared to years the traditional donors have been relating with Africa. On the contrary, China's aid to Africa should best be evaluated regularly to get a fair assessment of how effective it is.

2. Methodology

2.1. Data and sample

China's annual loans dataset retrieved from China Africa Research Initiative (CARI) database 2003–2017[1] is the dependent variables for the two specified models. The data for bilateral China imports and exports include all traded *goods* listed on UN-COMTRADE Harmonized System (HS) 1-99 nomenclature and is categorised into agriculture (HS 1-24), oil/minerals (HS 25-27) and manufacturing (HS 28-99). For the socio-economic variables, the data is retrieved from World Bank, World Development Indicators, and institutional variables data is retrieved from the World Bank Governance Index database. The 18 selected countries[2] are; Nigeria, Angola, Algeria, Egypt, Libya, Chad, Gabon, Ghana, South Africa, Equatorial Guinea, Congo, Cameroon, Tunisia, Cote D'Ivoire, Congo (DRC), Mauritania, Zambia and Ethiopia.

2.2. Empirical models

Modifying the models of Biggeri and Sanfilippo (2009), Calì and te Velde (2011), Vijil and Wagner (2012) and Younas (2008), China's bilateral loan (aid) to Africa is the dependent variable in the panel data sets. Aid as the dependent variable is assumed to be the sum of both physical capital and complementary capital, which overall improves the marginal productivity through investment in infrastructure that helps to connect markets. The specified aid models were to examine whether China gives aid for "altruism" or "trade". The use of these models brings out how aid influences each disaggregate sectoral trade variables. In the first model, bilateral country-import-by-product is used to investigate the "altruism" motive for aid. A measurement of the aid-for-altruism is to confirm whether China's motive is consistent with economic theory. The second model examines whether "aid-is-tie-to-trade" using bilateral country-export-by-product. Hence, both imports and exports are classified into agriculturemanufacturing and oil/minerals. The institutional quality variables (political instability and corruption) are expected to deter aid (Asiedu, 2002, 2006). Also, following Biggeri and Sanfilippo (2009), Younas and Bandyopadhyay (2007), total external debt, trade openness, GDP, per capita income and infant mortality rate are included in the models.

Thus, the imports panel model for China's aid for "altruism" motive is specified as follows:

$$\begin{aligned}\ln ChinaLoans_{ijt} &= \beta_0 + \beta_1 \ln Debt_{jt} + \beta_2 \ln IMAGRICShr_{ijt} + \beta_3 \ln IMOILShr_{ijt} + \\ &\beta_4 \ln IMMANUShr_{ijt} + \beta_5 Mortalityrate_{jt} + \beta_6 \ln OPENSS_{jt} + \beta_7 \ln GDPperk_{jt} + \\ &\beta_8 POLSTAB_{jt} + \varepsilon_{ijt},\end{aligned} \tag{1}$$

where: ln – represents natural logs of variables, $ChinaLoans_{ijt}$ – China's bilateral loans to the recipient country$_j$, $Debt_{jt}$ – Total Debt external, $IMAGRICShr_{ijt}$ – Imports Agriculture share of country$_i$ trade from country$_j$, $IMOILShr_{ijt}$ – Imports oil/minerals share of country$_i$ trade from country$_j$, $IMMANUShr_{ijt}$ – Imports Manufacturing share of country$_i$ trade from country$_j$, $Mortalityrate_{jt}$ – Infant mortality rate, $OPENSS_{jt}$ – Trade openness, $GDPperk_{jt}$ – Income per capita, GDP_{jt} – GDP, $POLSTAB_{jt}$ – political instability, β – Regression coefficients, t – Time and ε_{ijt} – Error term.

