China's BRI Transportation Investments: Development Bonanza or Debt Trap?

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Abstract: *Based on the China Global Investment Tracker (CGIT) database of 2005-2018, this paper creates a country-sector-year panel set for a study on the BRI's investment effects on the transportation sector of BRI countries using the difference-in-differences-in-differences (DDD) method. Our study finds that the BRI has significantly increased transportation investments by Chinese companies in the BRI countries without causing significant rise in problem transactions. The "debt trap" narrative that the BRI aims to take control over host countries' sovereign rights in exchange for debt write-offs is not supported by evidence. Discussions on sub-samples reveal that the BRI has mainly propelled SOEs in making transportation investments to generate development effects in host countries, most of which are Asian countries, and that the preferred mode of investment is cross-border M&As.*

Key words: *the Belt and Road Initiative, transportation investment, development effect, debt trap*

JEL Classification Codes: L74, H40, O20
DOI: 10.19602/j.chinaeconomist.2020.09.03

1. Introduction

The Belt and Road Initiative (BRI) has sparked heated discussions in the international community. Some countries and think-tanks have played up a "debt trap" narrative, casting a shadow on the BRI's sustained development (Cheng, 2016). China's infrastructure projects under the BRI, they argue, leave host countries unable to pay for the loans, and thus force them to cede project control and even sovereign rights in exchange for debt write-offs. An important goal of the BRI is to encourage Chinese companies to invest in overseas transportation infrastructure, some of which incurred debt burdens to host countries. Almost all of China's outward investment projects embroiled in the so-called debt trap, therefore, are investments in the transportation sector. Sri Lankan Hambantota Port is an example. The question of broad concern is whether China's transportation investments in BRI countries have generated a development effect or a debt trap? Answering this question is of great importance to strengthening BRI's early achievements and exploring its future potentials. Regretfully, existing studies on the "debt burden" narrative are

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Acknowledgement: This study is supported by the National Natural Science Foundation of China (NSFC) Youth Program "Study on the Diffusion Mechanism and Policy Effects of Local Environmental Management Policies: an Example of the 'River Chief System'" (Grant No.: 71903085); the National Social Science Foundation of China Key Research Program "Study on BRI Trade and Investment Liberalization and Facilitation: Quantitative Evaluation and Implementation Strategies" (Grant No.: 18VDL014)"; the National Social Science Foundation of China Key Program "Study on China's Economic Growth Potentials and Drivers" (Grant No.: 14ZDA023).

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limited to qualitative descriptions without any stringent causal identification of the BRI's policy effects. This paper is intended to fill this gap.

This study aims to unravel the "debt burden" myth surrounding the BRI. To do so, two basic questions need to be answered: First, does the BRI encourage Chinese companies to invest more in the transportation sector of the BRI countries? The "debt burden" narrative assumes that the BRI induces Chinese companies to invest more in the debt-financed transportation projects in BRI countries. If this assumption is wrong, i.e. the BRI did not bring more Chinese transportation investments to BRI countries, the "debt burden" narrative will be proven unfounded. The second question is whether the BRI makes it more likely for Chinese transportation investments in BRI countries to bring problems (for instance, by incurring an excessive debt burden to host countries). If the "debt trap" narrative's intrinsic logic holds true, it should be discovered that the BRI gives rise to propensity among Chinese companies to invest in transportation projects that easily fail in order to take over project control in exchange for debt write-offs.

This paper uses an appropriate database for answering the above two questions. The China Global Investment Tracker (CGIT) released by the American Enterprise Research Institute and the Heritage Foundation gathers information about each overseas investment made by Chinese companies worth more than 100 million US dollars since 2005. This database includes both greenfield investments and cross-border M&As, and is the only database that discloses detailed information about greenfield investments made and new constructions undertaken by Chinese companies overseas (Du and Zhang, 2018). Aside from the value of each investment, this database also provides detailed information about when and which entities made the investment in which sector and country, at what equity ratio, and whether the investment faced any troubles. According to the database's definition, an investment is deemed as a problem transaction if the project cannot continue due to the interference of non-commercial factors in a commercial agreement (Scissors, 2018).[1] China's overseas transportation investment projects cited by Western scholars and media as "debt traps," such as Sri Lankan Hambantota Port and an expressway in Bangladesh, are all considered as problem transactions in this database. Hence, the database provides a rare opportunity for systematically evaluating the BRI's policy effects on Chinese companies' transportation investments in the BRI countries.

Based on the above data, this paper creates a three-dimensional panel data set of large-scale outward investments made by Chinese companies over the period 2005-2018, and identifies the BRI's policy effects on Chinese companies' transportation investments in BRI countries with the difference-in-differences-in-differences (DDD) method. Empirical results suggest that compared with non-transportation investments, the BRI has led to 22.15% and 7.90% increases in Chinese companies' transportation investments in BRI countries by value and number of projects, respectively, without significant increase in the number and probability of troubles in Chinese companies' overseas transportation investments. This conclusion still holds after a series of robustness tests and the consideration of the identification strategy's reliability. In conclusion, the BRI brings transportation development rather than debt trap to BRI countries.

This paper offers reliable empirical evidence demonstrating the falsehood of the "debt trap" narrative surrounding the BRI, and is of great theoretical importance to the success of the BRI. In addition, this paper supplements empirical literature on the BRI's policy effects. Existing studies on the BRI have either defined the BRI's concepts and implications (Ferdinand, 2016; Huang, 2016; Wang, 2016) or limited the sample to BRI countries for researching on classical questions

[1] Some projects stalled mainly because a host country government had suspended the transaction. If an investment made or project contract undertaken by a Chinese company involves a significant value to the extent that causes the host country's debt level to rise rapidly with potential social and political ramifications, the host country may suspend the project over non-commercial concerns.

