Institutional Quality, Foreign Aid and Economic Growth in Recipient Countries

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Abstract: *Foreign aid is an important aspect of China's Belt and Road Initiative (BRI) for enhancing two-way cooperation with BRI countries. Based on the panel data of China's foreign aid over the period 2000-2014, this paper employs the Worldwide Governance Indicators (WGI) to conduct an empirical study on the economic growth effects of China's foreign aid and recipient countries' institutional quality with the endogeneity of aid taken into account. Results of our empirical study suggest that (i) China's foreign aid, especially infrastructure aid, can effectively promote economic growth in recipient countries; (ii) sound institutional development offers an important assurance for economic growth in recipient countries; (iii) sample-specific regression reveals that the institutional quality of recipient countries can significantly influence the economic growth effects of China's foreign aid, especially economic infrastructure aid for recipient countries in Asia and Europe. To improve aid effectiveness and quality, China needs to improve aid structure, supervise aid program implementation, and mitigate the impact of institutional risks in recipient countries.*

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1. Introduction

As the world's largest developing country, China takes an active part in international development cooperation and provides assistance to other developing countries, especially the least developed countries (LDCs). While seeking self-development, China strives to link its own interests with those of other countries. With China's growing economic prowess and friendly ties with other countries, China's increasing overseas aid has drawn extensive attention from the international community. The *White Paper on China's Foreign Aid (2014)* ("White Paper") reported a continuous rise in China's foreign aid from 2010 to 2012. According to Aid Data, most recipients of Chinese aid are countries in Africa, Asia, South America and the Caribbean region. From 2000 to 2014, China implemented 5,466 aid projects worth 350 billion US dollars in 140 countries and regions. China's foreign aid includes economic infrastructure aid, social infrastructure aid, physical capital aid to production sectors, as well as debt

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relief and emergency aid to recipient countries' governments. Among them, economic infrastructure has always been a key priority and accounts for 22.6% of total projects and 67.7% of total aid value.

Most aid recipients are developing countries with inadequate institutions and infrastructure, rampant corruption, and significant political risks. Many scholars believed that foreign aid could support economic growth in recipient countries under the "infrastructure effect" (Lin, 2016). After investigating how corruption in host countries impedes enterprises' outward foreign direct investments (OFDI), Wei (2000) concluded that corruption had increased firms' sunk cost and investment uncertainties. Compared with OFDI, aid projects and funds from other countries are often handled by host-country governments and more subject to recipient countries' institutional quality. Despite the great importance of the above questions to China's BRI development and foreign aid quality, few Chinese scholars have explored the relationship between China's foreign aid and institutional risks and economic growth in host countries.

2. Literature Review

This paper aims to investigate how foreign aid and institutional quality influence economic growth in aid recipient countries. Related literature primarily includes studies on the economic growth effects of institutional quality and those on the economic effects of foreign aid for recipient countries.

2.1 Institutional Quality and Economic Growth

Existing studies have explained the determinants of a country's economic growth from various dimensions. According to the neoclassical macroeconomic theory and development economics, long-term economic growth is primarily subject to changing economic structure, capital accumulation and technology (Harrod, 1939; Solow, 1957); while short-term growth determinants include consumption, export, domestic investment, and foreign direct investment (FDI) (Keynes, 1936). Yet poor institutional systems, corruption and inefficiency have restrained growth potentials in most developing countries, drawing attention from academics to the economic growth effects of these non-economic factors. G. Myrdal (1957) made an early discovery of the institutional factor's effects on developing countries, and explained why the capital circulation accumulation theory could not explain the secular stagnation of developed countries. North (1990) described institutions as a set of rules that influence economic growth in equally significant ways as population and savings. Like other tangible resources, the quality of institutions varies as well. Effective institutions are a comparative advantage for a country or region and can raise resource allocation efficiency and economic growth. As demonstrated by extensive empirical research by Chinese and international academics, institutional quality is a key determinant of regional economic growth (Knack *et al*., 1995; Hall *et al*., 1999; Acemoglu *et al*., 2001). However, the effect of institutions varies across countries at different levels of development. Bouis *et al*. (2011) ascribed such differences to a country's development stage.

Aside from institutional quality, some academics have also investigated the economic growth effects of corruption. Leff (1964) and Lui (1985) put forth the "effective corruption theory", which argues that in developing countries with poor institutional systems, corruption may help firms obtain market access first and bypass inefficient administrative control, that is, corruption acts as a "lubricant.". An opposite theory is the "friction effect theory," i.e., some scholars argued that rent seeking not only leads to monopoly but causes resources to be wasted as well (Krueger, 1974). Extensive empirical research after the 1990s has supported corruption's negative effect on economic growth. For instance, Mauro (1985) found a significant negative correlation between corruption and the investment/GDP ratio based on data from 58 countries.