To determine whether China's aid motive is "trade-tied", the export panel model is specified as follows:

$$\ln ChinaLoans_{ijt} = \beta_0 + \beta_1 \ln Debt_{jt} + \beta_2 \ln EXAGRICShr_{ijt} + \beta_3 \ln EXOILShr_{ijt} + \beta_4 \ln EXMANUShr_{ijt} + \beta_5 Mortalityrate_{jt} + \beta_6 \ln OPENSS_{jt} + \beta_7 \ln GDPperk_{jt} + \beta_8 GDP_{jt} + \beta_9 Corrpt_{jt} + \varepsilon_{ijt}, \quad (2)$$

where: ln – represents natural logs of variables, $ChinaLoans_{ijt}$ – China's bilateral loans to the recipient country$_j$, $Debt_{jt}$ – Total Debt external, $EXAGRICShr_{ijt}$ – Exports Agriculture share of country$_i$ trade from country$_j$, $EXOILShr_{ijt}$ – Exports oil/minerals share of country$_i$ trade from country$_j$, $EXMANUShr_{ijt}$ – Exports Manufacturing share of country$_i$ trade from country$_j$, $Mortalityrate_{jt}$ – Infant mortality rate, $OPENSS_{jt}$ – Trade openness, $GDPperk_{jt}$ – Income per capita, GDP_{jt} – GDP, $Corrpt_{jt}$ – control of corruption perception index, β – Regression coefficients, t – Time and ε_{ijt} – Error term.

2.3. Estimation techniques

The pooled OLS is appropriate in estimating Eqs (1) and (2), since the endogeneity issue may not likely arise because Chinese aid is minor in the recipient African countries. However, using the OLS approach could create a potential serial correlation and heterogeneity issues in regression. Taking into consideration simultaneous issue that could occur between the dependent variable and some independent variables such as per capita income, GDP and external debt total in the models. Although, OLS issues can be fixed with the use of the fixed effects (FE) estimator (especially for Eq. (1)) since β_0 captures all time-invariant factors in the models and GLS estimator will be used for robustness check. But then again, with the use of FE, important information may be left, resulting in a substantial loss in the degree of freedom in the regression results (Selaya & Sunesen, 2012).

In the equations, the natural logarithm of explanatory variables except for institutional quality and infant mortality rate variables were taken to put the coefficients in elasticity forms, while the dependent variable "loan" cannot be lag without losing the observations with zero (0). Therefore, a better method of handling this type of issue is to standardise variable "loan" and allow the panel data estimator to determine how to handle cases of zero (Wagner, 2003). Also, measurement error is likely to be visible in China's aid data since the values recorded are based on reported voluntary disbursement by Chinese government agencies. Such errors could arise from a miscalculation of the actual capital disbursed to complete a project, differences in the value of the currency, and inefficient project reports that may make China's aid coefficient to be inconsistent. To avoid these potential estimation errors, the Pesaran dynamic fixed effects which generate internal instruments to control the likely endogeneity, control for the unobserved recipient, and allow the parameters to vary across cross-sections in the short run, but restrict homogeneity of the parameters, in the long run, was used (Musibau et al., 2019; Pesaran et al., 1999).

3. Results and discussion

3.1. Descriptive statistics

Table 2 represents the summary of statistics of the variables used in investigating whether China's aid to 18 oil-exporting African countries is determined by altruism. The study employs the relationship between *China*Loans (dependent variable) and other control variables and the mean and standard deviation for the indicators are listed in the Table.

Table 2. Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ChinaLoans	270	230.6441	710.4356	0	6299.3
Debt	256	1.56e+10	2.21e+10	1.10e+09	1.45e+11
PolStabVln	270	–.7504542	.8357341	–2.580621	.8140736
IMAgric	288	2.89e+07	7.55e+07	0	4.56e+08
IMOIL	273	1.61e+09	4.55e+09	0	3.35e+10
IMMANU	288	8.99e+08	4.24e+09	0	3.86e+10
Mortalityrate	288	93.79722	51.00112	13.4	216.7
Openess	268	87.98448	44.36547	25.04194	351.1057
GDPperK	287	2943.486	2911.965	194.169	11933.8
GDP	287	7.49e+10	1.07e+11	2.70e+09	4.64e+11

Similar to Table 2, the summary of statistics of the variables used in investigating whether China's aid to 18 oil-exporting African countries is determined by economic motive is presented in Table 3. The mean and standard deviation for indicators in the sub-region for indexes of all variables are indicated.