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concerning export and outward investment such as export determinants and the selection of outward investment destinations (Yu and Cao, 2015; Duan *et al*., 2018; Liu *et al*., 2018). In contrast, the literature on the causality of BRI's policy effects remains scant. Very few studies have examined the BRI's causal effects on Chinese companies' development, outward investment, and trade with BRI countries (Irshad *et al*., 2015; Du and Zhang, 2018; Mao *et al*., 2019). Compared with these studies, this paper adopts a more stringent causality framework: Unlike the difference-in-differences (DID) method commonly employed in existing studies, this paper adopts the difference-in-differences-in-differences (DDD) method to exclude the time trend of Chinese companies' investments in specific BRI countries. Moreover, we employ geographical distance as an instrumental variable for the assignment of BRI countries, thus mitigating the endogeneity problem from the non-random selection of BRI countries.

2. Research Design

2.1 Econometric Model

Following Hering and Poncet (2014), we conduct an estimation based on the following model:

$$y_{ikt} = \alpha OBOR_i \times Infras_k \times Post + \boldsymbol{X}_{ikt} + v_{it} + \lambda_{kt} + \theta_{ik} + \varepsilon_{ikt} \qquad (1)$$

Where y_{ikt} denotes the size of overseas investments or problem investments made by Chinese companies in sector k of host country i in year t. Total outward investment by value (*Investment*) and number of projects (*Investnum*) are the proxy variables for the size of outward investment, respectively; the number of problem investments (*Troublenum*) and the share of problem investments in total investments (*Troubleratio*) are the proxy variables for problem investments. $OBOR_i$ denotes whether a host country is a BRI country. $Infras_k$ denotes whether a sector is related to transportation infrastructure. $Post$ denotes whether the project was initiated after the BRI's announcement. v_{it} is the combined fixed effect of "country-year". λ_{kt} is the combined fixed effect of "sector-year". θ_{ik} is the combined fixed effect of " country-sector ". ε_{ikt} is an error term. This paper clusters standard errors at the "sector-year" level. This paper includes such control variables as $WTO_i \times Infras_k \times Post$, $Res_i \times Infras_k \times Post$, and $Pgdp_i \times Infras_k \times Post$. Where, WTO_i denotes whether a country i is a WTO member; Res_i denotes country i's natural resource endowment; $Pgdp_i$ denotes country i's per capita GDP.

2.2 Variables and Data

(i) Dependent variables: In this paper, dependent variables include total investments by Chinese companies in sector k of host country i in year t by value (*Investment*) and number of projects (*Investnum*), the number of problem investments (*Troublenum*), and the share of problem investments in total investments (*Troubleratio*). Data on dependent variables are from the China Global Investment Tracker (CGIT) database published by the American Enterprise Research Institute and the Heritage Foundation. By June 2018, the CGIT database had gathered information about 3,161 investments by 765 Chinese investment entities in 14 sectors across 152 countries or regions. This paper aggregates the micro-level investment data of investment entities at the sectoral level, and creates a (investment destination) country-sector-year balanced panel data set to obtain samples with 29,792 observations (14 sectors in 152 countries for a period of 14 years).

(ii) Independent variables: (1) Whether a country is a BRI country ($OBOR_i$). The CGIT database provides information about whether each outward investment has occurred along a BRI country. With such information, this paper specifies the value of $OBOR_i$. Chinese companies have made large

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outward investments in 62 BRI countries. (2) Whether an investment is related to transportation infrastructure ($Infras_k$). In the latest CGIT database, Chinese companies have made outward investments in 14 sectors, including agriculture, chemical engineering, energy, entertainment, finance, healthcare, logistics, metal, real estate, technology, tourism, transportation, public utilities, and others. Among the 14 sectors, this paper classifies transportation and logistics as sectors related to transportation infrastructure, and other sectors as non-transportation infrastructure sectors. When Chinese companies make outward investments in transportation or logistics, $Infras_k$'s value is 1; otherwise, it is 0. (3) Whether an investment was preceded by the BRI's announcement ($Post$). Since the BRI was announced at the end of 2013 and written into the Government Work Report at China's legislative sessions for the first time in March 2014, this paper specifies $Post$'s value to be 1 if the year is equal or greater than 2014; otherwise, the value is 0.

(iii) Control variables and the instrumental variable: Dummy variables for the host country's WTO membership (WTO_i), natural resource endowment (Res_i), and per capita GDP ($Pgdp_i$) all adopt the samples' early values in 2005. Natural resource endowment is denoted by mineral ore and metal exports as a share of total export. Host countries' WTO membership information is from the CEPII database. Per capita GDP and mineral ore and metal exports as a share of total export data are from the World Bank's World Development Indicators (WDI) database. This paper selects the geographical distance of a host country's capital city to Beijing (*Distance*) as the instrumental variable for whether the country is a BRI country. Geographical distance data is from the CEPII database.