2.2 Economic Effects of Foreign Aid

The economic effects of international aid recipient countries have drawn extensive attention among

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scholars, who have sufficiently studied the relationship between aid and economic growth but reached different conclusions. Clemens *et al*. (2012) and Galiani *et al*. (2017) examined the positive effects of foreign aid from developed countries on economic growth in recipient countries. Munemo (2006) and Helble *et al*. (2012) investigated how international aid influenced foreign trade in recipient countries, and found that aid could boost recipient countries' exports. Yet Rajan *et al*. (2008) and Doucouliagos *et al*. (2009) found no actual positive effect of international aid on economic growth. Voivodas (1973) found that aid exerted significantly negative effects on recipient countries' economic growth based on data from 22 countries over the period 1956-1978.

The above studies primarily focused on the effects of foreign aid from developed countries. With increasing economic strength, some developing countries are emerging as aid providers, attracting a growing body of research from Chinese and international scholars. Compared with aid from developed countries, China's foreign aid puts a greater premium on economic and social infrastructures (Tierney *et al*., 2011). There are two predominant views in the academia about the economic effects of foreign aid from China. One thinks that infrastructure investment from China may boost economic growth in recipient countries, i.e. significant "infrastructure effect" exists (Deininger and Okidi, 2003). As for studies conducted by Chinese scholars, based on China's aid projects in Africa and calibrated nightlight data over the period 2001-2013, Zhu *et al*. (2018) created an analytical framework on the economic growth effects of China's aid to Africa, including effects on material capital, human capital, and technology transfer and spillover, and found that steady infrastructure and financial aid from China had significantly increased economic growth in recipient countries. The other view suggests that aid from China could not promote economic growth in recipient countries (Crouigneau *et al*., 2006). Some even argued that China's aid, especially aid to Africa, was primarily intended to access mineral resources in recipient countries and would condemn recipient countries to a resource curse (Taylor, 2006). In addition, Pattillo *et al*. (2003) found that aid from China would inhibit FDI in recipient countries.

2.3 Summary Comments

Based on the above survey of existing studies, we have discovered that existing research on foreign aid from China is focused on aid to Africa and whether China's aid to Africa was conducive to economic growth in African countries, without identifying the differentiated effects. Most target recipient countries are developing countries, whose economic development and benefits from aid are limited by institutional drawbacks. For instance, Yang and Li (2018) found that corruption in African countries exerted a "friction effect" on Chinese investments in Africa and aid to Africa led to significantly more indirect Chinese investments in Africa through the "infrastructure effect". In examining the economic effect of China's foreign aid, existing studies did not take institutional quality in recipient countries into account, thus leaving defects in relevant empirical studies. In the context of the BRI, China's foreign aid has entered an important period of transition characterized by changing amount and regional distribution of aid (Bai, 2015). Hence, it is of great practical relevance to fully assess the economic effects of China's foreign aid on recipient countries.

This paper examines the economic effects of aid from China based on data of China's aid to 130 countries over the period 2000-2014. This paper offers the following contributions: First, unlike existing studies that focus on China's aid to African countries, this paper adopts a broader scope of research subjects, including countries in Asia, Africa, Oceania, and South America, for a more comprehensive assessment of the economic effects of aid from China, taking into account regional differences that are also compared. Second, this paper evaluates the interactive effect between aid from China and host countries' institutional quality, i.e., whether institutional quality would influence the economic growth effect of aid from China, and such interactive effect is also examined to see in which regions and with which types of aid it is more significant.

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3. Model Specification and Data

3.1 Model Specification

Based on this paper's research priorities and referencing Barro (1999) and Anyanwu (2014), we create the following two regression equations:

$$lnGDP_{it}=\beta_0+\beta_1 number_{it}+\beta_2 ins_{it}+\Sigma\beta_m X_{mt}+\mu_i+v_i+\epsilon_{it} \quad (1)$$

$$lnGDP_{it}=\beta_0+\beta_1 number_{it}+\beta_2 ins_{it}+\beta_3 number_{it}\times ins_{it}+\Sigma\beta_m X_{mt}+\mu_i+v_i+\epsilon_{it} \quad (2)$$

Subscripts *i* and *t* respectively denote recipient country and year; explained variable GDP denotes economic growth; *number* means the number of projects aided by China in a host country in a given year;[1] *ins* is the institutional quality of a recipient country; *number*×*ins* is the interaction term between aid and institutional quality. X is a set of control variables, including the amount of aid from OECD countries to a recipient countries (*oecd*), trade openness (*open*), resource endowment (*resource*), labor status (*labor*), and foreign direct investment (*fdi*). μ_i is the individual fixed effect of different countries; v_t is the fixed effect of time; ϵ_{it} is stochastic disturbance term.