Table 3. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ChinaLoans	270	230.6441	710.4356	0	6299.3
Debt	256	1.56e+10	2.21e+10	1.10e+09	1.45e+11
Corupt	270	–.7961122	.5160143	–1.836509	.6120459
EXAgric	272	136.5	78.66384	1	272
EXOIL	288	127.0972	80.86935	1	269
EXMANU	288	144.5	83.28265	1	288
Mortalityrate	288	93.79722	51.00112	13.4	216.7
Openess	268	87.98448	44.36547	25.04194	351.1057
GDPperK	287	2943.486	2911.965	194.169	11933.8
GDP	287	7.49e+10	1.07e+11	2.70e+09	4.64e+11

3.2. Chinese foreign aid-for-altruism estimation framework

To examine whether China's aid to Africa is determined by altruism motive, panel estimation technique is employed. The choice of the estimation technique is because the time series is too short to estimate for each country individually. Also, panel analysis is regarded as a suitable technique due to the identified advantages of the ability to tackle heterogeneity of variables over a period; take into consideration omitted variables and limiting collinearity between the explanatory variables (Baltagi, 2008; Flannery & Hankins, 2013). In the first instance, the result of Breusch-Pagan/Cook-Weisberg test for heteroskedasticity performed on the OLS regression is significant which means that the null hypothesis should be rejected, due to the presence of heteroskedasticity in the cross-section. While the result of Wooldridge test for autocorrelation in panel data is not significant, the null hypothesis is accepted since the estimated result is free of serial correlation problem. Also, the Variance Inflation Test (VIF) for multicollinearity mean is 2.50, meaning that the OLS regression analysis result did not suggest the presence of multicollinearity issues.

Based on the outcome of the diagnostics tests, OLS (fixed effects) can be used to tackle the heteroskedasticity issue in the regression. This led to the use of FE regression in which the choice between random effects (RE) and FE was determined by Hausman test (Hausman & Taylor, 1981), which the *p*-value is significant to confirm the relevance of using FE over RE. Likewise, the results of the modified Wald test for group-wise heteroskedasticity in FE regression model rejected the null hypothesis, indicating the presence of heteroskedasticity in FE results. Therefore, to resolve this issue of heteroskedasticity, the model is re-estimated using FE with robust standard errors and generalised least squares (GLS) estimator is used for consistency check. Ideally, it is best to re-estimate the model using either panel corrected standard errors (PCSE) proposed by Beck and Katz (1995) and Beck (2001), or feasible GLS to tackle the problem more comprehensively, but no time periods are common to all panels. Therefore, Stata software cannot estimate disturbance covariance matrix using casewise PCSE inclusion. As expected, the GLS results presented in Table 4 tackle the white correction for heteroskedasticity in the cross-section and gives stronger results. Furthermore, to deal with likely endogeneity problem, the dynamic fixed effects regression estimated error correction form is adapted to estimate Eq. (1). The dynamic panel estimator properties hold when N (number of cross-section units) is longer, and T (time) is shorter, and the long-run and short-run of the results is reported in Table 6. However, the explanatory power and the magnitude of the results are way lesser than that of the reported GLS estimation. On this premise, much emphasis is placed on the GLS results due to its robustness.

3.2.1. Empirical findings

The GLS results reported in Table 4 are interpreted alongside the Pesaran dynamic fixed effects results reported in Table 6. In Table 5, FE and FE robust standard errors are reported. However, the magnitude and explanatory powers of all FE results are less significant when compared to OLS and GLS, hence, it is excluded entirely from the discussion. While OLS and GLS results show little variation in coefficients and explanatory power in all variables

without any exception. Besides, the GLS log-likelihood value is –187.348, Wald Chi^2: 75.89, p = 0.000 (null hypothesis is rejected at 1% significant level), which confirms the validity of the estimator.

Table 4. Pooled OLS and GLS results of China's aid-for-altruism

Variables	Coefficients (OLS)	p-value	Coefficients (GLS)	p-value
$lnDebt_j$	–0.350*** (–2.67)	0.008	–0.350*** (–2.76)	0.006
$POLSTAB_j$	–0.242** (–2.27)	0.025	–0.242** (–2.35)	0.019
$lnIMMANUShr_{ij}$	0.136*** (3.94)	0.000	0.136*** (4.07)	0.000
$lnIMOILShr_{ij}$	0.023 (0.78)	0.439	0.023 (0.80)	0.422
$lnIMAGRICShr_{ij}$	0.136*** (5.76)	0.000	0.136*** (5.96)	0.000
$Mortalityrate_j$	–0.003 (–1.45)	0.149	–0.003 (–1.50)	0.133
$lnOPENSS_j$	–0.313 (–1.18)	0.238	–0.313 (–1.22)	0.221
$lnGDPperk_j$	0.204** (2.01)	0.046	0.204** (2.08)	0.037
$lnGDP_j$	–0.203* (–1.69)	0.093	–0.203* (–1.75)	0.080
Constant	8.226*** (3.27)	0.001	8.226*** (3.39)	0.001
R-squared	0.332			
Adj. R-squared	0.289			
Number of observations	153		153	
Log-Likelihood			–187.348	
Wald chi^2 (Prob > chi^2)			75.89 (0.000)	