3. Empirical Results and Analysis

3.1 Benchmark Regression

Table 1 reports the results of this paper's benchmark regression. The dependent variable in columns (1) and (2) is total outward investment value (*Investment*), from which it can be found that when the combined fixed effect is not controlled for, *OBOR*×*Infras*×*Post*'s estimated coefficient is 0.2447 and statistically significant at 10% level. When the combined fixed effect is further controlled for, *OBOR*×*Infras*×*Post*'s coefficient sign and significance remain unchanged. The dependent variable in columns (3) and (4) is the number of outward investments (*Investnum*), from which it can be found that *OBOR*×*Infras*×*Post*'s estimated coefficient is 0.0875 and statistically significant at 5% level. When the combined fixed effect is further controlled for, *OBOR*×*Infras*×*Post*'s coefficient sign and significance remain unchanged. According to the results in columns (2) and (4), compared with the non-transportation sector, the BRI has led to increases in the value and number of Chinese companies' infrastructure investments in the transportation sector of BRI countries by 22.15% and 7.90%, respectively. Obviously, the BRI's development effect in encouraging Chinese companies to make outward investments in the transportation sector is also economically significant.

The dependent variable in columns (5) and (6) is the number of problem investments (*Troublenum*), and the dependent variable in columns (7) and (8) is the number of problem investments as a share of total investments (*Troubleratio*). It can be found that despite *OBOR*×*Infras*×*Post*'s positive estimated coefficient, it does not pass the significance test at the level of at least 10%. This result suggests that the BRI encouraged Chinese companies to invest more in the transportation sector of BRI countries without increasing risks of more problems. This paper argues that if the "debt trap" narrative holds true, the BRI should have made Chinese transportation investments more likely to run into trouble in BRI countries. It is true that debt financing is necessary for infrastructure projects in the transportation sector. Yet if China issued loans to

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Table 1: Benchmark Regression Results

	Investment		*Investnum*		*Troublenum*		*Troubleratio*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OBOR×Post	0.0516		0.0072		0.0030		0.0031**	
	(0.0591)		(0.0189)		(0.0029)		(0.0016)	
Infras×Post	0.0434		-0.0649		0.0372***		0.0135	
	(0.2621)		(0.0809)		(0.0133)		(0.0087)	
OBOR×Infras	0.0122		0.0071		0.0026		0.0011	
	(0.0383)		(0.0112)		(0.0034)		(0.0027)	
OBOR×Infras×Post	0.2447*	0.2215*	0.0875**	0.0790**	0.0070	0.0073	0.0031	0.0035
	(0.1471)	(0.1178)	(0.0439)	(0.0350)	(0.0075)	(0.0072)	(0.0056)	(0.0055)
WTO×Infras×Post	0.5065***	0.2723*	0.1649***	0.0934*	0.0222**	0.0161*	0.0131*	0.0114
	(0.1736)	(0.1591)	(0.0597)	(0.0514)	(0.0093)	(0.0097)	(0.0073)	(0.0077)
Res×Infras×Post	-0.0064**	-0.0010	-0.0014	-0.0001	-0.0004**	0.0000	-0.0002	0.0000
	(0.0028)	(0.0030)	(0.0009)	(0.0011)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Pgdp×Infras×Post	-0.0349	-0.0464	-0.0030	-0.0056	-0.0065***	-0.0074**	-0.0028*	-0.0044**
	(0.0302)	(0.0393)	(0.0083)	(0.0110)	(0.0022)	(0.0031)	(0.0016)	(0.0019)
Country FE	Yes	No	Yes	No	Yes	No	Yes	No
Sector FE	Yes	No	Yes	No	Yes	No	Yes	No
Year FE	Yes	No	Yes	No	Yes	No	Yes	No
Country-Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Country-Sector FE	No	Yes	No	Yes	No	Yes	No	Yes
Sector-Year FE	No	Yes	No	Yes	No	Yes	No	Yes
N	28,224	28,224	28,224	28,224	28,224	28,224	28,224	28,224
R-squared	0.1799	0.4265	0.1820	0.4940	0.0481	0.2862	0.0245	0.1865

Note: All regressions adopt robust standard errors clustered at the sector-year level. *Country FE* is the fixed effect of country; *Sector FE* is the fixed effect of sector; *Year FE* is the fixed effect of year; *Country-Year FE* is the combined fixed effect of "country-year"; *Country-Sector FE* is the combined fixed effect of "country-sector", *Sector-Year FE* is the combined fixed effect of "sector-year". ***, ** and * denote significance at 1%, 5% and 10% levels.
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transportation infrastructure projects in BRI countries with the aim to ensnare relevant countries into a debt trap in exchange for political dividends, such projects should be much more likely to be terminated by host country governments and lead to much more problem investments. But in fact, this paper's empirical evidence does not support this view.

3.2 Robustness Test

This paper conducts the following robustness tests to ensure the reliability of benchmark conclusions:[2]

(i) Exclusion of sample deviation: Since the samples of specific years, sectors and countries may interfere with this paper's main conclusions, this paper re-examines the previous benchmark findings by selecting a sample of years with different intervals, deleting any industry or any country sample, and using propensity score matching to find matched non-BRI countries for BRI countries. Empirical results suggest that after the problem of potential sample deviation is taken into account, this paper's main conclusions still hold true.

(ii) Exclusion of other policy effects: Other policies that may exist may make it more likely for BRI countries to receive transportation investments from Chinese companies or less likely for projects to face trouble. For instance, China has entered into agreements with other countries to avoid double taxation and prevent tax evasion with significant effects on outward investments (Weyzig, 2013). Compared with other sectors, transportation investments from Chinese companies are more likely to be affected . If this logic holds, this paper's benchmark regression results will be subject to the interference of whether a country has signed any policy agreement to avoid double taxation. Hence, this paper gathers information from the official website of the State Administration of Taxation (SAT) about bilateral agreements to avoid double taxation between China and other countries, and creates a dummy variable for the signing of an agreement to avoid double taxation *Sign*, which is multiplied with *Infras* and *Post* to form the *Sign*×*Infras*×*Post* triple interaction term, which is substituted into equation (1) for regression as a control variable. Empirical results suggest that this paper's main conclusions are free from the interference of other policy effects.