Equation (1) is more focused on the direct effects of China's foreign aid and recipient countries' institutional quality on their economic growth. By introducing the interaction term between aid and institutional quality on the basis of equation (1), equation (2) reflects the interactive effect between aid and institutions:

$$\frac{\partial \frac{\partial ln\mathrm{GDP}_{it}}{\partial ins_{it}}}{\partial number_{it}}=\beta_3$$

The interaction term's coefficient is the impact of institutional quality on the marginal economic growth effect of aid. If $\beta_3>0$, the implication is that the recipient country's institutional quality will increase the economic effects of aid from China.

In order to reflect the actual effects of aid from China and avoid potential two-way causality between institutional quality, economic growth and between foreign aid and economic growth, this paper conducts a regression analysis with two-year-lagged data from recipient countries followed by a robustness test. Revised regression models are as follows:

$$lnGDP_{it}=\beta_0+\beta_1 number_{it-2}+\beta_2 ins_{it}+\Sigma\beta_m X_{mt}+\mu_i+v_t+\epsilon_{it} \quad (3)$$

$$lnGDP_{it}=\beta_0+\beta_1 number_{it-2}+\beta_2 ins_{it}+\beta_3 number_{it-2}\times ins_{it-2}+\Sigma\beta_m X_{mt}+\mu_i+v_t+\epsilon_{it} \quad (4)$$

3.2 Data

The explained variable is economic growth in the recipient country, which is measured by the logarithm of per capita real GDP. Core explanatory variable data (*number*) is from Aid Data database,[2] and institutional quality data (*ins*) is from the Worldwide Governance Indicators (WGI), which include

[1] Due to missing aid data, this paper measures China's foreign aid by the total number of aid projects undertaken by China in the recipient country.

[2] The College of William & Mary's Aid Data database published the Global Chinese Official Finance Dataset in November 2017. Based on the Tracking Underreported Financial Flows (TUFF) method, this database collected data about China's Official Development Assistance (ODA) and Other Official Flows (OOF) to 140 countries and regions during 2000-2014, including Africa and Asia. Each aid program in the database contains information about recipient country, project status, project type, and amount of aid.

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voice and accountability, political stability, rule of law, control of corruption, governance effectiveness, and regulatory quality. Higher values denote higher institutional quality of relevant countries and smaller institutional risks. A country's overall institutional quality is measured by the mean value of the six indicators. This paper employs the logarithm of aid from OECD countries to sample countries (*oecd*) to differentiate the effects of aid from China and aid from other countries or entities. The logarithm of labor aged between 15 and 64 years (*labor*) denotes labor input. The logarithm of foreign direct investment (*fdi*) measures foreign capital inflows. Total imports and exports as a share of GDP denote trade openness (*open*). Rent on natural resources as a share of GDP is the proxy variable for the recipient countries' natural resources endowment. All the control variables are from the World Bank's WDI database.

This paper selects over 130 countries aided by China over the period 2000-2014 as sample countries. Due to missing aid data for countries like Niue and Syria and missing data about OECD countries' aid to countries such as Australia, Singapore and Bahama, the final valid samples are 118 countries. Since some data are zero and some samples are missing when taking logarithms, there are 1,580 actual valid samples when conducting the total sample regression. Specifically, natural resource endowment and trade openness are percentages, and per capita GDP, FDI and aid from OECD countries are 2010 constant US dollar values (per capita GDP is in thousand US dollars and all other variables are

Table 1: Data Description

Variable	Meaning	Number of observations	Mean value	Standard error	Expected sign
ln*GDP*	Economic growth in recipient countries	1,957	1.025	1.366	\
number	Number of China's foreign aid projects	1,995	2.14	3.047	+
amount	Amount of China's foreign aid	1,026	17.26	2.678	+
social	China's foreign aid for social infrastructure	1,995	1.09	1.71	+
infras	China's foreign aid for economic infrastructure	1,995	0.604	1.31	+
produce	Production sector aid from China	1,995	0.198	0.512	+
others	Other types of aid from China	1,995	0.323	0.919	+
ins	Institutional quality in recipient countries	1,995	-0.319	0.644	+
cor	Corruption in recipient countries	1,995	-0.377	0.815	+
oecd	Foreign aid from OECD countries	1,761	5.435	1.388	+
fdi	Foreign direct investment	1,854	6.094	2.216	+
labor	Labor input	1,975	14.888	1.935	+
resource	Natural resources endowment	1,931	10.168	12.877	?
open	Trade openness	1,926	82.863	49.838	+
pop	Total population in a host country	1,976	15.725	1.952	+
steel	China's steel output	15	5.069	3.212	+

Source: Indicated in this paper.