Note: All estimations are carried out with Stata 12 software. The coefficients and t-values for OLS and the estimated z-statistics for GLS are in parentheses; Wald chi^2 test p-values in brackets; Asterisk *, ** and, *** denotes the level of significance at 10%, 5% and 1% respectively.

Table 5. Fixed effects and fixed effects (robust standard error) results of China's aid-for-altruism

Variables	Coefficients (Fixed effect)	p-value	Coefficients (Fixed effect robust)	p-value
$lnDebt_j$	0.019 (0.10)	0.924	0.019 (0.19)	0.924
$POLSTAB_j$	0.320** (2.26)	0.039	0.320** (0.14)	0.039

End of Table 5

Variables	Coefficients (Fixed effect)	*p*-value	Coefficients (Fixed effect robust)	*p*-value
$lnIMMANUShr_{ij}$	0.117* (1.83)	0.087	0.117* (0.06)	0.087
$lnIMOILShr_{ij}$	–0.018* (–1.77)	0.097	–0.018* (0.01)	0.097
$lnIMAGRICShr_{ij}$	0.026 (0.82)	0.425	0.026 (0.031)	0.425
$Mortalityrate_{j}$	–0.005 (–0.41)	0.691	–0.005 (0.013)	0.691
$lnOPENSS_{j}$	–0.674* (–1.90)	0.077	–0.674* (0.36)	0.077
$lnGDPperk_{j}$	1.441*** (3.58)	0.003	1.441*** (0.40)	0.003
$lnGDP_{j}$	1.283 (1.48)	0.159	1.283 (0.87)	0.159
Constant	–41.183* (17.62)	0.085	–41.183* (22.33)	0.085
R-squared	0.500		0.500	
Number of observations	153		153	

Note: All estimations are carried out with Stata 12 software. The coefficients and *p*-values for both FE and FE (robust) are in parentheses. Asterisk *, ** and, *** denotes the level of significance at 10%, 5% and 1% respectively.

Table 6. Pesaran dynamic fixed effects results of China's aid-for-altruism

Variables	Coefficients (long-run)	*p*-value	Coefficients (short-run)	*p*-value
$lnDebt_{j}$	–0.049 (–0.25)	0.803	–0.267 (–0.87)	0.384
$POLSTAB_{j}$	0.341 (1.38)	0.168	0.469 (1.38)	0.166
$lnIMMANUShr_{ij}$	0.251*** (3.02)	0.003	–0.152** (–2.38)	0.017
$lnIMOILShr_{ij}$	–0.003 (–0.06)	0.951	–0.055 (–1.56)	0.120
$lnIMAGRICShr_{ij}$	0.042 (0.68)	0.497	–0.042 (–0.82)	0.411
$Mortalityrate_{j}$	–0.027** (–2.04)	0.041	0.001 (0.01)	0.995
$lnOPENSS_{j}$	–1.347** (–2.54)	0.011	0.152 (0.26)	0.792
$lnGDPperk_{j}$	0.499 (0.65)	0.513	–3.528** (–2.16)	0.030

End of Table 6

Variables	Coefficients (long-run)	*p*-value	Coefficients (short-run)	*p*-value
$lnGDP_j$	−0.336 (−0.33)	0.743	4.174** (1.94)	0.053
Constant			9.467 (0.35)	0.723
Error correction (ECM)			−1.046*** (−8.26)	0.000

Note: All estimations are carried out with Stata 12 software. The coefficients and the *z*-values for all variables are given in parentheses. Asterisk *, ** and, *** denotes level of significance at 10%, 5% and 1% respectively.