(iii) Adopting PPML estimation method: In the three-dimensional panel data set obtained from the outward investment data, such dependent variables as total outward investment value (*Investment*) contain many zero values. Hence, this paper employs the Poisson pseudo-maximum likelihood (PPML) estimation method to re-test this paper's main conclusions. Empirical results suggest that after changing the model estimation method, this paper's main conclusions still hold true.

(iv) Adopting enterprise-level data: All the foregoing conclusions in this paper are based on the country-sector-year balanced panel data set . Based on the micro outward investment data at the enterprise level, this paper directly evaluates the BRI's policy effects on firms' outbound transportation investments. Empirical results reveal that this paper's main conclusions still hold true.

3.3 Test of Identification Strategy

(i) Test of the parallel trend hypothesis. The foregoing research result is also predicated upon the assumption that the treatment group and the control group satisfy the parallel trend hypothesis. This paper replaces *Post* variable in equation (1) with the dummy variable for various years during the sample period for regression with 2005 as the omitted year to test the *ex-ante* parallel trend in the outbound transportation investments in the BRI and non-BRI countries. Figure 1 shows the estimated coefficients for various years, and the dotted line denotes the 95% confidence interval. It can be found that for the pre-BRI period, the policy effect floats around 0 and does not pass the significance test. After the BRI's

[2] We have retained the process and results of the robustness test, which are available upon request.

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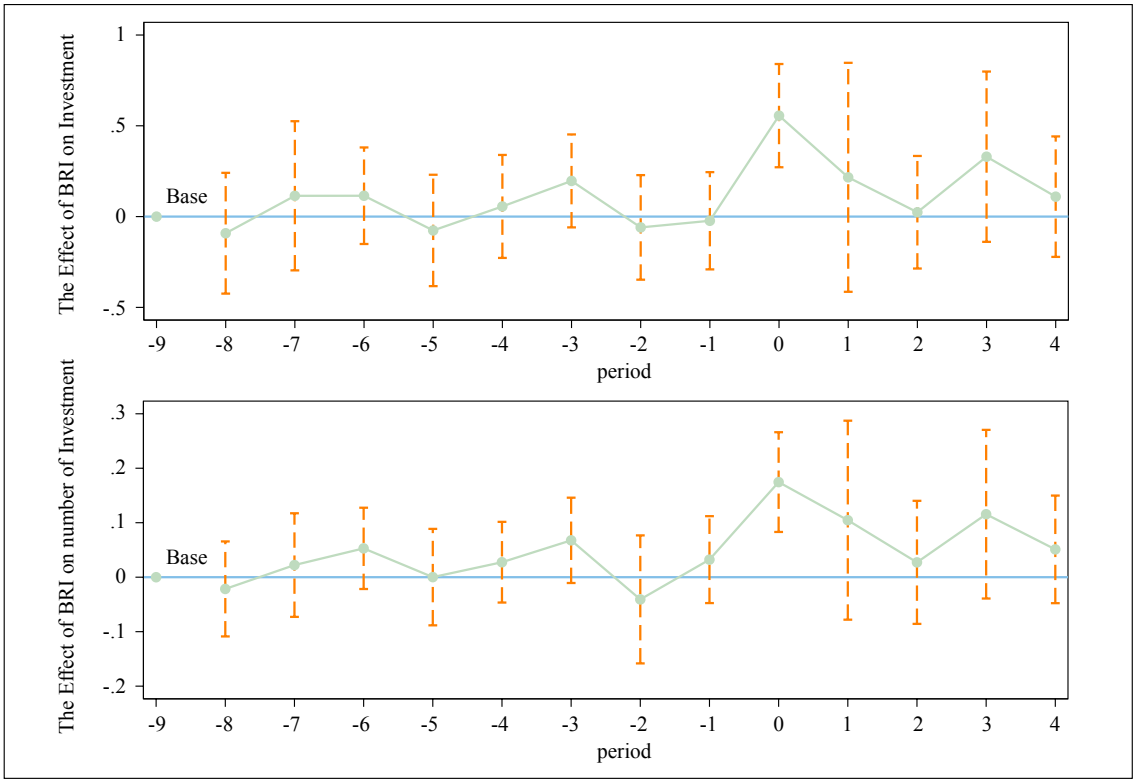

Figure 1: BRI's Policy Effects on China's Outward Transportation Investments

Sources: Drawn by the authors.