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in million US dollars). Except for the number of aid projects, institutional quality, trade openness and natural resources endowment, all other data are in logarithmic form. Table 1 shows summary statistics of all variables and expected signs of explanatory variables.

4. Empirical Results

4.1 Baseline Regression

This section presents our regression results with economic growth in recipient countries as explained variable, and institutional quality, China's foreign aid and their interaction term as explanatory variables, as well as control variables and other economic indicators. Table 2 shows the baseline results.

Columns (1) and (2) include no control variable. Column (3) includes other control variables. The coefficients of aid from China and institutional quality remain significantly positive, i.e., aid from China and institutional quality are positively correlated with economic growth in recipient countries. Each additional aid project undertaken by China would bring about per capita GDP growth by 0.00402-0.00569 units. Various types of development aid from China would help increase per capita GDP in recipient countries, which is consistent with the research findings of many scholars. China's foreign aid is not what some Western media described as "resource exploitation" or "neocolonialism". In fact, aid from China would not only improve local infrastructure, but increase local human capital through better education and healthcare. Steady aid from China enables recipient countries to develop their economy in ways that otherwise would be hard to achieve. After testing the direct growth effects of aid from China and institutional quality, this paper continues to investigate whether institutional quality in host countries would reduce the positive economic effects of aid. As shown in existing research, poor institutional systems would compromise the effectiveness of government policy implementation, and opaque supervision and management breed corruption, causing foreign aid and the home country's fiscal policies to fail. To verify the differentiated impact of recipient countries' institutional quality on the economic effects of aid from China, we divide recipient countries into two groups according to the average scores of institutional quality. Judging by the results of regressions (6) and (7), the coefficient of foreign aid in the high institutional quality group is greater than that for the low institutional quality group, and the former keeps significant at 1% level, which initially supports the conclusion that institutional quality in recipient countries will influence the effects of foreign aid. When a recipient country's institutional quality is adverse, it cannot effectively turn foreign aid into a factor input to compensate for its lack of material and human capital.

Based on the above equation, we include the interaction term between aid and institutional quality to evaluate whether institutional quality will affect the positive economic effects of aid. Judging by the regression results, the regression coefficients of foreign aid and institutional quality remain significantly positive, and the interaction term's coefficient is positive but not significant. The implication is that the interactive effect between institutional quality and the total number of aid projects is insignificant, i.e., sound institutions cannot always magnify the economic effects of foreign aid. Since aid projects include various types of aid to recipient countries from geographically diverse regions, it does not make sense to consider the impact of institutional quality at the overall level. In the following paragraphs, we examine the direct effect and interactive effect of aid according to the types of aid and the geographical regions of recipient countries respectively.

Among other control variables, the coefficient of foreign direct investment (*fdi*) is generally significantly positive at 5%, which indicates that foreign investment is an important driver of economic growth in developing countries when a country lacks capital. Labor input (*labor*) is insignificant in most cases, which indicates that an increase in labor input is not the primary driver of economic growth and may even exert a negative effect. Compared with workforce size, it is more important to

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Table 2: Results of Benchmark Regression

	Total samples					High institutional quality	Low institutional quality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
number	0.00569***		0.00402**	0.00464*	0.00464*	0.00677***	0.00189
	(0.002)		(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
ins		0.430***	0.248***	0.247***	0.247***	0.128**	0.356***
		(0.122)	(0.054)	(0.054)	(0.054)	(0.059)	(0.087)
number×ins				0.00132	0.00132		
				(0.003)	(0.003)		
oecd			0.0126	0.0125	0.0125	-0.0166	0.0184
			(0.015)	(0.015)	(0.015)	(0.015)	(0.022)
fdi			0.0168**	0.0169**	0.0169**	0.0440***	0.00589
			(0.007)	(0.007)	(0.007)	(0.012)	(0.008)
labor			-0.0766	-0.0760	-0.0760	-0.141	-0.226
			(0.146)	(0.146)	(0.146)	(0.162)	(0.246)
open			-0.000231	-0.000234	-0.000234	0.000220	-0.000682
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
resource			-0.000393	-0.000407	-0.000407	0.00775***	-0.00246
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
cons	0.816***	0.950***	1.681	1.671	1.586	3.041	3.728
	(0.015)	(0.042)	(2.142)	(2.142)	(2.140)	(2.287)	(3.672)
Fixed effect of time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,957	1,957	1,584	1,584	1,584	691	893
R^2	0.057	0.47	0.316	0.318	0.097	0.221	0.056

Notes: Standard errors are clustered at the country level, and numbers in parentheses are robust standard errors. All the three core explanatory variables in regression (5) have been decentralized. ***, ** and * denote significance of estimated coefficients at 1%, 5% and 10% levels. All are within groups. The same for Table 2 through Table 7.