Predictably, the GLS results in Table 4 show that infant mortality rate, external debt and political instability have the expected signs and significance. The variable that captures China's imports of oil/minerals products has no meaningful effect on aid in both GLS and Pesaran dynamic fixed effects. However, both agriculture and manufacturing are significantly positive at 1% level, with manufacturing imports coefficient being a bit lower at 0.135 than that of agriculture at 0.136 in the GLS results. These results suggest the importance of foreign aid in enabling more of China's imports. Similarly, in the Pesaran dynamic fixed effects long-run results in Table 6, manufacturing is positive and significant at 1% with coefficient estimates of 0.251. On balance, the significance of manufacturing is relatively robust across the various estimations. Although, it is negatively significant at 5% level in the short-run. The GLS results on institutional variable proxy as political stability did not conform with theoretical expectation for it is negatively significant at 5% level. Indicating a 1% increase in political stability will impede aid by –0.241%. This result is consistent with the findings of Biggeri and Sanfilippo (2009). In general, lower political risk is related to high levels of government stability and quality institution in a political structure which is an important direct determinant of aid allocation. However, the negatively significant coefficient estimates of this variable in the GLS results conform to convention view that China's aid to oil/minerals exporting countries in Africa may be due to political instability. Furthermore, given the policy implications that will arise from the findings of this study, and to correct any misspecifications, robustness check and sensitivity analysis were carried out to include more institutional variables in the analysis. Thus, the corruption index and rule of law index were included as two alternative specifications to account for other institutional factors as determinants of China's aid in non-reported analysis. However, the significance level and magnitude of other variables of interest changed considerably, giving somewhat different results and reducing the robustness of the results. This is because, these two variables are highly correlated, hence, the exclusion from the reported estimations. Results of the recipient countries' market size, proxy as GDP, has a lower magnitude of –0.202 and is negative and significant at 10% level in the GLS. Considering the importance of market size, the coefficients of GDP have smaller magnitudes. However, it is significantly positive at 5% level with a high coefficient of 4.174 in the short-run Pesaran dynamic effect regression results, and insignificantly negative in the Pesaran dynamic effects regression long-run results with a lower coefficient of –0.336.

From the short-run Pesaran dynamic effects regression result, it can be deduced that size of the recipient's economy, and China's aid conforms with theoretical expectation, even when this cannot be guaranteed in the long-run. In other words, China's aid goes to countries with higher GDP and since most of the oil/minerals exporting countries are relatively big in terms of foreign earnings.

The trade openness variable in both GLS and Pesaran dynamic fixed effect results did not conform to *a prior* expectation. In the Pesaran dynamic fixed effect results in Table 6, trade openness has no significant effect in the short-run on aid, but significantly negative at 5% level with –1.347 coefficients in the long-run. This indicates that China's aid is negatively correlated with Africa's trade openness. However, it will be incautious to conclude that trade openness has no role in conditioning the macroeconomic impact of aid increase, even when the proxy used do not provide any indication for such effect (Fielding & Gibson, 2013). External debt of the recipient's country is included in the model to ascertain the claim by Biggeri and Sanfilippo (2009) claim that China's capital flows are channelled into heavily indebted, or net aid resources endowed African countries. Also, to determine whether the indebtedness of oil/minerals exporting countries affects Beijing's interest in giving aid. On the contrary external debt that is significantly negative at 1% level with coefficients of –0.350 in the GLS. The results suggest that a 1% decrease in external debt impact China's aid by a 0.35% increase. For the per capita GDP results, the magnitude of the estimated coefficient is higher for the GLS (0.204) than the Pesaran dynamic fixed effects (–3.528), and it is positive and significant at 5% level for the GLS. While it is negative and significant at 5% level in the Pesaran dynamic fixed effects regression short-run result. Thus, the reported per capita GDP in the Pesaran dynamic fixed effects results have the expected sign and significance, indicating that the recipient country's economic development underperformance determines or attracts more China's aid (Biggeri & Sanfilippo, 2009; Neumayer & Spess, 2005). On the other hand, the estimated GLS reported results to show that China cares less about reducing poverty in the countries under study. In the case of the mortality rate, it is significant and negative at 5% level with –0.027 coefficients in the long-run Pesaran dynamic fixed effects results only. The inclusion of this variable is to complement per capita GDP which according to Trumbull and Wall (1994), Wall (1995) and Younas (2008), is not a sufficient measure of recipients' well-being and economic needs for aid. In other words, China as an aid donor focuses on real per capita GDP of African countries as a *de facto* measure of well-being or economic development but not on infant mortality rate.