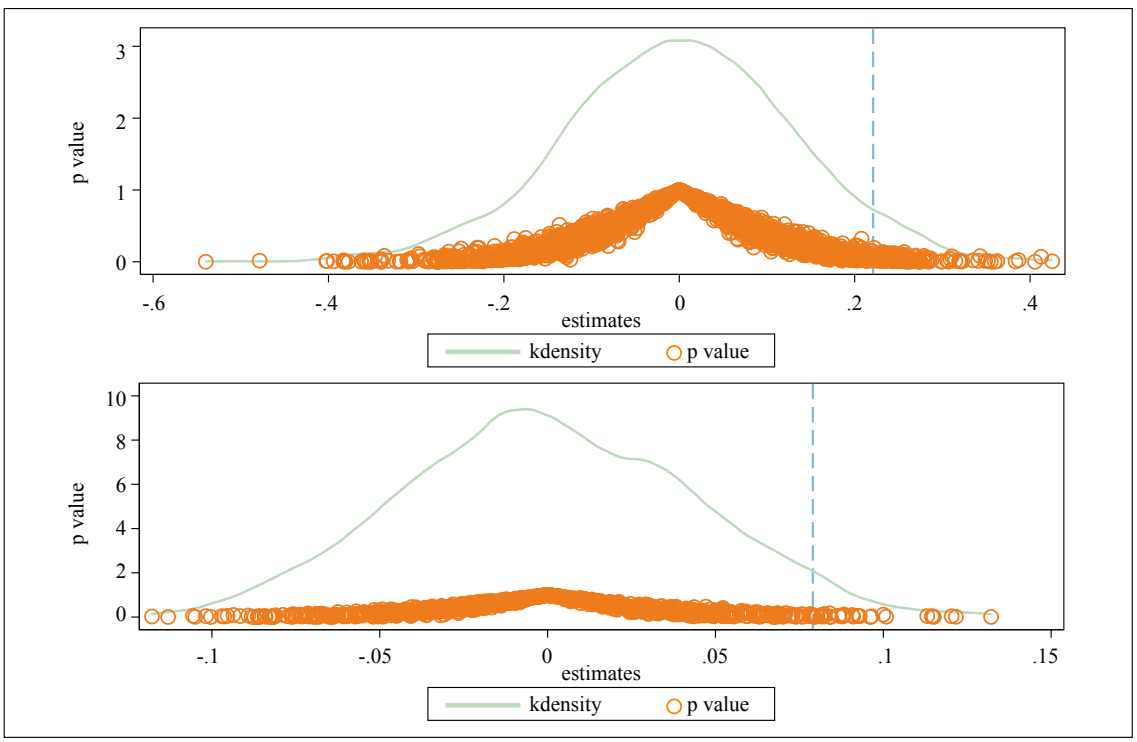

Figure 2: Results of Placebo Test

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announcement, the current-phase policy effect turned positive and significantly different from 0. This result suggests that this paper's identification strategy satisfies the parallel trend hypothesis. Notably, the BRI's dynamic effect in a later phase is insignificant, which is probably due to the cross-temporal substitution effect of large transportation investments involving long project cycles.

(ii) Placebo test: Following La Ferrara *et al*. (2012), this paper conducts a placebo test through a random specification of BRI countries to further test that the BRI's development effect is free from the impact of omitted variables. In this paper's samples, Chinese companies have invested in a total of 152 countries. In each regression, therefore, we randomly select 62 countries from 152 country samples, assuming that these countries are subject to the BRI's effects while others are not. In this manner, we create a pseudo-treatment group and a control group. Then, we conduct 1,000 times of regression with the value and number of firms' outward investments as dependent variables. Figure 2 reports the probability density distribution of the estimated coefficients of the BRI's development effect on the value and number of investments based on the random samples. As can be seen from the chart, all the estimated coefficients are distributed with 0 as the center, and most P values are greater than 0.1. Accordingly, there is a low probability for obtaining the above-mentioned estimated coefficient in benchmark regression based on the random samples. In view of the above results, it can be concluded that the BRI's development effect uncovered in this paper is unlikely to be subject to the interference of omitted variables.

3.4 Instrumental Variable Method

Since the selection of BRI countries is not random, the above empirical results are likely to suffer the endogeneity problem. Hence, this paper attempts to further strengthen the reliability of the conclusions through the instrumental variable method. This paper uses the distance between a country's capital and Beijing (*Distance*) as the instrumental variable for whether the country is a BRI country (*OBOR*). We take the logarithmic form of geographical distance. Theoretically, the selection of geographical distance as an instrumental variable is reasonable in the following ways: (i) In terms of relevance, BRI countries largely overlap with ancient trade routes: The Silk Road Economic Belt and the 21st Century Maritime Silk Road encompass the travel routes of Han Dynasty envoy Zhang Qian's trip to the Western Regions (138-126 B.C.) and Ming Dynasty explorer Zheng He's maritime expeditions (1405-1433 A.D.), respectively. In ancient times when transportation was far less developed, geographical distance largely decided which countries Zhang Qian and Zheng He were able to reach, and to some extent influenced the selection of BRI countries. Hence, geographical distance is negatively correlated with a country's probability of being recognized as a BRI country. (ii) In terms of exclusivity, geographical distance will not incur additional investment cost to outward investments as it does to export trade. This paper argues that as communications technology advances, geographical distance is unlikely to directly affect Chinese companies' investments in BRI countries through non-BRI channels.[3]

Table 2 reports the instrumental variable's estimation results. Where, column (1) is the first-stage regression results, and *Distance*×*Infras*×*Post*'s estimated coefficient is negative and statistically significant at 1% level, indicating a significantly negative correlation between geographical distance and a country's assignment as a BRI country. F test value of the first-stage regression is 10,076.960, which is greater than the critical value 10. That is to say, the instrumental variable selected in this paper is free from the weak instrumental variable problem. Columns (2), (4), (6) and (8) report the second-stage results of the instrumental variable regression, from which it can be found that when the dependent variables are the value (*Investment*) and number (*Investnum*) of outward investments, *OBOR*×*Infras*×*Post*'s estimated

[3] This paper tests the instrumental variable's exclusivity through a reduced form regression, and the specific process and results are available upon request.