improve human capital by increasing workforce competence. The coefficient of trade openness (*open*) is insignificant. Baldé (2009) believed that developing countries could not resist international competition from multinational firms from the developed world and therefore hardly benefited from trade. Notably, the coefficient of natural resource endowment (*resource*) is insignificant for both total-sample and low-institutional-quality group regressions but positive for high-institutional-quality group and significant at 1%. That is to say, natural resource endowment may promote economic growth in countries with sound

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institutions. Many analysis such as Mehlum *et al*. (2006), Boschini *et al*. (2007) and Zheng and Qin (2016) all believed that the TFP effects of natural resources were subject to institutional quality, which is echoed by this paper's empirical results.

4.2 Grouped Regression

In this section, we conduct a grouped regression analysis to differentiate how different types of aid from China influenced countries of different types.

4.2.1 Grouping by recipient countries' geographic regions

Geographic location is an important determinant of a country's political system. Early political geography was primarily concerned with how geographical environment influenced political systems and people's political behaviors. In the *Spirit of the Laws*, Baron de Montesquieu extensively discussed the effects of geographical environment like climate and soil on human activity and identified climate as a cause of "civil slavery".

In recent history, Asia, Africa and the Americas have experienced disparate paths of political democratization due to different geographical locations. Hall *et al*. (1999) identified the distance of each country to the equator as the instrumental variable for institutions. We divide recipient countries into Eurasia, Africa and Latin America for a regression analysis. The Eurasia group includes over 50 recipient countries such as Afghanistan and Albania located in Asia, the Middle East, Central Europe and Eastern Europe. The African group includes over 50 countries such as Algeria and Angola in Africa. The Latin American group includes more than 30 countries such as Antigua, Barbuda and Argentina in Latin America, the Caribbean and Pacific regions.

Table 3 shows the grouped regression results. Compared with the baseline results, aid and institutional quality as the core explanatory variables demonstrate the same pattern, i.e., coefficient is positive and significant at 5%, which indicates the robustness of baseline results. The coefficients of the core explanatory variables in the regression for the Latin American group are insignificant for the following possible reasons: First, Latin America was not a priority region for China's foreign aid and received a small share of aid from China, so that aid from China generated an insignificant economic effect there. The other reason is the limited number of samples and economic volatility of some Latin American countries due to political instability and the middle-income trap.

Judging by the regression results for the Eurasian group and the African group, the coefficients of aid and institutional quality for Asian countries are both smaller than those for the African group. Specifically, each additional aid project from China would bring about economic growth by 0.00824 units for African countries and 0.004 units for Asian countries. With the world's starkest poverty, Africa requires a steady stream of capital inflows to lift economic growth and escape poverty. According to the law of marginal diminishing return, China's aid to African countries may generate greater economic effects. China has used its best efforts to support African countries since 1956. Grouped regression in Table 3 also tests the interactive effects of aid and institutional quality. As shown in the regression results, the interaction term passes the 10% significance test for the Eurasia group, which indicates that the institutional quality of Asian countries greatly influenced the economic effects of aid from China, and sound institutions magnified the economic effects of aid. Overall, the African region was plagued by political instability, government collapses, and policy discontinuity. Such political risks threaten to compromise the effectiveness of direct investments from Chinese companies and aid in Africa. In the grouped regression, it should be noted that OECD countries exerted significantly positive effects on economic growth in African and Latin American countries. As Africa's former suzerain countries, EU members use aid as a key method to maintain their influence in Africa. The United States also exerts significant influences over the Latin American countries as its close neighbors.

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Table 3: Region-Specific Regression Results

	Eurasia		Africa		Latin America	
	(1)	(2)	(3)	(4)	(5)	(6)
number	0.00400**	0.00400**	0.00824**	0.00824**	-0.00154	-0.00154
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
ins	0.189**	0.189**	0.249***	0.249***	0.0977	0.0977
	(0.078)	(0.078)	(0.084)	(0.084)	(0.064)	(0.064)
number×ins	0.00427*	0.00427*	-0.000371	-0.000371	0.00360	0.00360
	(0.002)	(0.002)	(0.005)	(0.005)	(0.006)	(0.006)
oecd	0.0174	0.0174	0.0355*	0.0355*	-0.0442*	-0.0442*
	(0.028)	(0.028)	(0.020)	(0.020)	(0.023)	(0.023)
fdi	0.0182	0.0182	0.00298	0.00298	0.0253	0.0253
	(0.016)	(0.016)	(0.008)	(0.008)	(0.017)	(0.017)
labor	-0.209	-0.209	0.259	0.259	0.324	0.324
	(0.186)	(0.186)	(0.306)	(0.306)	(0.241)	(0.241)
open	0.0000843	0.0000843	-0.000118	-0.000118	-0.000465	-0.000465
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
resource	-0.00424	-0.00424	0.00302*	0.00302*	0.00224	0.00224
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
cons	3.915	3.859	-3.993	-4.055	-2.953	-2.991
	(2.804)	(2.811)	(4.530)	(4.528)	(3.423)	(3.418)
Fixed effect of time	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes
N	537	537	694	694	353	353
R^2	0.297	0.297	0.009	0.009	0.007	0.007

Note: The three core explanatory variables in equations (2), (4) and (6) have all been decentralized. The regressions of direct effects without the interaction term are not listed due to space limitations.