3.3. Chinese foreign aid-for-trade estimation framework

Augmenting the aid model initiated by Biggeri and Sanfilippo (2009); Vijil and Wagner (2012), panel estimation technique is employed to capture whether China's aid to Africa is determined by an economic motive. Worth mentioning that, this framework is similar to section 3.2. The Variance Inflation Test (VIF) for multicollinearity mean is 2.13, which indicate that in the OLS results, there are no multicollinearity issues among the variables, except for only the serial correlation issue. Although, it is expected that the GLS results presented in Table 7 will tackle the first-order autocorrelation in the cross-section and give stronger results. However, the results are not too different from that of the reported OLS in

the same Table. On this premise, much emphasis is placed on the GLS and FE results due to robustness.

3.3.1. Empirical findings

The GLS results reported in Table 7 is interpreted alongside the FE (with robust standard error) and Pesaran dynamic fixed effects results that are reported in Table 8 and Table 9. Unlike the aid-for-altruism results presented in Section 3.2, the FE results are not excluded from the discussion in this section, on the basis that its magnitude and explanatory powers are more significant on nearly different variables when compared to both OLS and GLS results. Besides, the GLS log-likelihood value is –291.972; Wald Chi^2: 20.66, p = 0.014 (null hypothesis is rejected at a 5% significant level), which confirms its validity. The GLS results show that external debt, corruption and infant mortality rate are the only few variables that have the expected negative signs and are significant at 5% (–0.235), 1% (–0.541), and 5% (–0.004) respectively. The debt of the recipient's country is included in the model to ascertain the claim by Biggeri and Sanfilippo (2009), that China's capital flows are channelled into heavily indebted, or net aid resources exporting African countries like Angola and Sudan. Also, to determine whether the indebtedness of oil/minerals exporting countries affects Beijing's interest in giving aid. On this premise, debt is significantly negative at 5% level with –0.235 estimated coefficients in the GLS regression results only. The result suggests that a 1% increase in total debt affects China's aid by 0.235% decrease.

Table 7. Pooled OLS and GLS results of China's aid-for-trade

Variables	Coefficients (OLS)	*p*-value	Coefficients (GLS)	*p*-value
$lnDebt_j$	–0.235* (0.13)	0.061	–0.235** (0.12)	0.054
$Corrpt_{jt}$	–0.541*** (0.19)	0.004	–0.541*** (0.18)	0.003
$lnEXMANUShr_{ij}$	0.036 (0.09)	0.687	0.036 (0.09)	0.679
$lnEXOILShr_{ij}$	0.037 (0.09)	0.658	0.037 (0.08)	0.650
$lnEXAGRICShr_{ij}$	0.124 (0.09)	0.162	0.124 (0.09)	0.151
$Mortalityrate_j$	–0.004** (0.02)	0.043	–0.004** (0.00)	0.037
$lnOPENSS_j$	–0.206 (0.21)	0.329	–0.206 (0.21)	0.316
$lnGDPperk_j$	–0.111 (0.09)	0.210	–0.111 (0.09)	0.197
$lnGDP_j$	0.143 (0.11)	0.180	0.143 (0.11)	0.168
Constant	2.782 (2.22)	0.212	2.782 (2.17)	0.199
R-squared	0.0896			

End of Table 7

Variables	Coefficients (OLS)	*p*-value	Coefficients (GLS)	*p*-value
Adj R-squared	0.0896			
Number of observations	210		210	
Log-Likelihood			–291.972	
Wald chi2 (Prob > chi2)			20.66 (0.014)	

Note: All estimations are carried out with Stata 12 software. The coefficients and *t*-values for OLS and the estimated *z*-statistics for GLS are in parentheses; Wald chi^2 test *p*-values in brackets; Asterisk *, ** and, *** denotes the level of significance at 10%, 5% and 1% respectively.

In general, the lower the level of corruption, that is, gross abuse of public power for private or elites' benefits within a government the more the aid allocation. The institutional variable proxy as corruption, is negative and significant at 1% level, in the GLS results, indicating a 1% increase in less control of corruption will reduce aid by –0.541%. Hence, the GLS results did not conform with *a prior* expectation.