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coefficients are 0.3749 and 0.1394, respectively, and statistically significant at 5% level. When the dependent variables are the number (*Troublenum*) and share (*Troubleratio*) of problem investments, *OBOR×Infras×Post*'s estimated coefficients are 0.0226 and 0.0139, respectively, but none of them passes the significance test. Even with the endogeneity problem for the selection of BRI countries taken into account, this paper's core conclusions still hold true.

Research suggests that institutional differences between the host country and the home country are a key factor that influences firms' outward investments (Habib and Zurawicki, 2002). In addition, the geographical distance could be a key variable that influences institutional diffusion, and the institutional distance with China may increase with the geographical distance with China. Hence, the geographical distance may influence Chinese firms' transportation investments through its effects on institutional distance. To exclude this factor's interference with the instrumental variable's regression results, this paper further conducts an instrumental variable regression after controlling for the host country's institutional distance (*Institution*) with China.[4] Columns (3), (5),

Table 2: Instrumental Variable's Estimation Results

	OBOR×Infras×Post	*Investment*		*Investnum*		*Troublenum*		*Troubleratio*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Distance×Infras×Post	-0.5353***								
	(0.0053)								
OBOR×Infras×Post		0.3749**	0.3734**	0.1394**	0.1323**	0.0226	0.0220	0.0139	0.0131
		(0.1838)	(0.1777)	(0.0565)	(0.0547)	(0.0145)	(0.0140)	(0.0086)	(0.0083)
Institution×Infras×Post			0.0096		0.0458		0.0041		0.0052
			(0.1088)		(0.0335)		(0.0086)		(0.0051)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	27048	27048	27048	27048	27048	27048	27048	27048	27048
The First Stage F Statistic	10076.960								

Notes: *Controls include WTO×Infras×Post, Res×Infras×Post and Pgdp×Infras×Post. Country-Year FE* denotes the combined fixed effect of "country-year"; *Country-Sector FE* denotes the combined fixed effect of "country-sector"; *Sector-Year FE* denotes the combined fixed effect of "sector-year". Standard errors are reported in the parentheses. ***, ** and * are significant at 1%, 5% and 10% level, respectively.
Sources: Compiled by the authors.

[4] Method for creating the institutional distance is available upon request.

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(7) and (9) of Table 2 include the regression results of the institutional distance's interaction term (*Institution*×*Infras*×*Post*), from which it can be found that the instrumental variable test results are highly robust.

4. Heterogeneity Analysis

4.1 SOEs and Non-SOEs

In this paper, we manually match the CGIT database with the database of A-share listed companies on the Shanghai and Shenzhen stock exchanges. An investing company's ownership is determined by its equity composition. Enterprises are divided into SOEs and non-SOEs, and non-SOEs include private and foreign-funded enterprises. Our estimation is conducted with the following difference-in-differences-in-differences-in-differences (DDDD) model:

$$y_{ikt}^{SOE} = \alpha OBOR_i \times Infras_k \times Post + \varphi OBOR_i \times Infras_k \times Post \times SOE + \mu_1 OBOR_i \times Post \times SOE + \mu_2 Infras_k \times Post \times SOE + \boldsymbol{X}_{ikt} + v_{it} + \lambda_{kt} + \theta_{ik}^{SOE} + \psi_t^{SOE} + \varepsilon_{ikt} \quad (2)$$

Where, *SOE* denotes whether a company is an SOE; if so, this variable's value is 1; otherwise, it is 0. y_{ikt}^{SOE} denotes the size of outward investments and the status of problem investments made by companies of different ownership types in sector k of country i in year t. θ_{ik}^{SOE} is the combined fixed effect of "country-sector-type of enterprise" to control for the common shocks influencing outward investments made by specific types of Chinese companies in the specific sectors of specific countries. ψ_t^{SOE} is the combined fixed effect of "company type-year" to control for systematic time-trend differences that may exist in the outward investments by companies of different ownership types. Other variables have the same definitions as in equation (1).

Table 3 reports regression results based on equation (2). It can be found that when the dependent variable is the value (*Investment*) and number (*Investnum*) of outward investments made by Chinese companies, *OBOR*×*Infras*×*Post*×*SOE*'s estimated coefficients are all significantly positive. This result suggests that compared with non-SOEs, the BRI has led to an increase in transportation investments mainly from Chinese SOEs in BRI countries. This finding is generally consistent with Du and Zhang's (2018) conclusions. A possible reason for this result is that the soft budgetary constraint and risk resilience have enabled SOEs to respond to the BRI more swiftly compared with their non-SOE peers. When the dependent variables are the number (*Troublenum*) and share (*Troubleratio*) of problem investments made by Chinese companies, *OBOR*×*Infras*×*Post*×*SOE* and *OBOR*×*Infras*×*Post*'s estimated coefficients have all failed to pass the significance test, which suggests that the BRI did not increase the number and probability of troubled outbound transportation investments by Chinese SOEs. This finding echoes the full-sample estimation results.