4.2.2 Grouping by different types of aid

Zhu *et al*. (2018) found that different types of foreign aid could influence economic growth in different ways. Anyanwu (2012) *et al*. investigated the marginal productivity, FDI and economic growth effects of economic infrastructure aid in sectors like transportation and communication. Referencing the above-mentioned classification method, we divide aid into four categories, including social infrastructure, economic infrastructure, production sector aid, and others to reveal the economic growth effects of different types of aid. Table 4 shows the regression results.

As shown in regression (3) and (4) in Table 4, the coefficient of aid is significantly positive, and an increase in economic infrastructure aid by each unit on average would raise per capita GDP by 0.0092

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Table 4: Results of Grouped Aid Regression

	Social infrastructure aid		Economic infrastructure aid		Production sector aid		Other aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
number	0.00164	0.00164	0.0133***	0.0133***	0.0135	0.0135	-0.000540	-0.000540
	(0.003)	(0.003)	(0.005)	(0.005)	(0.008)	(0.008)	(0.004)	(0.004)
ins	0.250***	0.250***	0.248***	0.248***	0.252***	0.252***	0.253***	0.253***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.055)	(0.055)	(0.055)	(0.055)
number×ins	-0.00370	-0.00370	0.0100*	0.0100*	0.00591	0.00591	-0.00446	-0.00446
	(0.005)	(0.005)	(0.006)	(0.006)	(0.011)	(0.011)	(0.006)	(0.006)
oecd	0.0126	0.0126	0.0127	0.0127	0.0137	0.0137	0.0136	0.0136
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
fdi	0.0174**	0.0174**	0.0172**	0.0172**	0.0175**	0.0175**	0.0177**	0.0177**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
labor	-0.0690	-0.0690	-0.0636	-0.0636	-0.0600	-0.0600	-0.0615	-0.0615
	(0.149)	(0.149)	(0.149)	(0.149)	(0.150)	(0.150)	(0.150)	(0.150)
open	-0.000224	-0.000224	-0.000227	-0.000227	-0.000226	-0.000226	-0.000235	-0.000235
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
resource	-0.000261	-0.000261	-0.000451	-0.000451	-0.000301	-0.000301	-0.000294	-0.000294
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
cons	1.567	1.490	1.486	1.412	1.427	1.349	1.451	1.371
	(2.177)	(2.176)	(2.180)	(2.179)	(2.195)	(2.194)	(2.196)	(2.195)
Fixed effect of time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,584	1,584	1,584	1,584	1,584	1,584	1,584	1,584
R^2	0.336	0.335	0.348	0.348	0.358	0.358	0.354	0.353

Note: The three core explanatory variables in equations (2), (4) and (6) have all been decentralized. The regressions of direct effects without the interaction term are not listed due to space limitations.

units. Compared with the regression results of overall aid in Table 2, economic infrastructure's positive effect on per capita GDP is about twice as much as that of overall aid. First, economic infrastructure aid from China has played a primary role in spurring economic growth in recipient countries; second, other types of aid are more focused on reducing poverty, improving livelihoods and education without significant short-term growth effects. Economic infrastructure has always been a priority of China's foreign aid. Economic infrastructure aid projects steadily accounted for more than 30% of the total number of aid projects although this percentage underwent no significant increase. The amount of aid accounted for 60% for most of the time with an upward trend. Hence, it can be concluded that economic infrastructure aid exerted a significant positive effect on economic growth in recipient countries.

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Judging by the interactive effect between different types of aid and institutional quality, economic infrastructure aid, recipient countries' institutional quality and their interaction term have all passed 10% significance test. That is to say, a significant interactive effect exists between economic infrastructure aid and host countries' institutional quality with respect to economic growth. Sound institutional systems are conducive to the economic growth effects of infrastructure aid. For large infrastructure projects in which government and officials play a greater role, sound institutional systems can ensure the effects of project implementation, significantly raise labor and capital factor productivity, and contribute tremendously to economic growth. The interaction term between other types of aid and institutional quality is insignificant possibly because other types of aid such as production sector aid exerted insignificant effects on economic growth.