However, the three trade variables of interest; oil/minerals, agriculture and manufacturing used to determine whether China's aid is for economic motive do not have any meaningful effects on aid in both GLS and Pesaran dynamic fixed effects results. Whereas, only manufacturing is positive and significant at 5% level, with the magnitude of 0.116 in the FE (with robust standard error) reported results in Table 8. Indicating that the relationship between manufacturing exports and aid are larger, suggesting the importance of exports in enabling more aid from China. More importantly, it shows that oil/minerals and agriculture exports from China to Africa are not determinants of aid. In other words, China gives aid to African oil/minerals exporting countries to promote China's manufacturing exports goods, that is, aid is for-economic-motive.

Table 8. Results of the fixed effects and fixed effects (robust standard error) of China's aid-for-trade

Variables	Coefficients (Fixed effect)	*p*-value	Coefficients (Fixed effect Robust)	*p*-value
$lnDebt_j$	0.089 (0.14)	0.538	0.089 (0.14)	0.532
$Corrpt_{jt}$	0.067 (0.30)	0.826	0.067 (0.40)	0.870
$lnEXMANUShr_{ij}$	0.116 (0.07)	0.110	0.116** (0.05)	0.044
$lnEXOILShr_{ij}$	–0.077 (0.065)	0.239	–0.077 (0.06)	0.222
$lnEXAGRICShr_{ij}$	0.043 (0.08)	0.576	0.043 (0.06)	0.474
$Mortalityrate_j$	–0.029*** (0.01)	0.000	–0.029*** (0.01)	0.002

End of Table 8

Variables	Coefficients (Fixed effect)	*p*-value	Coefficients (Fixed effect Robust)	*p*-value
$lnOPENSS_j$	–0.557** (0.29)	0.052	–0.557** (0.26)	0.047
$lnGDPperk_j$	1.6671*** (0.42)	0.000	1.6671*** (0.28)	0.000
$lnGDP_j$	0.307 (0.45)	0.495	0.307 (0.57)	0.601
Constant	–17.103 (10.67)	0.111	–17.103 (13.97)	0.240
R-squared	0.535		0.535	
Number of observations	210		210	

Note: All estimations are carried out with Stata 12 software. The coefficients and *t*-values for both FE and FE with robust standard error are in parentheses. Asterisk *, ** and, *** denotes the level of significance at 10%, 5% and 1% respectively.

Table 9. Results of the Pesaran dynamic fixed effects of China's aid-for-trade

Variables	Coefficients (long-run)	*p*-value	Coefficients (short-run)	*p*-value
$lnDebt_j$	0.047 (0.18)	0.796	0.301 (0.24)	0.214
$Corrpt_{jt}$	–0.238 (0.41)	0.558	0.329 (0.43)	0.444
$lnEXMANUShr_{ij}$	0.169 (0.11)	0.119	–0.069 (0.08)	0.371
$lnEXOILShr_{ij}$	–0.105 (0.11)	0.331	0.059 (0.07)	0.381
$lnEXAGRICShr_{ij}$	0.128 (0.12)	0.282	–0.014 (0.08)	0.864
$Mortalityrate_j$	–0.038*** (0.01)	0.000	–0.031 (0.05)	0.550
$lnOPENSS_j$	–0.541 (0.41)	0.189	–0.471 (0.39)	0.227
$lnGDPperk_j$	1.452** (0.58)	0.013	–3.719*** (1.23)	0.002
$lnGDP_j$	0.034 (0.66)	0.959	2.669** (1.31)	0.041
Constant			–7.588 (14.99)	0.613
Error correction (ECM)			–0.939*** (0.09)	0.000

Note: All estimations are carried out with Stata 12 software. The coefficients and the *z*-values for all variables are given in parentheses. Asterisk *, ** and, *** denotes level of significance at 10%, 5% and 1% respectively.