4.2 Greenfield Investments and Cross-border M&As

Chinese companies invest in host countries primarily in the form of greenfield investment and cross-border M&A (Jiang, 2017). Compared with cross-border M&As, greenfield investment allows an investor to acquire greater control over an investment project in a host country. The "debt trap" narrative argues that Chinese companies' outbound transportation investments are intended to acquire control over investment projects. Hence, a further test of the BRI's effects on the mode of transportation investments by Chinese companies may provide more evidence for demonstrating the "debt trap" narrative's falsehood. Specifically, our estimation is conducted with the following difference-in-differences-in-indifferences-in-differences (DDDD) model:

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$$y_{ikt}^{G} = \alpha OBOR_i \times Infras_k \times Post + \varphi OBOR_i \times Infras_k \times Post \times Green + \mu_1 OBOR_i \times Post \times Green + \mu_2 Infras_k \times Post \times Green + \boldsymbol{X}_{ikt}\gamma + v_{it} + \lambda_{kt} + \theta_{ik}^{G} + \psi_t^{G} + \varepsilon_{ikt} \quad (3)$$

Where, $Green$ means whether an investment is a greenfield investment; if so, the variable's value is 1; otherwise, it is 0. y_{ikt}^{G} is the size of outward investment and the status of troubled investment by companies with different outward investment modes in sector *k* of country *i* in year *t*. θ_{ik}^{G} is the combined fixed effect of "country-sector-investment mode" to control for the common shocks to outward investments made by companies in a specific sector of a specific country under a

Table 3: BRI's Effects on Outbound Transportation Investments by Enterprises of Different Ownership Types

	Investment		*Investnum*		*Troublenum*		*Troubleratio*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OBOR×Infras×Post	-0.0463	-0.0741	-0.0104	-0.0171*	0.0021	0.0018	0.0024	0.0020
	(0.0377)	(0.0459)	(0.0082)	(0.0096)	(0.0027)	(0.0032)	(0.0025)	(0.0029)
OBOR×Infras×Post×SOE	0.1811*	0.2260*	0.0498**	0.0735**	0.0020	0.0037	-0.0009	-0.0007
	(0.0958)	(0.1171)	(0.0244)	(0.0306)	(0.0047)	(0.0063)	(0.0039)	(0.0050)
OBOR×Post×SOE	0.0484**	0.0618**	0.0159***	0.0198***	0.0019	0.0017	0.0008	0.0005
	(0.0240)	(0.0297)	(0.0057)	(0.0071)	(0.0014)	(0.0017)	(0.0011)	(0.0014)
Infras×Post×SOE	0.1019*	0.4995	0.0246*	0.1113	-0.0001	0.0053	-0.0003	-0.0033
	(0.0574)	(0.3659)	(0.0136)	(0.0939)	(0.0022)	(0.0133)	(0.0020)	(0.0099)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Country-Sector-SOE FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SOE-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	59,584	46,256	59,584	46,256	59,584	46,256	59,584	46,256
R-squared	0.2552	0.2558	0.2823	0.2853	0.1337	0.1350	0.1218	0.1192

Notes: All regressions adopt robust standard errors clustered at the level of country-year. *Controls include WTO×Infras×Post, Res×Infras×Post, Pgdp×Infras×Post, WTO×Infras×Post×SOE, Res×Infras×Post×SOE, Pgdp×Infras×Post×SOE, WTO×Post×SOE, Res×Post×SOE, and Pgdp×Post×SOE. Country-Year FE* denotes the combined fixed effect of "country-year"; *Country-Sector-SOE FE* denotes the combined fixed effect of "country-sector-enterprise type"; *Country-Year FE* denotes the combined fixed effect of "country-year"; *Sector-Year FE* denotes the combined fixed effect of "sector-year"; *SOE-Year FE* denotes the combined fixed effect of "company type-year". ***, ** and * are significant at 1%, 5% and 10% level, respectively.
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specific mode. ψ_t^G is the combined fixed effect of "investment mode-year" to control for systematic time-trend differences that may exist in the outward investments by companies of different investment modes. Other variables have the same definitions as in equation (1).

Table 4 reports regression results based on equation (3). As can be found from the regression results of columns (1)-(4), when the dependent variable is the number of outward investments (*Investnum*), *OBOR×Infras×Post×Green*'s estimated coefficients are all significantly negative. This result indicates that compared with cross-border M&A, the BRI has significantly reduced the number of transportation investments from Chinese companies in BRI countries under the

Table 4: BRI's Effects on China's Outbound Transportation Investments under Different Investment Modes

	Investment		*Investnum*		*Troublenum*		*Troubleratio*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OBOR×Infras×Post	0.1042	0.0766	0.0598*	0.0770*	0.0022	0.0013	-0.0016	-0.0045
	(0.1133)	(0.1369)	(0.0340)	(0.0427)	(0.0072)	(0.0088)	(0.0055)	(0.0066)
OBOR×Infras×Post×Green	-0.0828	-0.0591	-0.0581*	-0.0761*	0.0006	0.0033	0.0046	0.0093
	(0.1205)	(0.1455)	(0.0352)	(0.0442)	(0.0080)	(0.0099)	(0.0059)	(0.0073)
OBOR×Post×Green	-0.0158	-0.0209	0.0025	0.0042	-0.0030	-0.0032	-0.0039**	-0.0051**
	(0.0416)	(0.0492)	(0.0131)	(0.0160)	(0.0033)	(0.0037)	(0.0019)	(0.0022)
Infras×Post×Green	-0.1346*	-0.4189	-0.0376*	-0.0835	0.0015	-0.0573*	-0.0004	-0.0250
	(0.0690)	(0.4241)	(0.0194)	(0.1319)	(0.0055)	(0.0295)	(0.0036)	(0.0175)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Country-Sector-Green FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Green-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	59,584	46,256	59,584	46,256	59,584	46,256	59,584	46,256
R-squared	0.3610	0.3708	0.4170	0.4266	0.2149	0.2398	0.1444	0.1491

Notes: All regressions adopt robust standard errors clustered at the level of country-year. *Controls* include *WTO×Infras×Post, Res×Infras×Post, Pgdp×Infras×Post, WTO×Infras×Post×Green, Res×Infras×Post×Green, Pgdp×Infras×Post×Green, WTO×Post×Green, Res×Post×Green, Pgdp×Post×Green. Country-Sector-Green FE* denotes the combined fixed effect of "country-year-investment mode"; *Country-Year FE* denotes the combined fixed effect of "country-year"; *Sector-Year FE* denotes the combined fixed effect of "sector-year"; *Green-Year FE* denotes the combined fixed effect of "investment mode-year". ***, ** and * are significant at 1%, 5% and 10% level, respectively.