It can be discovered based on the above regression results that infrastructure aid and especially economic infrastructure aid exerted significant effects on recipient countries' economic growth, but such effects are also significantly subject to institutional quality. The interactive effect between aid and institutional quality is insignificant for the African region where government institutions are generally underdeveloped, yet significant for the Eurasian region. As a noneconomic factor, institutions play a vital role in the economic growth of developing countries. Good institutional design and implementation will reduce the costs of transaction, raise administrative efficiency, curb rent-seeking, subdue the interference of corruption in resource allocation, and thus effectively increase the economic effects of China's foreign aid.

4.2.3 Robustness test

(1) Corruption as a proxy variable for institutional quality

In the baseline regression, this paper employs the mean value of six Worldwide Governance Index (WDI) indicators to measure a country's overall institutional quality. In the robustness test, we select the corruption index that influences economic activity the most directly and is extensively studied as the proxy variable for institutional quality. Aid from other countries can be deemed as part of a recipient country's public expenditure. Corruption significantly influences economic growth through its effects on public spending efficiency (Liu and Feng, 2011). Embezzlements by government officials will undercut public investments and aid effectiveness. Gupta *et al*. (2001) and Croix (2009) found that corruption could influence the structure of public spending. Corruption increases spending on the military and other large projects, leaving fewer resources available to essential expenditures such as education. Hence, corruption as the substitute variable for institutional quality more directly reflects the interactive effect between aid and institutional quality.

Table 5 presents the regression results with corruption as the proxy variable, and clean government still exerts a positive effect on economic growth. Consistent with main regression results, the sign of the interaction term in the regressions of the Eurasian group and economic infrastructure aid is positive and significant. Clean government exerted a positive effect on economic growth derived from foreign aid. Such an effect is mainly reflected in economic infrastructure aid.

(2) Aid amount as an explanatory variable

In this paper's baseline regression and grouped regression, the number of China's foreign aid projects is employed as an explanatory variable. While such data reflect China's overall foreign aid status, the number of projects alone cannot precisely reflect the amount of aid from China to different countries. Hence, we use the amount of aid as an explanatory variable to separately examine the effect of economic infrastructure aid and test the robustness of this paper's core conclusions. Table 6 shows the regression results.

Regression results in Table 6 reveal a positive effect of aid from China on recipient countries'

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Table 5: Regression Results of Proxy Variables

	Total samples			Eurasia group		Economic infrastructure aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
number	0.00428**	0.00564**	0.00564**	0.00363**	0.0037	0.0137***	0.0137***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.004)	(0.004)
cor	0.111***	0.113***	0.113***	0.0777	0.126***	0.114***	0.114***
	(0.032)	(0.031)	(0.031)	(0.052)	(0.03)	(0.031)	(0.031)
number×cor		0.00249	0.00249	0.00339*	0.00430*	0.00930**	0.00930**
		(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
cons	2.567	2.539	2.505	5.021*	4.576***	2.370	2.332
	(2.077)	(2.084)	(2.085)	(2.839)	(0.570)	(2.118)	(2.118)
Fixed effect of time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,584	1,583	1,583	537	537	1,583	1,583
R^2	0.15	0.159	0.158	0.239	0.29	0.172	0.172

Notes: Grouped regression only tests the significance results of the above section, and the three core explanatory variables in regressions (3), (5) and (7) have all been decentralized. The regressions of direct effects without the interaction term are not listed due to space limitations.

Table 6: Test with Aid Amount as an Explanatory Variable

	Total samples				Economic infrastructure aid	
	(1)	(2)	(3)	(4)	(5)	(6)
amount	0.00333		0.00439*	0.00439*	0.00132	0.00132
	(0.003)		(0.002)	(0.002)	(0.003)	(0.003)
ins		0.406***	0.265***	0.265***	0.268**	0.268**
		(0.125)	(0.056)	(0.056)	(0.116)	(0.116)
amount×ins			0.00497*	0.00497*	0.0104*	0.0104*
			(0.003)	(0.003)	(0.006)	(0.006)
cons	0.368***	0.967***	0.486***	0.443***	0.427***	0.308**
	(0.043)	(0.041)	(0.063)	(0.048)	(0.154)	(0.124)
Other control variables	No	No	Yes	Yes	Yes	Yes
Fixed effect of time	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes	Yes	Yes	Yes
N	1,015	2,002	909	909	211	211
R^2	0.047	0.487	0.437	0.437	0.397	0.397

Note: The three core explanatory variables in equations (4) and (6) have been decentralized.