In the case of the mortality rate, the magnitude of the coefficient is –0.004, and it is negative and significant at 5% level in the GLS results. Also, in the FE (with robust standard error) results, the magnitude of the coefficient of mortality rate is –0.029 and it is significant at 1% level. Similarly, it is statistically negative and significant at 1% level with –0.038 coefficients in the long-run Pesaran dynamic fixed effects results. Therefore, the results for infant mortality rate did not support *a prior* expectation with the significantly negative and stronger coefficients, which indicates that China as a donor careless about improving the physical well-being of the oil/minerals exporting countries in Africa. The degree of trade openness in the FE (with robust standard error) results did not conform to *a prior* expectation, as the results show that the relationship between aid and trade openness is negative. In the FE results, trade openness variable is significantly negative at 5% level with –0.557 coefficients. However, it will be incautious to conclude that trade openness has no role in conditioning the macroeconomic impact of aid increase, even when the proxy used do not provide any indication for such effect (Fielding & Gibson, 2013). For the per capita GDP results, the magnitude of the estimated coefficient is higher for the FE robust (1.6671) and strongly significant at 1% as compared to the Pesaran dynamic fixed effects long-run results with the magnitude of 1.452 and significantly positive at 5% level, while it is negative and significant at 1% level in the Pesaran dynamic fixed effects short-run results with a coefficient of –3.719. Thus, the reported real per capita GDP in the FE with robust standard error and Pesaran dynamic fixed effects long-run results indicate that the recipient country's economic development underperformance is not a determinant of China's aid (Biggeri & Sanfilippo, 2009; Cao & Paltiel, 2015; Neumayer & Spess, 2005).

Conclusions

Given the importance of China's foreign aid to Africa, this paper examined the determinant of China's bilateral aid to 18 oil/minerals exporting African countries. Using pooled OLS, FE, GLS and Pesaran dynamic fixed effects estimators. To do so, China's bilateral loan data obtainable from CARI; UN-Comtrade disaggregate HS products imports and exports data that are categorised into agriculture (1–24), oil/minerals (25–27) and manufacturing (28–99); political instability index and corruption index obtainable from WGI and other exploratory variables from 2003–2017 were used.

Surprisingly, the results show that manufacturing and agriculture imports are the determinants of Chinese aid-for-altruism. While the aid-for-economic motive results indicate China's manufacturing exports enable more aid. An indication that the debated oil/minerals are not the determinants of Chinese aid. From these results, one can deduce that oil/minerals are uncorrelated with Chinese aid. This is justifiable because the oil/minerals sector is highly capital intensive where resource-exporting countries rely on Joint Ventures/Partnership from MNCs and TNCs for operation. Therefore, the extractive industry may not require aid. Instead, aid is provided in the form of corporate social responsibilities (CSR) to the communities where the oil and minerals are being extracted. More importantly, China's economic cooperation interest in the form of aid has been in agro and allied industries, construction, consulting and related services in which the data are not available. Therefore,

the findings from the empirical analyses lead to the conclusion that detail knowledge of the trade specific sector that determines China's bilateral foreign aid will enable African countries understudy to position themselves effectively towards global markets and improve better the aid-trade link. Also, the institutional structure of the African countries under study serves as determinants of their economic relations with China since political instability and corruption enhance aid. Nevertheless, Africa as a region should advocate for a sound institutional structure that will bring the desired economic growth and development. Consequently, for more effective economic cooperation between China and Africa that is capable of changing Africans vision of becoming less dependent on aid, to industrialised economies with higher GDP per capita and less poverty. Then, Africa should not rely on foreign aid for its infrastructure development, but if they must, the government must negotiate for appropriate configuration of aid for that purpose. Other components of development assistance such as the flexible exchange rate regime and low inflation, which are elements of macroeconomic balance policy should be improved to allow for more aid effectiveness and partnership between donors and recipients.

More importantly, it is believed that the determinant differs in each country, but due to the short data duration, time series econometric analysis is not available to be carried out in each African oil/minerals exporting countries. Therefore, the results of the econometric analysis for the 18 African oil/minerals exporting countries are relatively general. Further empirical research can be extended to the Middle East and other African countries that were left out in this study, to give a more representation for African oil/minerals exporting countries as a group. As well, to analyse if the determinants of Chinese aid are similar in the two major oil-exporting regions. Lastly, the role of financial institutions in enabling aid and financial flows need rigorous research, hence, are left for further studies.

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Author contributions

Kafilah Gold, Rajah Rasiah and Kian Teng Kwek conceived the study and were responsible for the design, development of the data analysis and wrote the first draft of the article. Kafilah Gold, Hammed Yusuf, Hammed Musibau and Murtala Muhammad were responsible for data collection. Kafilah Gold, Hammed Yusuf, Hammed Musibau and Murtala Muhammad were responsible for data interpretation.

Disclosure statement

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