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greenfield investment mode. This result chimes with the heterogeneity theory developed by Nocke and Yeaple (2008), they find that when a company develops transferable advantages with respect to technology, R&D and managerial competence, it tends to invest through cross-border M&A. Given their superior technological and managerial strengths compared with host-country companies, it is consistent with economic laws for Chinese companies in the transportation sector to make fewer greenfield investments. The "debt trap" narrative that the BRI lacks economic motivations is unfounded.

Based on the regression results of columns (5)-(8), it can be found that the BRI neither increased the number and probability of troubled cross-border M&As nor increased the number and probability of greenfield investments by Chinese companies in BRI countries. That is to say, whichever mode of investment, the BRI did not significantly increase the risk for relevant investment projects to run into trouble.

4.3 BRI Countries in Various Regions

This paper analyzes which countries have experienced the BRI's transportation development effect and the possibility of a "debt trap" arising from outbound transportation investments by Chinese companies. This paper examines the BRI's investment effects in the Middle East and North Africa (*Arab*), East Asia (*EastAsia*), Europe (*Europe*), sub-Saharan Africa (*Saharan*), and West Africa (*WestAsia*).[5] Specifically, each region's dummy variable is specified and multiplied by *OBOR*×*Infras*×*Post* to form a DDDD interaction term to be substituted into equation (1) for regression.[6] Test results suggest that when the dependent variable is the value (*Investment*) and number (*Investnum*) of outward investments by Chinese companies, *OBOR*×*Infras*×*Post*'s estimated coefficients are all significantly positive. Meanwhile, the estimated coefficients of *OBOR*×*Infras*×*Post*×*Arab*, *OBOR*×*Infras*×*Post*×*Europe* and *OBOR*×*Infras*×*Post*×*Saharan* demonstrate negative effects with at least 5% significance levels, and the estimated coefficients of *OBOR*×*Infras*×*Post*×*EastAsia* and *OBOR*×*Infras*×*Post*×*WestAsia* both fail to pass the significance test at the level of at least 10%. This result indicates that in such regions as the Middle East and North Africa, Europe and sub-Saharan Africa, the BRI exerted a smaller development effect in promoting outbound transportation investments by Chinese companies, and such effects mainly exist in Asia, including East Asia and West Asia. This result is consistent with the BRI's policy goal to focus on Asian countries. When the dependent variables are the number of problem investments by Chinese companies (*Troublenum*) and the share of problem investments in total investments (*Troubleratio*), *OBOR*×*Infras*×*Post*'s estimated coefficients all fail to pass the significance test of at least 10%. Moreover, the estimated coefficients of the DDDD interaction term of *OBOR*×*Infras*×*Post* multiplied by the dummy variable of different regions all fail to pass the significance test. Once again, this result indicates that the BRI did not lead to any increase in troubled transportation investments in any country or region along the BRI routes.

5. Conclusions and Policy Implications

Based on the China Global Investment Tracker (CGIT) database of 2005-2018, this paper creates a country-sector-year panel set for outward investments by Chinese companies, and employs the difference-in-differences-in-differences (DDD) method to identify the BRI's causal relationship

[5] According to the sample data employed in this paper, the outbound investments by Chinese companies since 2005 have primarily found their way into eight regions, including the Middle East and North Africa, Australia, Europe, North America (excluding the United States), South America, sub-Sahara Africa, the United States, East Asia, and West Asia.

[6] Heterogeneity test results with regional differentiation are available upon request.

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with the size of Chinese companies' outbound transportation investments and the status of problem investments. Research results suggest that the BRI has significantly increased transportation investments by Chinese companies in BRI countries without increasing the number and probability of problem investments. As far as the transportation sector is concerned, the BRI's policy effect is primarily development effect and in no way constitute a debt trap. Sample test results also suggest that for different types of enterprises, investment modes and investment destinations, the conclusion that the BRI did not increase problem investments by Chinese companies in the transportation sector still holds true.

While further promoting China's outbound transportation investments, the BRI should tread carefully to avoid unfounded accusations like the "debt trap" narrative. In this respect, this paper's conclusions offer the following policy implications: (i) China should further encourage its companies to invest in the transportation sector of BRI countries. Most BRI countries are developing countries whose economic growth is constrained by a lack of transportation infrastructure. In this sense, the BRI's development effect is conducive to stable economic growth in BRI countries in the long run, which is essential to overcoming the vicious cycle of high indebtedness and low growth. (ii) China should beef up the BRI's sound and sustainable development. The "debt trap" narrative originated from a few troubled transportation investment projects by Chinese companies in BRI countries. In the BRI's implementation, priority should be given to addressing the internal and external factors that led to problems in China's outward investments, which is vital to promoting favorable public opinions about the BRI.

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