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economic growth, which again verifies this paper's core conclusion that China's foreign aid is conducive to economic growth in recipient countries. The coefficient of interaction term is positive and significant at 10%, which supports our discussions on the interactive effects in the baseline regression. Regressions (5) and (6) respectively examine the economic growth effects of the interactive effect between institutional quality and economic infrastructure. Although the coefficient of aid is insignificant, the interactive effect is significant. There are two possible reasons: First, sample size is limited due to missing financial data of aid; second, road, communication and other large infrastructure projects involve a long construction cycle, and some projects were still under construction or yet to generate significant economic effects during this paper's observation period. Overall, the regression results in Table 6 supports the conclusions of our baseline regression, i.e., the empirical research of this paper is robust.

(3) China's steel output as an instrumental variable

This paper's core explanatory variable, i.e., China's foreign aid, may have endogeneity with economic growth in the recipient country. With the main goals of reducing poverty and improving people's welfare, China may give priority to poorer countries with greater development potentials when extending foreign aid, thus causing deviations in the test results. To address this endogeneity problem, we create an instrumental variable for a two-stage least square regression (2SLS) referencing Dreher *et al*. (2017). Unlike aid from Western countries, China's foreign aid focuses on infrastructure. Considering that steel is an essential raw material for large construction projects, we construct the following first-order regression equation based on the goals of foreign aid:

Table 7: 2SLS Regression

	Stage 1	Stage 2	
	(1)	(2)	(3)
steel	0.588***		
	(0.189)		
number		0.117***	0.0592***
		(0.015)	(0.019)
ins		0.237	0.148***
		(0.166)	(0.056)
number×ins		0.0610**	0.0491***
		(0.027)	(0.019)
K-P Wald F statistic		8.093	11.103
C-D Wald F statistic		60.728	18.783
weak ID test critical values		7.03(10%)	7.03(10%)
Hansen J statistic		0.000	0.000
Other control variables	Yes	No	Yes
Fixed effect of time	Yes	Yes	Yes
Fixed effect of country	Yes	Yes	Yes
N	1,976	1,045	1,045

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$$Aid_{it}=\beta_1 steel_{it-1}*p_i+\beta_2 pop_{it-1}+\mu_i+v_t+\epsilon_{it} \quad (5)$$

Steel is China's steel output in year *t-1*, and p_i is the frequency of China's aid to country i over the period 2000-2014. p_i is 1 if China provides aid each year. *pop* is the total population of the recipient country in the previous year. Logarithms are taken for both *steel* and *pop*[3]. μ_i is the individual fixed effect of countries; v_t is the fixed effect of time; ϵ_{it} is stochastic disturbance term. Table 7 presents 2SLS regression results.[4] As shown in the regression results, the selected instrumental variable has passed the weak instrumental variable (at 10% deviation) and over-identification test, which verify the selected instrumental variable's effectiveness. After controlling for potential endogeneity, the results of instrumental variable regression still support this paper's core conclusions.

5. Concluding Remarks

As China's foreign aid grows after the turn of the new century, evaluating the economic growth effects of China's foreign aid helps better implement China's foreign aid policy and achieve intended development goals. Based on China's foreign aid and two-year-lagged economic growth panel data of recipient countries over the period 2000-2014, this paper employs the panel fixed effect regression and 2SLS methods to investigate the relationship of China's foreign aid and recipient countries' institutional quality and economic growth. This paper finds that improving institutional quality is conducive to economic growth, i.e., poor institutions impede economic growth in developing countries; foreign aid from China can promote economic growth in recipient countries, and infrastructure aid, especially economic infrastructure aid, exerts a significant positive effect on host countries' economic growth; sound institutional systems will increase the economic effects of China's foreign aid. These conclusions remain robust in the regressions with substitute variables and 2SLS method. By differentiating recipient countries from various regions and aid of various types, this paper finds that the interactive effect between institutional quality and aid is particularly significant for Eurasian recipient countries and economic infrastructure aid.

Foreign aid is an important way to move forward the BRI and facilitate policy communication, infrastructure interconnection between China and BRI countries. Infrastructure construction and industrial capacity cooperation supported by China's foreign aid programs play a pivotal role in strengthening two-way economic and trade cooperation with host countries. To raise aid efficiency and effectiveness, China should enhance policy communication with recipient countries to mitigate the adverse impacts of institutional problems such as corruption. On the other hand, we should increase public supervision over aid programs by taking such steps as information disclosure, project evaluation and aid management to mitigate corruption in recipient countries and dispel doubts and misunderstandings from the international community over aid from China due to the lack of access to transparent information.

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[3] Steel output data is from the NBS, and recipient countries' population data is from the WDI database. Table 1 shows statistical descriptions.

[4] To avoid other endogeneity problems of economic growth in recipient countries arising from steel trade with China, we have excluded Eurasian countries as China's close trading partners in the second-stage regression, and conducted 2SLS regressions only for African and Latin American countries.

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